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CONTENTS

The cultural growing of the Physiotherapy in Italy and the response of the Italian Academia

M. BACCINI

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In this issue of the *Italian Journal of Physiotherapy* we publish the lectures and the abstracts of the IV National Congress of the S.I.F, that took place in Florence on May 24-25. Only two lectures were suitable for publication, since the Congress was mainly focused on the discussion of clinical cases among medical and rehabilitation professionals. Each case was introduced by a brief video presentation and discussed as regards diagnosis, functional prognosis, medical therapy and rehabilitation interventions. A brief written article, therefore, could not report all the necessary information and the proposals and recommendations made in the debate that followed each presentation. The lectures that we publish here did not refer directly to specific clinical cases but dealt with strongly related topics, i.e. the measuring of changes at the individual level – an enormously intricate issue that only in recent years began to be unraveled – and the study designs that are appropriate for case reporting or for studying the effects of interventions at the individual, rather than at a group, level – a particularly appealing design to connect rehabilitation clinical practice and research.

The choice of structuring the congress almost entirely on clinical cases was largely innovative, but now we can state that it was a good choice. Indeed, the way of replicating this experience in future events to be organized together with other scientific societies is currently being addressed by the S.I.F. management.

At the same time, the IV S.I.F. National Congress was the occasion to view the current level of Italian physiotherapists' research activity. Forty-one abstracts were presented as oral or poster presentations, some of which having the potential to be published as full length original article in rehabilitation journals. Actually, some are currently under revisions or even have been accepted for publication - the original article published in the present issue of the *Italian Journal of Physiotherapy* is one of them. Overall, the number and the quality of the abstracts corroborates the impression that the gap in the research activity level among the Italian physiotherapists and the physiotherapists of other European countries is narrowing.[1]

This fact is even more remarkable when one considers that the Italian physiotherapists are actually excluded from the academic world: only two therapists have currently been appointed professors in the academic sector that is devoted to the allied health professionals (AHP), though thousands of university credits are entrusted to physiotherapists in the 85 university programs in Physiotherapy that are being taught in Italy.

This exclusion is not without consequences for the development of the Physiotherapy science in Italy. All around the world the Academia's mission is to promote and to develop the research in the different fields of human knowledge as long as to convey the knowledge through teaching activities: the two tasks, teaching and researching, need to be joined in order to develop the knowledge. The legitimate aspiration of some Italian physiotherapists to access to a university

role, therefore, should not be viewed merely as a personal ambition, since that access is crucial for the future development of the Physiotherapy profession in Italy.

The recent results of the new process for the appointment of Italian university professors (i.e. the national qualification for each scientific sector as a prerequisite to participate in the competitive examinations issued locally by each University),[2] announced in June 2014, raise fears that this exclusion will persist or even worsen in the future: none of the 25 Italian physiotherapists who applied attained the qualification. The reason is formally technical: the scientific level of applicant physiotherapists was not up to standard. Actually, we demonstrated that this happened because their scientific level was compared with that of researchers from a wide range of scientific disciplines who have been certificated to become professors in the AHP sciences although their qualifications and experience are quite different:[3] a number of applicant physiotherapists exhibited a scientific level that greatly exceed the threshold that is required for physiatrists to become qualified in their own scientific sector. Up to now, therefore, the response of the Italian Academia to the cultural growth of the Physiotherapy in Italy seems to be a closure that possibly arises from political, rather than cultural, motives. The result of such a choice, however, would be a University that missed its role.

No need to emphasize that this is not a corporate complaint: the importance of recruiting professors among researchers with high-level scientific curriculum is beyond question. It is time, however, to draw attention to a condition of the Italian Academy that is paradoxical, definitely atypical and no more acceptable.

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Società Italiana di Fisioterapia

Fourth National Congress

ITALIAN SOCIETY OF PHYSIOTHERAPY (SIF)

CLINICAL CASES IN PHYSIOTHERAPY: FROM FUNCTIONAL DIAGNOSIS TO TREATMENT

Florence 24th - 25th May, 2014

EDIZIONI MINERVA MEDICA

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INVITED LECTURES

Writing a case report: the connections between clinical practice and methodological severity.

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In biomedical literature, evidence for the efficacy of rehabilitation interventions is traditionally associated with powerful experimental methods such as randomized controlled trials (RCTs). However, even if case reports (CRs) cannot be a substitute for comprehensive analysis in research, if well conducted they can, and sometimes do, serve as the first observation leading to an important discovery. CRs can be defined as the non experimental, systematic description of a well defined unit, usually an episode of clinical care[1], endowed with the characteristic of being unexpected. These studies should be able to clarify the sequence of logical steps, that are the basis of clinical reasoning.

CRs may include a case study (CS), which is the subjective description of an individual's behavior, in which responses to treatment are described but target behaviors are not always specifically defined. CSs can be used to generate hypotheses for future research, but the conclusions that can be drawn are severely limited by the lack of experimental control and by the fact that they do not provide a reliable measure of the variable under analysis. Other kinds of CRs are the single-subject or small-sample research designs (SSRDs). The method of SSRDs has been suggested for use in rehabilitation settings where studies like RCTs have practical and ethical limitations[2]. This method, based on continuous assessment and outcome information, can be used by the clinician to monitor patient progress and even to adjust the intervention at individual level[3]. SSRDs offer the possibility of performing a comparison between phases of intervention and phases of non-intervention (baseline or follow-up) or between two or more treatments. Depending on the behavior to be analyzed, different designs can be employed, from the most basic, the AB design, to more sophisticated ones such as the multiple baseline design or the alternating treatment design[4].

This context suggests that well written and appropriate CRs will continue to contribute to the scientific and medical literature. They could also serve to promote students' critical thinking through information tagged to real-life events or as a launching pad for novice authors to start out on the path of medical writing. Checklists for writing CRs can be found in the literature[5-7] and in some websites (such as www.care-statement.org). Like other type of publications, CRs must meet specific criteria in order to be accepted for publication in scientific journals. They should convey some educational message of specific relevance to Physical and Rehabilitation Medicine, adding something new to scientific knowledge. They should identify and describe new or rare diseases, adverse or beneficial drug side effects, rare manifestations of diseases or mechanisms of a disease, or new diagnostic, therapeutic, or rehabilitative approaches.

Finally, the authors of a CR will benefit from the aid of a mentor with experience in medical writing, who can help them by reviewing the CR's contents, as well as give support in discussing the best timing for writing/submission, in journal selection strategies, and in the drafting of the cover letter. In particular, this letter is very important in the publication process, because it represents the initial chance to convince the editor of the importance and usefulness of the message contained in the CR[7].

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*Dr. Bravini summarized here the lecture done at the IV S.I.F. National Congress by Prof. Franco Franchignoni.

Interpreting of individual clinical changes in rehabilitation.

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Assessing patient progress is an integral part of clinical practice, and meaningful threshold change values of outcome tools are essential for decision making regarding a patient's status and to facilitate the communication of results in a concise and comprehensible fashion. However, the absence of a gold standard combined with multiple change coefficients has created uncertainty for those who investigate the sensitivity to change and responsiveness of health status measures.[1]

The purposes of this presentation are to: 1) identify the most useful indices and thresholds to quantify changes at the individual level; and 2) show an example of a study on the responsiveness of a patient-reported outcome measure for the upper limb.

Indices and methodsused to calculate responsiveness

In an attempt to assist clinical decision making regarding a patient's change status, researchers have offered many study-

based threshold change values to calculate the responsiveness of a measure. The most useful threshold in daily practice, where clinicians routinely compare the current and previous values of outcome measures of interest, is the Minimal Clinically Important Difference (MCID), which was first defined by Jaeschke and colleagues [2] as "the smallest difference in score in the domain of interest which patients perceive as beneficial and which would mandate, in the absence of troublesome side effects and excessive costs, a change in the patient's management". There are 2 types of approach for evaluating responsiveness and clinical significance: distribution-based methods and anchor-based methods.[3]

Distribution-based methods (DBMs)

The DBMs are based on the statistical characteristics of the obtained sample and analyze the ability to detect change in general. The major disadvantage of distribution-based approaches is that they do not provide a good indication of the importance of the observed change;[4] thus their main role lies in identifying the Minimal Detectable Change (MDC). The MDC is defined as the minimal amount of change required between 2 points in time to be confident that a patient has truly changed,[5] but it does not address whether the change is clinically important.

The MDC is the result of the multiplication of the SEM * z-value * $\sqrt{2}$, where SEM is the standard error of measurement and z-value correspond to the desired confidence level (this is usually set at 90% or 95%). The meaning of this statistic is that if a patient has a change score equal to or above the MDC threshold it is possible to state with 90% (or 95%) confidence that this change is real and not due to measurement error.

Anchor-based methods (ABMs)

Two ABMs are commonly employed: the mean change and the Receiver Operating Characteristic (ROC) curve approaches. Both require an external criterion (defined as "anchor") to determine whether changes in outcome scores are clinically meaningful. Accuracy of results of ABMs - which can mostly provide the MCID - depends among other things on the choice of anchor, the definition of 'minimal importance' on the anchor, and on baseline values, type of population, and contextual characteristics.[6]

In responsiveness studies, the anchor is frequently represented by a global rating of change scale (GRCS) designed to quantify a patient's improvement/deterioration over time, usually for the purpose of determining the effect of an intervention or to chart the clinical course of a condition. At the time of the final assessment (after the rehabilitation treatment), patients are asked to independently rate the overall change in their condition from when they began treatment. For this purpose, the GRCS could be represented by a 7-point scale ranging from −3 ("a great deal worse") to +3 ("a great deal better"), with 0 indicating "unchanged".[2]

For the mean change approach, patients' mean change could be graded on the GRCS as: not improved (GRCS ≤ 0), minimally improved (GRCS = +1), moderately improved (GRCS = +2), or largely improved (GRCS = +3).

For the ROC curve approach, the optimal cutoff score should be determined considering the subjects improved or not improved according to the GRCS (for example, those with a GRCS score ≥ +2). A ROC curve plots sensitivity (y-axis) against 1-specificity (x-axis). In this context, sensitivity is calculated as the number of patients correctly identified as improved based on the cutoff value divided by all patients identified as having had a meaningful change (GRCS ≥ +2), while specificity refers to the number of patients who were correctly identified as not improved based on the cutoff value divided by all patients who truly did not have a meaningful change (GRCS < +2). The optimal cutoff is chosen as the point that jointly maximizes sensitivity and specificity (being associated with the least amount of misclassification).

MCID calculation

Because it is common for the different approaches to yield different threshold values, recent papers recommend that the MCID be based primarily on ABMs (and particularly on the ROC method),[3] be higher than MDC values (the boundary of variability typically found in stable patients),[3,5] and not be based on 1 study or 1 method only.[7] In addition, it appears that the best choice to determine MCID is to select a small range of threshold estimates after comparing and interpreting the information conveyed by multiple reference standards, calculated on the same sample.[3,7,8]

A literature example

In the literature, studies that aim to quantify the MCID of outcome measures are increasing, and such detailed information - for a number of outcome measures translated in Italian language - are available on the Italian Society of Physiotherapy website (www.sif-fisioterapia.it). However, for those who want to know more about, a practical example of an updated and comprehensive methodological approach to calculate and interpret MCID thresholds could be represented by a recent paper from our research group.[9] In a large sample of patients (n = 255) with upper-limb musculoskeletal disorders, we used both DBMs and ABMs in order to have a wider range of data on which to draw inferences about the MCID for the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire. After triangulation of all our results - the ROC curve approach was preferred as the first choice, as it addressed most limitations of the mean change method - a change of 10.83 points was defined as the most acceptable MCID for moderate improvement, with good sensitivity (82%), specificity (74%), and classification accuracy (79%).[9] This value represents the smallest improvement considered worthwhile by a patient, and thus increases the interpretability of score changes at the individual level observed in the clinical setting.

Conclusions

Due to the variation of MCID thresholds among populations and methods, caution is needed when interpreting and using the published MCID values at the individual level, and there is a clear need for improvement and standardization of the MCID methodology. Moreover, it is important to remember that the MCID threshold identify patients with a clinically important improvement, not those who have recovered. For this reason, to better understand the effects of treatment in some clinical settings, the construct of a return to "normal" functioning (that again could be linked to different indicators)[10] should also be taken into account.

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ORAL COMMUNICATIONS

The application of a global gait index based on Gait Analysis data in children with cerebral palsy.

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Aims. Beside studying individual parameters measured with the Gait Analysis (GA), some global indexes derived from these parameters have been proposed to quantify the distance between the set of discrete variables describing the patient's gait pattern and the value assumed by these variables in healthy people. One such index is the Gait Deviation Index (GDI)[1] that is computed through a principal components analysis from 12 kinematic and spatial-temporal gait parameters measured with the GA.

Purpose. Verify the application of the Gait Deviation Index in a sample of subjects with cerebral palsy (CP).

Methods. *Subjects.* 51 children with CP walking without aids (age 3-18) and 31 age-matched healthy children. *Procedure.* The GA were performed at the Motion Analysis Laboratory of the Azienda Sanitaria di Firenze, using an optoelectronic system (SMART -E90, BTS Milan). *Analysis of data.* The GDI was calculated for each child separately for the right (GDI-RL) and the left (GDI-LL) limb and averaged between the two limbs (GDI-A), using both published normative data (PND) and normative data from the healthy subjects enrolled in the present study (ESD). Indexes calculated with different reference standards were compared by paired t-tests and Pearson coefficients. The paired t-test was also used to compare GDI-RL and GDI-LL. Comparison between different CP forms was performed using independent samples t-tests.

Results. Values of GDI computed with ESD were significantly lower ($p<0.001$) but strongly associated ($r=0.843$-0.912, $p<0.001$) with values computed with PND (table 1). GDI were significantly higher in hemiplegic than in diplegic children, indicating a minor deviation from the normal values (table 2). No differences were found between GDI-RL and GDI-LL in both unilateral and bilateral CP forms.

Conclusion. The GDI seems to be a potentially useful tool summarizing the global gait pattern. It is sensitive to gravity, since it differentiates between unilateral and bilateral forms, but its sensitivity to detect changes produced by interventions and to monitor the clinical picture evolution over the years needs to be investigated. Since the measures could be laboratory-dependent, the sample size of children with normal development needs to be increased in order to obtain more complete normative values.

Table I. — *Global Deviation Indexes computer for the right (GDI-RL) and the left (GDI-LL) limb and averaged between the two sides (GDI-A), with published normative data (PND) and with data from subjects who were enrolled in the study (ESD). Data in mean±SD.*

	ESD	PND	p
GDI-RL	74.8±11.4	78.5±11.0	<0,001
GDI-LL	73.0±11.6	79.37±12.6	<0,001
GDI-A	73.9±10.2	78.9±10.9	<0,001

Table II. — *Global Deviation Indexes computer for the right (GDI-RL) and the left (GDI-LL) limb and averaged between the two sides (GDI-A), with published normative data (PND) and with data from subjects who were enrolled in the study (ESD), in children with unilateral or bilateral CP form. Data in mean±SD.*

	Unilateral	Bilateral	p
GDI-RL ESD	77.1±10.0	69.8±12.7	<0.001
GDI-LL ESD	75.9±10.7	66.3±11.0	<0.001
GDI-A ESD	76.5±8.7	68.1±11.1	<0.001
GDI-RL PND	82.2±8.9	70.6±10.9	<0.001
GDI-LL PND	82.7±11.2	71.5±12.4	<0.001
GDI-A PND	82.4±8.9	70.9±10.7	<0.001

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A study of subjective visual vertical in the assessment of patients with brain lesions.

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Aims. The Subjective Visual Vertical (SVV) is the ability to visually recognize the verticality of external objects. Healthy adults make systematic errors within ±2°.[1] The aim of this study is to validate a SVV test[2] in adults with brain lesions, by correlating SVV to functional changes.

Methods. Patients with brain lesions, walking autonomously, with no cognitive deficits were enrolled. In SVV testing they were required to detect the verticality of a luminous bar rotated on a PC screen in step of 0.4ºcounter-clockwise. The Minimal Real Difference in this test is |0.8°| (Tesio's protocol).[2] SVV, dynamic standing balance (mCTSIB, MXE, Weight Bearing Symmetry-Balance Master®, manual skill (Box and Block, 9-Hole Peg Test) and walk ratio[3] (step length/cadence) were assessed at baseline and after a daily program of customized conventional exercise (duration 15-47 days). Changes were measured in Minimal Real Difference (MRD) units[4], categorized (improved or not) and correlated across indexes (Cohen's k agreement, significance $p \leq 0.05$).

Results. Ten adults (4 M, 49.7±19.25 yrs) were recruited. They suffered from motor (all) and sensory (n=3) impairment, prevailing on the right (n=1), left (n=4) or both (n=5) body side, due to hemispheric (n=5) or brainstem (n=5) vascular or post-surgical lesions (onset 4-24 weeks). At baseline all patients

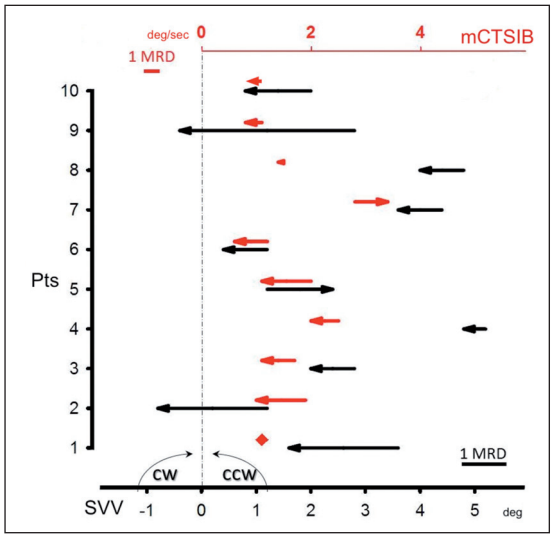

Figure 1.—Individual significant changes in SVV and mCTSIB (black and red arrows, respectively).

Table I.

N. PZ	1	2	33	4	5	6	7	8	9	10
SVV	X	X	X		-X	X	X	X	X	X
mCTSIB		X	X	X	X	X	-X		X	X

X= improvement ≥ 1 MRD; -X= worsening ≥ 1MRD

had SVV biased towards the right affected side (n=1), the right unaffected side (n=4), or right side in bilateral impairments (n=5). The constant error ranged 1.2°to 5.2°(mean 2.9°; SD 1.5). At follow-up, in 9 patients the SVV shifted towards 0°, while in 1 patient the SVV further departed from 0°. In 8 of the improved cases and in the worsened case, the change exceeded the MRD (|0.8°|). (fig 1). The changes in other indexes exceeded the MRD in at least 5 people only for mCTSIB ("x" changes >MRD). In 7 out of 10 cases SVV and mCTSIB co-varied (k=0.31, p≤0,00). Tab. 1 counts the individual significant changes in both indexes.

Discussion. SVV errors are consistent with the literature.[5] The partial correlation with the balance assessment supports its validity while indicating that it is not redundant. Also, the test looks sensitive to change across a clinically applicable time window.

Conclusions. the SVV test may usefully complement the balance assessment in brain lesions.

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Horticultural therapy in post-stroke rehabilitation: report on a "green" experience

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Aims. In the last few years an increasing amount of studies focused on the effects of horticultural therapy (HT) on physical and psychological wellbeing in elderly people. HT is structured as an active involvement of a person in a set of programmed gardening activities guided by health professionals such as occupational therapists or physiotherapists.[1] The objective of this work is to present data about an ongoing trial aimed at evaluate the effect of HT on physical and psychological aspects in a group of stroke patients.

Methods. We enrolled four post-acute stroke patients, with mild to moderate motor impairment, in a HT group-programme. The therapy consisted of different activities such as seeding or planting vegetables or flowers, creating flower-bouquets and posies of dry flowers. These activities were addressed to improve different precision grasps (i.e. digito-palmar dexterity, digital movements and finger strength); reaching, oculo-manual coordination and bimanual functionality. Patients underwent to a deep and wide assessment either for motor abilities and psychological profile. At this aim the following scales were adopted: Functional Independence Measure (FIM) ,Trunk Control Test (TCT), Modified Rankin Scale(MRS), Motricity Index (MI), Geriatric Depression Scale (GDS), Post-Stroke Depression Rating Scale (PSDRS) and questionnaire SF-12.

Results. Differences between FIM at admission and discharge was about 27 points in average; in particular main differences arose in subscale of mobility (mean difference=8) and personal care (mean difference=6). Also MRS showed a difference between the two time assessments (mean=1,75). Motricity scales showed high level of improvement of motor abilities: TCT (mean difference=41); MI (mean difference=24). Psychological profile seemsto improve for depression and quality of life: GDS (mean difference=4), PSDRS (mean difference=2), and SF-12 (mean difference SF12p=-5,55; SF12m=-4,55).

Discussion. Our preliminary data show that HT increases all functional, motricity and psychological scales. Interestingly, we also observed a considerable improvement in the subscales of FIM related to mobility and personal care, two crucial aspects of stroke patients' recovery.

Conclusions. Since the data obtained from this small pilot experience are showing promising results, we are currently increasing the number of participants in order to confirm the positive effects of HT on stroke patients' wellbeing.

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Paraplegia without etiological diagnosis: is it possible a functional prognosis? Case report.

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Aims. A 41 years-old woman with congenital achondroplasia and dwarfism. Previous surgical interventions for limb elongation. Completely independent before the new event. Acute hypotonic and areflexic paraplegia without sensitive or sphincter deficits since 1 month – maybe caused by multi-radicular damage. No deficits in control trunk. Important assistance needed in mobility and transfers. She is motivated and skilled for searching tailored strategies with strong use of her arms. Aims: a) autonomy in mobility; b) motor recovery.

Methods. Outcome measures pre- and post-treatment: a) Modified Barthel Index (MBI) and Spinal Cord Independency Measure (SCIM); b) Medical Research Council Scale (MRC) for muscle strength. Treatment (15 days): identification and training of suitable functional strategies; specific muscular strengthening exercises and muscular recruitment by muscular chain of fixation (in quadruped position, on knees or in standing-assisted position); electrical stimulation combined with exercises.

Results. The woman is independent for mobility in bed and is safe without any assistance in transfers (Figure). Movements in legs are improved in every levels of the legs (Table).

Figure 1.—Transfer from wheel-chair to bed ped-treatment.

Table: Outcome measures

OUTCOME	PRE		POST	
MBI	48/100		67/100	
Chair transfer	3/15		15/15	
Toileting	2/10		5/10	
Bathing	0/5		3/5	
SCIM	61/100		65/100	
MRC	R	L	R	L
Hip flexion	0	0	1+	1
Hip extension	0	0	1+	1+
Knee flexion	0	0	1	1
Knee extension	1+	1	3	1+
Dorsi-flexion	0	1	1	1
Plantar flexion	1	1	2	2

MBI: Modified Barthel Index; SCIM: Spinal Cord Independency Measure; MRC: Medical Research Council Scale; R: right leg; L: left leg.

Discussion. In literature there are prognostic data only for subjects with spinal cord injury paraplegia. The evaluation of the neurological damage enables to define the prognosis and to plan the appropriate care pathway. In our case, the lack of a defined etiological diagnosis and the absence of any evidence have lead the rehabilitation treatment towards a method of continuous evaluation and identification of aims. The constant observation of the changes in motor and functional situation of the subject has permitted to develop a functional prognosis "step-by-step". Considering the initial motor recovery and the functional improvements in a short time, we could assume a possible recovery of the standing position in the long term. Moreover, the muscular-skeletal characteristics and the already developed motor ability due to dwarfism have further influenced the rehabilitation approach. In fact, also literature suggests to consider the differences in motor abilities comparing subjects with dwarfism and healthy subjects.

Conclusions. Motor diagnosis and the monitoring of functional profile can lead rehabilitation also in absence of etiological diagnosis.

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A little elastic for a better performance: kinesiotaping of the motor effector modulates neural mechanisms for rhythmic movements.

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Aims. A rhythmic motor performance is brought about by an integration of timing information with movements. We have recently demonstrated that the precision of an isochronous performance, defined as performance of repeated movements having a uniform duration, was insensible to auditory stimuli of various characteristics.[1] Such finding has led us to further investigate where do the determining factors of precision reside.

Methods. For this purpose we used manipulation of cutaneous afferents by kinesiotaping (KT), an approach that was previously shown to improve some isokinetic performances.[2,3] Subjects, tested without KT and with KT, have participated in sessions in which sets of repeated isochronous wrist's flexion-extensions(IWFEs) were performed under various auditory conditions and during their recall. Kinematics was recorded and temporal parameters were extracted and analyzed.

Results and Discussion. Various degrees of improvement in the isochronous performances were evident for the KT recordings especially in terms of temporal precision. Our results indicate that, in the precision of repetitive rhythmic movements, the manipulation of cutaneous afferents plays a significant role. Whether this increase in precision is achieved by augmentation of the efficiency in central or local neural mechanisms is to be determined, but what remains certain is that when it comes to precision, a little elastic makes the difference.

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Comparison Between Two Therapeutic Exercise Programs in Computer Users with Chronic Cervical Pain: a Randomized Trial.

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Aims. Work-related chronic neck pain (CNP) is common in computer users. Exercise therapy can reduce symptoms but optimal programs at workplace remain unknown.

Purpose. To evaluate the efficacy of a 7-week moderate-intensity resistance exercises on symptoms and functioning in office workers with CNP.

Method. Thirty-five employees with CNP were randomly assigned to a *neck and shoulder resistance exercise* program (NSRE) or to a *stretching and postural exercise* program (SPE). During 45 minutes, twice a week, for 7 weeks, NSRE group performed resistance exercises to improve neck muscles endurance and shoulder abductors strength. SPE group performed neck and shoulder muscles stretching and postural exercises. Counselling on active management and workstation ergonomic adaptations were provided to both groups. Neck pain intensity and disability, the primary outcomes, were assessed with a numerical rating scale and the Neck Disability Index. Cervical active range of motion (AROM) was measured with a gravity goniometer. Endurance of deep neck flexors was assessed with the Grimmer test. Strength of shoulder abductors was assessed with the 10-RM test. Treatment impact on health related quality of life was measured with the SF-36.

Results. Twenty-seven subjects completed the treatment. Pain and disability decreased consistently in both groups ($p<0.001$) and no differences between groups were found. AROM improved in both groups ($p< 0.001$). Gains, though not significantly, were greater in NSRE. Neck flexors endurance and shoulder abductors strength improved in both groups ($p<0.001$) and in NSRE group were significantly higher than in SPE. SF-36 score improved slightly ($p>0.05$) in both groups. Adherence was high (86%) and no adverse effects were found in both groups.

Discussion. We reported clinically relevant symptoms relieve in both treatments. It remains controversial which physiological mechanism in exercise therapy is the most important in reducing neck pain. Resistance training showed more relevant effects than SPE on AROM and muscle function. Our

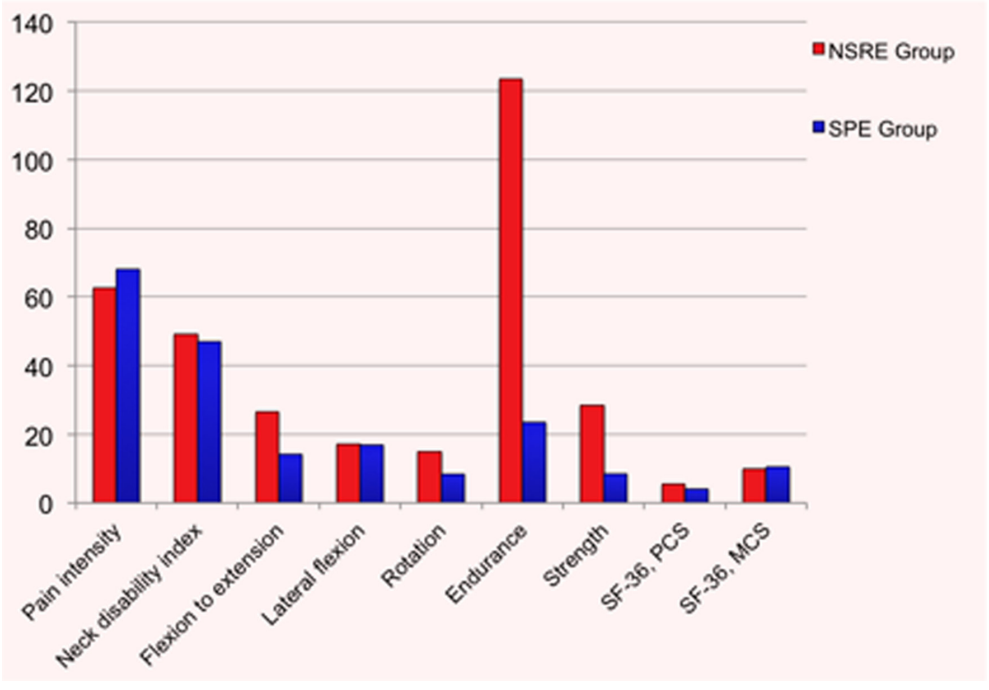

Figure 1.—% of improvement in both groups of treatment

Table I.—*Outcome differences between groups before and after treatment. Values are means (standard error) unless stated otherwise. Range of motion is in angular degree.*

	NSRE Group (n = 14)			SPE Group (n = 13)		
	Before	After	Change	Before	After	Change
NRS	5.0 (0.61)	1.9 (0.47)	3.1	5.1 (0.57)	1.6 (0.51)	3.5
NDI	19.3 (2.92)	9.9 (1.99)	9.4	18.9 (2.18)	10.0 (2.15)	8.9
Flexion to extension	103.6 (5.71)	131.1 (1.91)	27.4	112.2 (4.77)	128.2 (3.59)	15.9
Lateral flexion	65.6 (2.6)	82.8 (2.87)	17.2	72.6 (3.91)	84.9 (3.46)	12.3
Rotation	130.3 (5.51)	149.6 (3.48)	19.3	137.5 (3.36)	149.2 (2.72)	11.6
Endurance (seconds)	25.9 (3.58)	57.9 (10.88)	32.0	39.2 (10.24)	48.5 (9.24)	9.2
Strength (kg)	4.2 (0.37)	5.4 (0.37)	1.2	4.7 (0.49)	5.1 (0.52)	0.4
SF-36, PCS	46.7 (2.42)	49.2 (2.11)	2.6	47.7 (2.1)	49.6 (1.5)	1.9
SF-36, MCS	41.3 (3.3)	45.4 (3.0)	4.1	47.5 (3.1)	52.5 (1.3)	5.0

NSRE: Neck Shoulder Resistance Exercise; SPE: Stretching Postural exercise; NRS: Numeric Rating Scale; NDI: Neck Disability Index; PCS: Physical Component Summary; MCS: Mental Component Summary.

findings are similar to those reported in more intensive treatments.

Conclusions. A 7-week moderate-resistance muscular training is feasible at worksite, and is effective to relieve symptoms and improve functioning. Compared with SPE, NSRE training is more effective to improve muscular function and may be recommended to computer users with CNP.

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Rehabilitation practice in pediatric intensive care unit (PICU): a semi-systematic review.

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Aims. The portion of children with chronic conditions and/or disability that need hospitalization in a Pediatric Intensive Care Unit (PICU) is increasing. It means that the need for rehabilitation care in this setting is expected to increase too.[1] Even if the number of publications about rehabilitation care in intensive area is growing up,[2] there are still few studies that examine the way of interventions, the effectiveness of treatments and the role of physiotherapist and speech-therapist in PICU. The purpose of this study is to perform an assessment of available literature about the way of intervention and rehabilitation techniques most commonly used in PICU by physiotherapists and speech-therapists.

Methods. We reviewed the articles found in PubMed, Cochrane Library and Google Scholar databases using the following search terms: "children", "physical therapy" "not neonatal," "chest therapy", "feeding problems", "swallowing problems", "mobilization", "exercise", "rehabilitation", "pediatric intensive care unit " and "critical illness ". Inclusion criteria: all study designs, published in English or French language from January 2007 to February 2014, having as setting the PICU.

Results. A total of 35 articles were located, but only 10 studies were included in this semi-systematic review. Manual hyperinflation [3, 4] and early mobilization [5] are the rehabilitation interventions most frequently used with children with heart disease and respiratory failure hospitalized in PICU.

Conclusions. There are still few articles about the effectiveness of rehabilitation in the PICU. All authors agree that the effectiveness of treatments, the side effects and the role of rehabilitation intervention with children in PICU cannot be evidence-based, because of the clinical complexity of the patients and the lack of practice guidelines.

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Table I.—*Results of 10 studies included in the semi-systematic review.*

Study	Conclusions
Pires de Godoy V, *et al.* Rev Bras Ter Intensiva 2013;25(3):158-62 Design: Systematic Review	MHI is frequently used by physical therapists in patients requiring intensive care because it increases the peak expiratory flow, encouraging the mobilization of accumulated secretions. However, the evidence available in the literature are insufficient; therefore, randomized controlled trials are needed to establish the safety and efficacy.
Munkwitz M, *et al.* J Pediatr Rehabil Med 2010 ;3(3):215-27. *Design: Systematic Review*	Early mobilization in critically ill adult patients with respiratory failure is associated with a decrease in ventilator dependent days and hospital length of stay. The paucity of studies of early mobilization suggest that implementation of early mobilization is not widely practiced. However, the few studies on adults found concurred in the possible benefits and could be considered the possibility of applying this treatment in the PICU.
Bennett T.D, *et al.* Arch Phys Med Rehabil 2013;94(7):1268-76. Design: Retrospective cohort study	There is wide between–hospital variation in provision of rehabilitation therapies for children with Traumatic Brain Injury (TBI). Evidence-based criteria for initiation of routine therapy evaluations after TBI are needed .
Morrow B, *et al.* Aust J Physiother 2007 53(3):163-9. *Design: Randomized controlled trial*	There is insufficient evidence to support performing recruitment maneuvers after suctioning infants and children.
De Jong M, *et al.* J Adv Nurs 2011;68(8):1748-57. *Design: Randomized controlled trial*	Results do not support a benefit of "M" technique massage massage with or without mandarin oil compared to standard post-operative care of children between the ages of 3-36 months after craniofacial surgery. Several reasons may account for this: massage given too soon after general anaesthesia , young patients fear of strangers touching them, patients not used to massage
Choong K, *et al.* Crit Care Med 2013;41(7):1745-53 *Design: Cross-sectional study*	There are numerous perceived institutional, patient and provider-level barriers to early mobilization in Canadian pediatric critical care units, and diverse opinions on the appropriateness of early mobilization; for lack of sufficient scientific evidence in necessary to continue with further research.
Cremer R, *et al.* Crit Care Med 2009 37(4):1456-62. *Design: Cross-sectional study*	Prevalence of chronic conditions in PICU/NPICU was 67%. The medical staff is composed inside the intensive care unit or hospital staff who accesses the department on demand: more attention must be paid to the rehabilitation care needs of patients during their NPICU/PICU stay and after discharge.
McCord J, *et al.* Physiother Can 2013;65(4):374-7. *Design: Retrospective observational study*	Manual hyperinflation with the vibrations was used across diagnostic groups in the CCCU and PICU. Chest X-ray is an important clinical outcome and therefore needs to be recorded in a standardized manner to be useful for future research studies.
Bilan N, *et al.* Pak J Biol Sci 2009;12(5):467-9. *Design: Prospective observational study*	This study shows that non-invasive medical treatment of lung collapse which mainly consists of postural drainage, chest physiotherapy, aerosol therapy and inhaled bronchodilators administration, is not only scientific and effective but also simple.
Turner DA *et al.* Crit Care Med 2011;39(12):2593-8. *Design: Case report*	The rehabilitation program in ECMO patients awaiting lung transplant began with strengthening and reconditioning exercises in the supine position and if the clinical condition allowed it continued with exercises in a sitting position on the edge of the bed. A multidisciplinary rehabilitation intervention can be designed to allow active treatment safely improves the clinical conditions of the patients.

Rehabilitation practice in pediatric intensive care: Prospective observational study on cases june-december 2013 - Meyer children hospital

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Aims. The Pediatric Intensive Care Unit in Meyer Children Hospital (tertiary case center in Florence, Italy) has a service of endoscopic treatment and surgery of the airways, especially for children with congenital or acquired obstructions of the airways (for example tracheomalacia and subglottis stenosis). In this PICU works also the Rehabilitation team of the hospital, composed by: physiotherapists specialised in neuro-motor pediatric area, physiotherapists specialised in respiratory care, a speech-therapist specialized in dysphagia and swallowing management. The objective of this study is to describe the practice of the rehabilitation team in PICU Meyer.

Methods. The medical records of the children hospitalized in PICU Meyer from June to December 2013 that needed a support of the rehabilitation team were analysed. Data were collected from digital and manual medical records and reported on an Access database. Data were also studied by a descriptive statistical analysis.

Results. There were 338 children hospitalized, 49 of them needed a support of the rehabilitation team (the indication physical intervention was detected by medical staff). The average of the age is 4 years, the children are hospitalized for a long

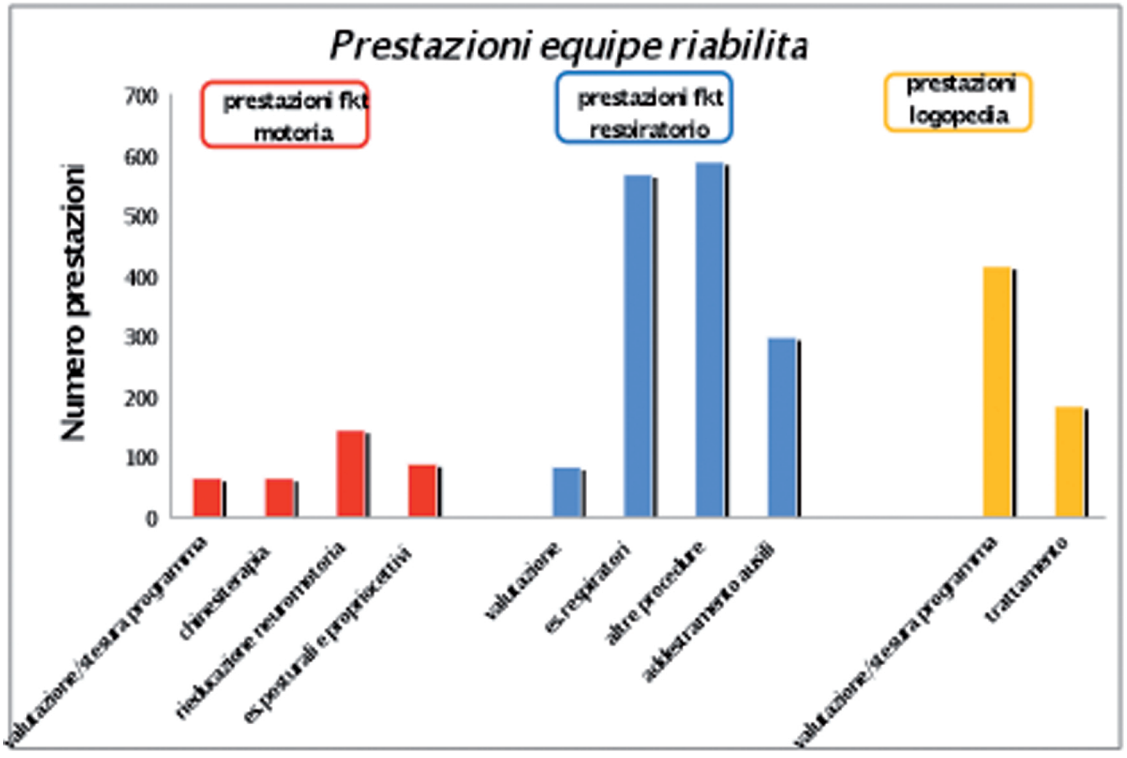

Figura 1.

time (an average of 42 days), the most of them had congenital heart disease and congenital airways malformation. Respiratory physiotherapy is the most requested and practiced (84% of the patients), then neuro-motor physiotherapy (40%) and then swallowing management by the speech-therapist (35%). The main instruments of intervention are: Positive Expiratory Pressure (PEP), PCPAP (Periodic Continuous Positive Airway Pressure), postural care, early mobilization and swallow-training. The workload amounts to an average of 135 hours per month (60% respiratory care).

Discussion: this study detect the rehabilitation techniques most used in PICU Meyer and the kind of children that need that, but it is not possible having an answer about their effectiveness orabout the reduction of the hospitalization time.

Conclusions: physiotherapists and the speech-therapist, even if involved with a selected part of the PICU patients, are an integral part of the care staff.

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Effects of an intervention based on the Microsystems Theory for low-back pain

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Aims. Low-back pain (LBP) shows epidemic proportions[1] and causes an enormous economic burden which appears growing over years.[2] A variety of interventions have been proposed for LBP, but considerable uncertainty still exists about their effectiveness.[3] An alternative approach is based on Microsystems Theory (MT), that claims the interconnection of all body parts and the possibility to influence back pain by acting on even remote segments. This study was aimed at verifying the effectiveness of a MT-based treatment for LBP.

Methods. Participants were 21 subjects with LBP lasting for at least 12 weeks and admitted for physiotherapy at the "Piero Palagi" Hospital in Florence. They were randomly allocated to MT group (MG, 11 subjects, age 56.0±14.3) or Control Group (CG, 10 subjects, age 71.2±12.4). All patients were treated for LBP with two sessions/week for five weeks using the standard protocol for LBP. MG patients received also

four sessions of the MT-based intervention, whereas patients of CG group received also a placebo intervention of the same duration. The outcome measures included the Measure Yourself Outcome Profile (MYMOP), the Roland&Morris questionnaire (R&M), the Visual Analogue Scale (VAS) for pain and were all administered at the beginning (T0) and at the end (T1) of treatment. The VAS was also administered before and after each MT or placebo additional session. After baseline comparisons, the effects of treatment were analyzed using the ANOVA with repeated measures.

Results. Groups were similar at baseline for LBP severity, use of medications and gender, but MT patients were significantly younger (p=0.018). Pain was significantly reduced after each MT session but not after placebo sessions (time x group, p<0.001). At T1 MTG patients showed higher improvements than controls in the R&M (time x group, p<0.01) and in all MYMOP items (p<0.001). Moreover, at T1 no MG but 4 GC patients were taking medications for LBP (p=0.020).

Conclusions. Data presented indicate that a MT-based intervention may have positive short-term effects for LBP, but this finding need confirmation due to the study limitations (small sample, unblinded therapist/assessor). Further research should also investigate the long-term effects of the intervention with adequate follow-up.

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Virtual reality with console Nintendo Wii in the rehabilitation of patients with spinal cord injury: a pilot study

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Aims. Virtual reality interactive videogames are useful in rehabilitation programs also for neurological pathologies to improve motor abilities, balance and quality of life[1,2]. Currently Nintendo Wii console and its interactive games are being studied for physiotherapy in spinal cord injury (SCI).[3,4,5]

Objective. To determine, with a pilot study, the suitability of Nintendo Wii console as an adjunct to physiotherapy in post-acute SCI, choosing from the available games those most appropriate for each patient and to document therapeutic potential of virtual reality use in SCI rehabilitation.

Methods. This pilot study, presented as case-series report, was performed at the Spinal Unit Careggi University Hospital, between January and March 2014.

Each available Wii game was analyzed and tested for feasibility in SCI patients based on characteristics required by patients to play the game (Table I).

6 inpatients recovering from SCI (3 female and 3 male, range 37 - 73 years, neurological level between C5 and C7, AIS A and C) were recruited. Patients were trained on games involving use of upper limbs in sitting position.

Table I.—*Nintendo Wii game items analyzed per characteristics required by SCI patients to be played.*

Items Analyzed	Characteristics Required
Buttons	If buttons have to be pressed or not
Hands	One or two hands needed
Speed	If speed is required to obtain a higher score
Trunk Movement	Not necessary, induced by the game or indispensable
Type of Movement Required	Description of movement required
Required Movement lassification	Discrete, serial or continues
Balance	Required or not
Coordination	Required or not
Resistance	Required or not

Together with conventional rehabilitation treatment, each patient followed a cycle of 10 sessions of 30 minutes each of physical therapy with use of Wii console games.

At the first (T0) and last (T1) session outcome measurements included: ASIA motor level and motor score, Pain rating scale, Van Lieshout Hand Function Test for Tetraplegia (VLT), Spinal Cord Indipendence Measure and SF36 Mental Health. Compliance and acceptability were recorded.

Pre-post comparisons were conducted with the Wilcoxon test.

Results. All patients completed foreseen sessions. No adverse effects were noted.

All outcome measurements showed improvement between T0 and T1 with statistical significance (p < 0,05) for ASIA motor level and motor score, Pain rating scale, VLT and SF36.

Conclusions. Games feasibility was easily evaluated to match patient motor characteristics. Despite low patient number and a heterogeneous group, suitability of Wii in SCI rehabilitation and patient compliance were high.

Wii can be used as an adjunct to physiotherapy for inpatients with post-acute SCI. Further research is needed to establish effectiveness of Wii as a rehabilitation tool for SCI patients.

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The effect of functional stabilization training on the cross sectional area of the deep stabilizers muscles in healthcare workers with chronic low back pain: a pilot, prospective and uncontrolled study

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Aims. Low back pain is one of greatest causes of occupation disease among healthcare workers (1). Rehabilitation programs for the deep stabilizing muscles are useful for the prevention and treatment of pain and disability caused by chronic LBP (2). The aim of this pilot study is to evaluate the effects of a specific training for the lumbar stabilization on the tropism of the Multifidus muscle (ML) and the Transversus Abdominis (TrA) in a group of healthcare workers with chronic LBP (primary objective). It will also assess the effect of the same training on pain and disability (secondary objective).

Methods. 5 female patients (mean age 39 years) were subjected to a lumbar stabilization program lasting 12 weeks. Subjects were assessed before treatment (T0), at the end of

Tabella I.

		$\bar{X}$	Δ	ρ	*P*
TrA (mm)	Pre	3.48			
	Post	3.71	6.6%	0.88	0.22
	Foll.-up	3.61	3.7%	0.98	0.33
LM (mm)					
L	Pre	27.5	14.2%	0.86	0.03
	Post	31.4			
	Foll.-up	32.1	16.5%	0.79	0.03
R	Pre	29.0			
	Post	31.3	7.9%	0.72	0.18
	Foll.-up	31.4	8.2%	0.42	0.26
NRS	Pre	4.4			
	Post	0.8	- 81.8%	0.67	0.002
	Foll.-up	1.0	- 77.3%	0.27	0.01
ODI-I	Pre	18.8			
	Post	6.0	- 68.1%	0.80	0.003
	Foll.-up	4.0	- 78.7%	0.42	0.01

$\bar{X}$: valore medio; D: variazione percentuale; ρ: indice di correlazione di Pearson; P: p value.

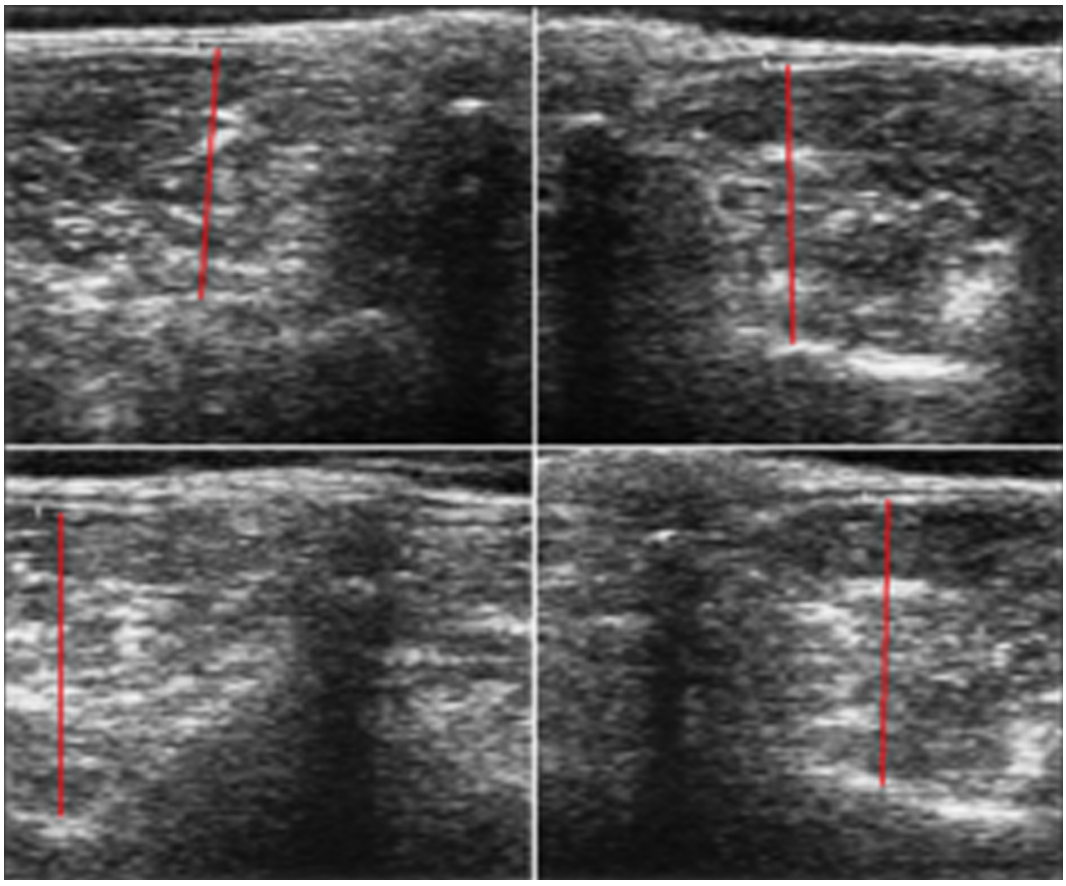

Figura 1. — Immagine ecografica trasversale bilaterale del multifido lombare al livello L4 prima (A) e dopo (B) il training di esercizi di stabilizzazione per la muscolatura profonda.

physiotherapy intervention (T1) and after two months (T2). Before starting the treatment (T0) it was evaluated the pain (NRS), the disability (ODI-I) and the thickness of stabilizing muscles (by ultrasound). The data were analyzed by T-Student test ($P<0.05$) and by Pearson correlation.

Results. No significant changes were showed in the cross sectional area of the TrA. Regarding the ML, the thickness of the hypotrophic side was increased in 4 of 5 subjects. As for the other outcomes, a significant improvement in pain intensity ($\rho=0.67$, $P=0.002$) and in degree of disability ($\rho=0.80$, $P=0.003$) was found. All results remained unchanged at the follow-up.

Discussion. In agreement with literature (3,4), this pilot study shows that a specific training for the stabilizing musculature is able to improve clinical outcomes (NRS, ODI) but not the tropism of the deep muscles. However, our study showed an improvement in the symmetry of the LM thickness (5).

Conclusions. The results of this preliminary study suggest that a specific stabilization training can improve pain, disability and the symmetry between the multifidus muscles at a vertebral level.

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Dysphagia associated with anterior cervical disc protrusion. A case report

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Aims. Dysphagia is the medical term to describe the symptom of difficulty in swallowing.[1] The possible mechanisms of dysphagia include mechanical compression to the esophagus, oro-pharyngeal tumors, retropharyngeal abscesses, periesophageal edema, inflammation, and anterior cervical bony outgrowths, also called osteophytes.[2] Dysphagia is a common presentation in older people (16%)[3] affected by diffuse idiopathic skeletal hyperostosis (DISH) or hypertrophic anterior cervical osteophytes (HACO) associated with degenerative disc disease.[4] The purpose of this report is to present the case of a 31 year-old female patient with neck pain and swallowing dysfunction.

Methods. This case report describes the subjective assessment and physical examination of a young female complaining of neck pain and dysphagia associated with cervical disc protrusion.

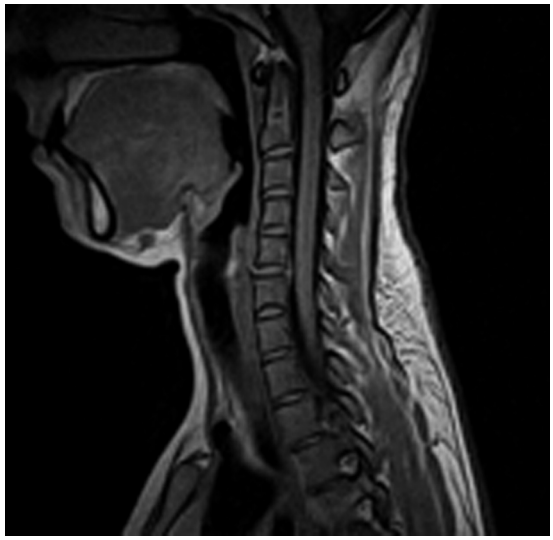

Figura 1.

Results. This patient presented at a physical therapy clinic with neck pain to the right side associated with swallowing dysfunction. Physical examination revealed a general restriction of the neck extension and rotation movements, ipsilateral to the painful side. However, during the physical examination, no symptoms of dysphagia appeared. Due to the uncommon symptoms, the patient was referred for imaging assessments. The diagnosis of anterior cervical protrusion was established by magnetic resonance imaging, that revealed an anterior protrusion at C5-C6 level in association with the interruption of the anterior longitudinal ligament (Fig. 1). Moreover, barium radiographs revealed small anterior cervical osteophytes at the C6 level characterized by a low level of calcium, causing a compression on the right posterior profile of the esophagus.

Discussion. This is the first report on a cervical pathology associated to a swallowing disorder in a young person, as in literature only few cases are described, all of whom are older individuals with large osteophytes.[5]

Conclusions. Dysphagia is a condition that can occur in association with neck pain, even in young people. A comprehensive clinical examination and imaging assessment can help clinicians when atypical symptoms are referred by the patient. Therefore it is important to consider all these elements, in order to reach a correct functional diagnosis.

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The Italian version of the Functional Behavior Profile: reliability in a population of persons with multiple sclerosis

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Aims. The aims of this study were to translate and investigate the inter-rater and test-retest reliability and the internal consistency of the Functional Behavior Profile (FBP) [1] in an Italian population with multiple sclerosis.

Method. The FBP is a 27-item questionnaire designed to measure the overall capacity of the impaired person to engage in 3 areas: Task Performance (TP), Problem Solving (PS) and Social Interaction (SI). Participants rate their symptoms on a 5-point Likert-type scale and scores range from 0 (have many troubles related to functional behavior) to 108 (no troubles related to functional behavior). *Translations.* FBP was forward translated from English into Italian by a professional native-speaking Italian translator. One bilingual native English-speaking translator backward translated the first version. The beta version was administered to 13 outpatients to verify if all the items and responses were understood correctly. This stage ended with an Italian version, the FBP-I.

Subjects and raters. Twenty two persons (16 females), aged between 31 and 65 years (mean age 48.2 ± 9.5), with a diagnosis of MS for 12.6 ± 2.8 years and an Expanded Disability Status Scale (EDSS) of 5.07 ± 0.93 were enrolled. Two raters independently examined all patients. To explore the test-retest reliability, both raters assessed again all patients 5 days later. *Statistical analysis. T*he inter-rater and test-retest reliability were estimated using the intraclass correlation coefficient (ICC) and the Standard Error of Measurement (SEM). To evaluate the internal consistency of the scale we calculated Cronbach's alpha coefficient.

Results. Inter-rater and test-retest reliability of the subscores and of the total score of the FBP-I had good to excellent levels of the ICC values (Table 1). The internal consistency of the FBP-I was also found to be high among the subscores and the total score (Cronbach's alpha = .892).

Discussion. This study shows that the FBP-I has good psychometric properties and can be used to assess functional status in patients with MS.

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Bibliometric indicators and levels of evidence are in physical therapy and rehabilitation medicine journals.

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Aims. To investigate the association between six bibliometric indicators of eight major peer-reviewed Physical Therapy and Rehabilitation Medicine journals and levels of evidence of articles published in these journals.

Main outcome measures. The following journals were selected: American Journal of Physical Medicine and Rehabilitation (non-OA), Archives of Physical Medicine and Rehabilitation (Open Access 12 months), Australian Journal of Physiotherapy (OA 12 months), Clinical Rehabilitation (non-OA), Disability and Rehabilitation (non-OA), Journal of Orthopedic and Sports Physical Therapy (non-OA), Journal of Rehabilitation Medicine (OA 6 months), Physical Therapy (OA 12 months). All the articles published in these journals between January 2004 and December 2009 were investigated. Level of evidence of the articles (Table I) and bibliometric indicators (Table II) of the journals were recorded. After having clustered articles per journal and per year, each bibliometric indicator value, converted in Z score, was associated to the level of evidence of articles published in the years considered for the indicator calculation. Data were analyzed by Generalized Estimation Equations (GEE), with bibliometric indicators as dependent variable and levels of evidence and the access to the journal (open vs non-open access).

Table I.—*Reliability of the Italian version of the Functional Behavior Profile (FBP-I) for both total and subsections scores.*

	Inter-rater reliability		Test-retest reliability		Internal consistency	
	ICC (95% CI)	SEM	ICC (95% CI)	SEM	α	p value
FBP-I total score	0.734 (.648-.807)	5.56	0.960 (.928-.978)	2.16	0.89	<0.001
Task Performance	0.941 (.894-.967)	1.3	0.947 (.906-.971)	1.23	0.90	<0.001
Social Interaction	0.772 (.681-.851)	2.05	0.909 (.839-.949)	1.29	0.84	<0.001
Problem Solving	0.872 (.778-.928)	1.35	0.890 (.808-.939)	1.25	0.86	<0.001

ICC: Intra-class Correlation Coefficients; CI Confidence interval; α: Cronbach's alpha.

Table I. — *Classification of articles. Legend: RCT: Randomized controlled trials; CCT: Non-randomized controlled trials.*

Level of Evidence	Study design
Level 1	RCT Meta-analysis Systematic Review
Level 2	CCT
Level 3	Cohort study Cross-sectional study Case–control study Observational/descriptive study Validation study Clinical trial (>10 subjects)
Level 4	Case report/case series (≥10 subjects) Narrative review
Level 5	Other article

Table II.—*Bibliometric indicators and their publication window (JCR = Journal Citation Report).*

	Publication window	Underlying database
Eigenfactor Score	Previous 5 years	JCR
Article Influence Score	Previous 5 years	JCR
Source Normalized Impact per Paper	Previous 5 years	Scopus
SCImago Journal Rank	Previous 5 years	Scopus
2-year Impact Factor	Previous 5 years	JCR
5-year Impact Factor	Previous 5 years	JCR

Results. A number of 6086 articles were included and analyzed. The main predictor of all bibliometric indicators were the type of access to the journals (Wald's Chi-square: 2649 to 10538, p<.001), while levels of evidence were a poorer predictors of bibliometric indicators (Wald's Chi-square: 53 to 375, p<.001) in the selected journals. However, within levels of evidence, level I seems to be the best predictor of higher bibliometric indicators (Wald's Chi-square: 12 to 206, p<.001), when compared to the others.

Conclusions. Results have shown poor association between the six bibliometric indicators and levels of evidence in the group of selected journals, suggesting caution in considering bibliometric indicators as a primary index of journals' publication of high levels of evidence articles and, at the same time, the hierarchy of evidence as a rigid approach to evaluating the potential relevance of different research designs.

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Mirror neurons and art: rehabilitative application of the "embodied simulation" theory in the recovery of the paretic upper limb

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Aims. The discovery of mirror neurons had fascinating implications in the field of aesthetics. Researchers studied the phenomenon of "embodied simulation" in the context of the empathic reactions prompted by works of art. Electroencephalographic studies detected motor cortical system activity during the visualisation of abstract works of art. In this context we can refer to embodied simulation and implicit gestures: mirror neurons are activated by static and non figurative images, which take us back to the dynamics of the artistic creation and which engage the areas and the corresponding motor programs in the observer brain. The objective of this work was to figure out rehabilitative applications of those discoveries and to answer this question: can subjects who had a stroke and developed upper limb paresis visualise and embody the artist gesture in a stroke of paint, and get a benefit from that?

Methods. A rehabilitative protocol was given to four patients suffering from dominant upper limb paresis. They were exposed to six works of abstract art. After they observed the paintings, they were asked to create motorial images of the gestures required to produce the paint strokes and to replicate them using paint and brushes. The protocol called for 10 sessions, an initial and a final assessments using the Ashworth scale, the Abilhand questionnaire, the Fugl-Meyer Assessment – Upper extremity, a final interview and a qualitative evaluation of the work produced.

Results and discussion. The results show an improvement in the processes involved in the dominant upper limb motor recovery with some degree of regained functionality, to better involvement of concomitant hands activities and to some noticeable regain of writing abilities. Despite the limitations due to the number of patients involved and the length of the follow-up, results seem to suggest that this protocol can be used in the rehabilitation of the paretic upper limb as a complementary treatment to more traditional physiotherapy techniques.

Conclusions. This work has shown that it is possible to enlist the activation of mirror neurons as a rehabilitative tool through less conventional methods making use of abstract art and associated painting activities. Further investigation in this direction is strongly recommended.

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The effect of the mobilisation of the contralateral limb on knee extension in slump position in healthy adult subjects

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Background and objective. The Slump Test[1] is a neurodynamic test, used when assessing patients with low back pain and associated radiating pain in the leg to discriminate whether the source of pain is of neural origin. According to the neurodynamic concept[2], it has been proposed that mobilising the unaffected leg with the patient in test position would decrease the adverse neural tension at the lumbar roots level[3]. As the angle between the lumbar roots and the spinal cord can be decomposed in a principal axial component and an accessory lateral displacement, it has been argued that tensioning the contralateral root would traction distally the axial component of the ipsilateral root thereby decreasing its adverse neural tension[3,4].

The objective of this work was to study the effects of the contralateral knee mobilisation on the knee extension range of motion (ROM) in slump position.

Figure 1.—Positioning of the subject.

Materials and methods. A repeated-measure design wasused to study 38 healthy adult subjects, naive to manual therapy or neurodynamics. All participants underwent a placebo (sham mobilization), control (no mobilization) and experimental (passive left contralateral knee mobilization into extension) procedures in a randomized order. Right knee extension ROM was measured by an optoelectronic motion analysis system before and after each procedure. The assessor was blinded to the procedures. Data were analysed using a Friedman's ANOVA and post-hoc pairwise comparisons were made using a Wilcoxon signed rank test with Bonferroni's correction.

Results. The experimental procedure produced a statistically significant increase of the knee extension ROM when compared with the control (p=.008) and the placebo (p=.009) procedures. No differences were observed when comparing the control and placebo procedures. However, a significant increase of the angle delimited by the column segment and the segment thigh was detected after the experimental procedures (p<.001), but not after the placebo and control procedures.

Discussion

Although the experimental procedure increased the ipsilateral knee extension, it also changed the angle delimited by the column and thigh segments. The observed effect seems most likely attributable to a mechanical action of the hamstring muscles on the ischial tuberosities rather than to the neural mobilisation of the lumbar roots.

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Changes induced by treatment with botulinum toxin a in children with cerebral palsy : prospective study

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Aims. Botulinum toxin A is used in the management of spasticity in children with Cerebral Palsy (CP). In the treatment of hypertone of gastrocnemius and soleus muscles, its efficacy has been demonstrated in terms of improvement of Functions and Body Structures (range of motion, muscle tone, gait pattern). Low attention has been addressed to the components of Activity and Partecipation, according to the International Classification of Functioning, Disability and Health, Version for children-adolescents (ICF-CY). In the studies that consider the gross motor abilities, botulinum toxin A is given in more parts of the body. The aim of this study is to observe changes induced by treatment with botulinum toxin A in the gastrocnemius and soleus, both on Functions and Body structures and Activity and Partecipation of children/adolescent affected by CP, according to ICF-CY.

Methods. This prospective observational study included 14 patients with CP, between 3 and 17 years, able to walk without assistance, classified into I and II level of Gross Motor Function Classification System (GMFCS), afferent to botulinum toxin services of hospitals in Florence and Prato. Before treatment and 1 month after treatment were evaluated: range of motion of the ankle, muscular tone of gastrocnemius and soleus, gait

pattern, distance walked in 6 minutes, gross-motor abilities.

Results. 8 males and 6 females were recruited, 3 with diplegia and 11 with hemiplegia, with a mean age of 8.5. After treatment with botulinum toxin a significant improvement of passive and active dorsiflexion of the ankle and a reduction of muscular tone in the gastrocnemius and soleus were observed.

Discussion. this study confirmed the efficacy of botulinum toxin in the gastrocnemium and soleus in the improvement of dorsiflexion of the ankle and in the reduction of muscular tone. There were no significant changes in gait pattern, distance walked in 6 minutes and gross motor abilities. Furthermore age seems to influence gross motor abilities.

Conclusions. The scarceness of the sampling and its varability influenced the results. It would be desirable for the future to involve more centres and to follow the subjects with a longer follow-up.

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Brain structural and functional changes after action observation therapy in Parkinson's disease patients with freezing of gait.

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Objectives. To assess brain functional and structural changes following action observation therapy (AOT) in patients with PD and freezing of gait (PD-FoG) [1].

Background. FoG is a disabling impairment for PD patients and may not respond to medications. AOT may enhance physical therapy in PD-FoG [2].

Methods. 23 PD-FoG patients underwent a 4-week (W4) rehabilitation training. Subjects were randomized into 2 groups: in AOT-group, therapy consisted of AO combined with practicing the observed actions; control-group performed the same training combined with landscape-videos observation. At baseline (T0) and W4, patients underwent: clinical and motor functional evaluations, 3D-T1-weighted and functional MRI. At T0, 15 age-matched healthy controls (HC) performed the same MRI protocol. FMRI tasks consisted of: foot simple-movement [3]; observation of videos showing a man in circumstances precipitating FoG; motor imagery in the same circumstances as observation task [4]. Clinical and motor functional assessments were repeated at week 8 (W8).

Table I.

	PD control	PD control	PD AOT	PD AOT
	W4-T0	W8-T0	W4-T0	W8-T0
UPDRS III ON	0.5	0.3	0.04	0.03
FoG-Q	0.02	0.1	0.02	0.1
PDQ-39	0.07	0.37	0.04	0.02
TUG	0.04	0.01	0.03	0.09
BBS	0.05	0.11	0.005	0.007
10M-WT	0.01	0.2	0.008	0.26

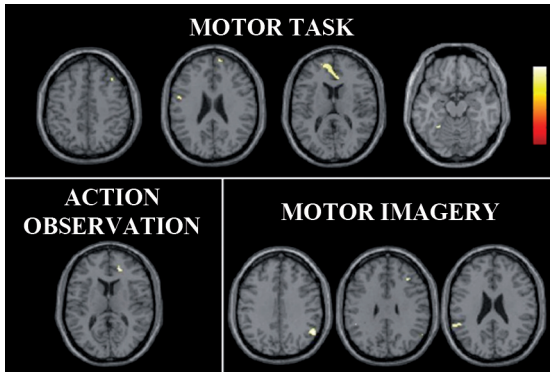

Figura 1.

Results. At W4, both groups showed reduced FoG severity and walking speed improvement. AOT-group showed additional UPDRS III, balance, and quality of life (QoL) improvements. At W8, functional motor improvements and positive effects on UPDRS III and QoL were observed in AOT-group only (Tabella I). At t0, PD patients show a reduced GM volume in the fronto-parietal network relative to HC; at W4, AOT was associated with an increased grey matter (GM) volume of parietal regions bilaterally; in control-group an increased primary motor cortex volume was observed bilaterally. FMRI showed that PD patients had a reduced recruitment of basal ganglia, motor and fronto-parietal network relative to HC. AOT was associated with increased recruitment of primary sensorimotor/premotor cortices, mirror neuron system (MNS) [5] and caudate nucleus bilaterally during simple-motor and motor imagery tasks (Fig.1). At W4, control-group showed reduced recruitment of the primary sensorimotor areas and parietal regions during all tasks. Only in AOT group, functional brain changes were associated with clinical improvements at W4 and predicted clinical evolution at W8.

Conclusions. AOT has a positive additional effect on walking ability recovery of PD-FoG patients. In PD, AOT promotes brain structural and functional plasticity of both the primary sensorimotor and MN systems.

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The efficacy of specific exercises in the treatment of adolescent idiopathic hyperkyphosis: a pilot study.

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Aims. Idiopathic hyperkyphosis is an increase of the physiological kyphotic curve that appears mainly during the adolescent period. There are no studies in literature which demonstrate the efficacy of exercises alone in the treatment of hyperkyphosis. This study was aimed at evaluating the efficacy of the Scientific Exercise Approach to Scoliosis (SEAS) for idiopathic hyperkyphosis after one year.

Methods. *Study design*. Retrospective cohort study. *Population.* 32 consecutive adolescents affected by idiopathic hyperkyphosis (18 females), mean age 12.75±1.8, selected in the clinics of Milan and Vigevano, provided that they completed at least one year of treatment with the SEAS approach and were not prescribed a brace before or during that year. *Outcome measures.* The values expressed in mm of C7, L3 and the sagittal index (C7+L3) were assessed at the beginning (T0) and the end (T1) of treatment. *Statistical Analysis*. Paired t-tests were used for pre-post treatment comparisons.

Results. After one year of treatment a statistically significant decrease of all parameters was observed. The mean value of C7 decreased from 51.56±9.45 at T0 assessment to 40.31±11.63 mm at T1 (<0.05). The initial value of L3 was 47.34±15.29mm, that was reduced to 41.40±15.35 mm after one year (p<0.05). The mean value of the sagittal index improved from 98.90±17.30 to 81.71±23.30, (p<0.05).

Discussion and conclusions. Our results show that the treatment of idiopathic hyperkyphosis with specific exercises can be helpful for the young patient improving the posture and that a specific training combined with the continuous education to keep the active self-correction during the day can help to counteract the progression of the pathology. This is the first study concerning the treatment of young patients affected by idiopathic hyperkyphosis only with physiotherapy and hence it can be considered relevant notwithstanding the methodological limitations (small sample, lack of a control group, retrospective study design, short duration). However, results need to be confirmed by controlled prospective studies of a major duration.

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Development and validation of the Italian version of the MYMOP (Measure Yourself Medical Outcome Profile) Scale.

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Aims. Muscular-skeletal disorders are a major cause of chronic illness in the community, with higher prevalence in women and in the elderly. These problems have a strong impact on patients' quality of life and on health services. Thus the availability of suitable measurement tools is needed to assess changes by patients over time.

One recently developed tool is the MYMOP (Measure Yourself Medical Outcome Profile) scale,[1,2] a questionnaire aimed at measuring outcomes from the patient's perspective. It's short and easy to administer, a feature which increases its applicability and acceptability. This study was aimed at providing a transcultural validated translation of the MYMOP scale in the Italian language (MYMOP-IT) and testing its metric properties in patients with muscular-skeletal disorders.

Methods. *Translation*. The double translation method (Italian translation from the original English version, back-translation, comparison between English back-translated and original versions) was used. *Subjects*. 200 subjects with muscular-skeletal disorders (59.1±14.9 years, range 19-85) admitted to the rehabilitation service at the "Piero Palagi" hospital in the OPTIMUS project [3,4] were assessed with the MYMOP-IT and the Short Form-36 at baseline (T0) and at 3 months follow-up (T1). At T1 subjects also filled in a 7-points outcome questionnaire about their symptoms (worse- than-ever, much-worsened, a-bit-worsened, unchanged, a-bit-improved, much-improved, completely-disappeared). *Analysis of data*. MYMOP-IT construct validity was estimated by correlations to SF-36 Mental and Physical scores, responsiveness by comparing MYMOP scores changes among patients with different outcomes and by calculation of the Standardised Response Mean (SRM) e Index of Responsiveness (IR).

Results. Significant correlations were found between MYMOP-IT and both Physical and Mental SF-36 scores (Table 1). Changes detected at T1 in the four MYMOP items were significantly different in subjects with different

TABLE I.—*Correlation between MYMOP-IT items scores and SF-36 Physical and Mental scores at baseline.*

	MYMOP-IT items			
	Main symptom	Activity limitation	General wellbeing	MYMOP profile
SF-36 Physical	-0,518*	-0,577*	-0,589*	-0,615*
SF-36 Mental	-0,290*	-0,259*	-0,320*	-0,320*

*p<0,001; SF-36= Short Form-36 scale.

Table II.—*Responsiveness of the MYMOP-IT scale and SF-36 indexes. Scale scores are expressed as mean (DS).*

	T0	Changes T0-T1 All subjects (N= 200)	SRM	Changes T0-T1 *"Unchanged"* (N=66)*	Changes T0-T1 *"A bit better"* (N=18)*	IR*
Main Symptom	4,18 (1,31)	1,94 (1,84)	1,06	-0,61 (1,24)	-1,45 (1,61)	-1,17
Activity Limitation	4,29 (1,34)	1,95 (2,04)	0,96	-0,17 (1,34)	-1,63 (1,75)	-1,22
General wellbeing	3,95 (1,22)	1,81 (1,76)	1,03	0,00 (1,33)	-1,59 (1,23)	-1,20
MYMOP Profile	4,14 (1,33)	1,90 (1,88)	1,01	-0,78 (3,42)	-4,75 (3,66)	-1,39
SF-36 PS	36,45 (7,88)	7,24 (9,00)	0,80	9,30	8,08	0,87
SF-36 MS	44,39 (10,67)	4,26 (9,86)	0,43	10,49	3,86	0,37

T0=baseline; T1=3 months follow-up; SRM=Standardised Response Mean, IR=Index of Responsiveness, SF-36= Short Form-36 scale; PS =Physical Score; MP=Mental Score.
*For MYMOP-IT and for SF-36 improvement is revealed by negative and by positive values, respectively.

perceived outcome (p<0.001). The IR and SRM were greater for all the four MYMOP items than for the two SF- 36 indexes (Table II).

Conclusions. The metric properties of MYMOP-IT scale were found to be similar to the original version, therefore the scale can be used as an outcome measure in this population. Future studies would extend results to subjects with disability caused by different disorders.

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Use of gait analysis to evaluate the effectiveness of treatment with botulinum toxin in children with cerebral palsy.

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Aims. In recent decades there has been a huge increase in spasticity focal treatment with botulinum toxin (BT) in children with Cerebral Palsy (CP).[1,2] However, the results in the individual child are not always documented by objective measurements and up to now no study evaluated the BT effects on gait in CP using an index that summarizes in a single value the global gait pattern. One such index is the Gait Deviation Index (GDI)[3] that is computed through a principal components analysis from 12 kinematic and spatial-temporal gait parameters measured with the Gait Analysis (GA).

Purpose. Verify the outcomes of BT injection in children with CP using the GDI and the individual measures of Gait Analysis.

Methods. 23 children (16 male, age 8,8±4,3 years, range 3-17) with unilateral or bilateral form of CP who underwent single or repeated BT injections. Before injection and after one

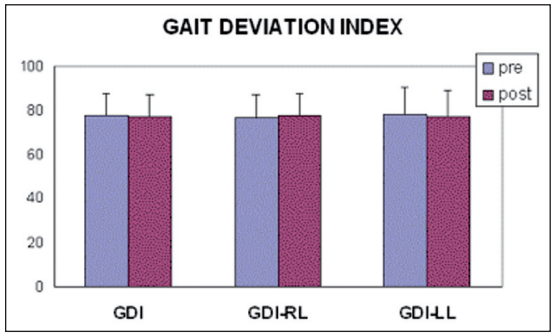

Figure 1.—The Gait Deviation Index measured before (pre) and 1 month after bodulinum injections (post) in the right (GDL-RL) and in the left (GDI-LL) limb and average between the two sides (GDI).

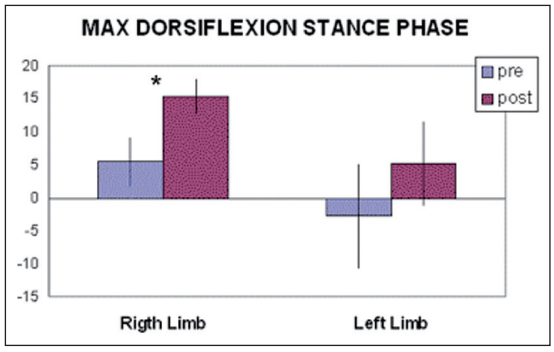

Figure 2.—The maximum ankle dorsiflexion measured before (pre) and 1 month after botulinum injections (post) during the stance phase of gait in the right and in the left limb (*p<0.05).

month, a GA was performed at the Motion Analysis Laboratory of the Azienda Sanitaria di Firenze, using an optoelectronic system (SMART -E90, BTS Milan). Changes in the GDI and in kinematic and spatial-temporal parameters were analyzed by paired t-tests.

Results. The treated muscles were plantar flexors (24 right, 12 left), hamstrings (3 right, 4 left) and hip adductors (1 in each side). No significant changes were found after injections in the GDI (figure 1) and in spatial-temporal parameters. After right plantar flexors inoculation, the maximum dorsiflexion during right stance phase significantly increased (p=0,023, figure 2) as well the range of left knee flexion (p=0.009). After left plantar flexors treatment the increase in left ankle dorsiflexion did not reach significance, whereas the range of right hip flexion increased significantly (p=0,043).

Conclusions. BT injections in a limited number of muscle groups seem not to be able to modify the global gait pattern as detected by the GDI. The main effect of BT in plantar flexors is an increase of passive dorsiflexion in stance without changes of the ankle kinematics in the swing phase. Some effects can be found also in the contralateral limb, though the observed changes might be unrelated to BT injections.

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Stabilometric Results in ON and OFF phases, compared to the Push and Release Test in patients with Parkinson's Disease

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Aims. Postural instability is one of the most disabling symptoms in Parkinson's disease (PD) and its analysis is a key component of clinic evaluation.[1]

Objective. to investigate the possibility of using the stabilometric platform as an assessment tool for postural instability, through the observation of the center of pressure (COP). Materials and Methods. 44 participants selected: 10 normal subjects, 34 patients with PD divided into 2 groups of severity (12, 2-2.5H&Y; 22, 3-4 H&Y),evaluated in ON and OFF phases. For the instrumental evaluation was used stabilometric platform (GPS-model). All acquisitions have: acquisition interval of 40s and a sampling frequency of 50Hz under the same conditions.[2] The clinical evaluation of postural instability was assessed with Push and Release Test (P-RT), which unlike the Pull Test eliminates the variable operator-dipendent,[3] UPDRS III and H&Y.

Results. A variability exists in fluctuations between the ON and the OFF phases that increases in relation to the degree of illness. The group staging H&Y2-2.5, in ON have a COP close and comparable to the control; the response to P-RT is slightly lower (p=0.015); OFF phase in this group shows a slight increase in the COP (p=0.006) and worsening of P-RT (p=0.01).

The group with an H&Y3-4, presents in ON, a COP wider then control (p=0.005) and is characterized by a difficult balance recovery compared to the control (p=0.007) and to the previous group (p=0.008). These same patients in OFF, have a COP greatly reduced compared to the control (p=0.02) with a P-RT (p=0.008) which reaches up to the fall.

Discussion. In late PD, a greater area of the COP in ON could be the establishment of compensation mechanisms for finding a better balance; in OFF, where the COP is very small, would lead to an inability to put in place the mechanisms necessary to maintain balance.

Conclusion. This observation could be an alternative reading of stabilometry in particular for phase 3-4 H&Y. A careful analysis of the results will require further study into subgroups, dividing not only by degree of disease but also in the clinical development of PD: stiff or hyperkinetic.

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How to measure "toe-walking" associated with autistic spectrum disorders (ASD): proposal for a new evaluation protocol.

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Aims. Twenty per cent of individuals with autistic spectrum disorders (ASD) walk on their tiptoes (toe-walking, TW) with different degrees of severity.[1-2] If persistent this may lead to important musculoskeletal changes.[3] Unfortunately methods to "quantify" TW are missing in literature. The aim of this study is twofold: a) to propose a protocol for assessing TW, and b) to assess whether a soft surface influences motor behavior.

Methods. The inclusion criteria were: a diagnosis of ASD according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)[4] and the presence of an ankle dorsiflexion range of motion wider than 90°. Videos were made during a static task (playing in front of a support for 3 minutes) and during a dynamic task (transporting an object from one spot to a therapist situated 2 meters away and back again for 15 times). Each task was repeated on three different days. The tests were repeated on a foam mat. An operator, not involved in the testing, assessed the videos of the static task trials by calculating the time spent in full feet support or on tiptoes. The dynamic task trials were assessed by counting the number of times the child was able to walk the full length with all steps in full feet support or in the toe-walking posture.

Results. On the floor, during the static tests the subject remained on tiptoes for an average of 85% of the time (table 1). During the dynamic tests the child toe-walked 100% of the

Table I.

	Static Task on Floor (in seconds)				Dynamic Task on Floor (N° of trials)		
	Two full feet	One full foot	Toe-walking	% total time in toe-walking	Full feet support	Toe-walking	% times in toe-walking
Trial 1	17	14	149	83%	0	30	100%
Trial 2	0	33	147	82%	0	30	100%
Trial 3	12	3	165	92%	0	30	100%
Mean	9.67	16.67	153.67	**85%**	0	30	**100%**
	Static Task on Mat (in seconds)				Dynamic Task on Mat (N° of trials)		
	Two full feet	One full foot	Toe-walking	% total time in toe-walking	Full feet support	Toe-walking	% times in TW
Trial 1	135	17	28	16%	20	10	33%
Trial 2	39	5	136	76%	16	14	47%
Trial 3	140	4	36	20%	16	14	47%
Mean	104.67	8.67	66.67	**37%**	17.33	12.67	**42%**

measured lengths. On the soft surface, during the static trials the child used the posture on tiptoes for an average of 37% of the time while during the dynamic trials he walked on his tiptoes 42% of the measured lengths.

Discussion and conclusions. The proposed protocol seems to be useful to provide a quantitative measure of two aspects of motor behavior of toe- walkers. The soft surface seems to influence considerably motor behavior inducing a significant increase in the time of full support during both static and dynamic tasks.

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Search strings for efficient retrieval of Manual Therapy literature in PubMed database.

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Aims. Evidence-based practice is a pressing issue for physiotherapy. The breadth and quality of research in the current lit-

Table I.—*Proposed PubMed search strategies for identifying potentially pertinent articles on MT.*

Narrow search strategy

— (Chiropractic[MH] OR Manipulation, Osteopathic[MH] OR Musculoskeletal Manipulations[MH] OR Chiropractic OR Joint Mobilization* OR Manipulative OR Manual Therap* OR "Muscle Strengthening" OR "Muscle Stretching" OR Myofascial* OR Osteopathic Manipulation* OR "Proprioceptive Neuromuscular Facilitation" OR Spinal Manipulation* OR "Static Stretching" OR Trigger Point*) NOT (animals[MH] NOT humans[MH]) AND *name(s)-of-the-disease*

Expanded search strategy

— (Chiropractic[MH] OR Manipulation, Osteopathic[MH] OR Musculoskeletal Manipulations[MH] OR Chiropractic OR Joint Mobilization* OR Manipulative OR Manual Therap* OR "Muscle Strengthening" OR "Muscle Stretching" OR Myofascial* OR Osteopathic Manipulation* OR "Proprioceptive Neuromuscular Facilitation" OR Spinal Manipulation* OR "Static Stretching" OR Trigger Point* OR Exercise Movement Techniques[MH] OR Exercise Therapy[MH] OR Manipulation, Orthopedic[MH] OR Massage[MH] OR Muscle Relaxation[MH] OR Muscle Stretching Exercises[MH] OR Osteopathic Medicine[MH] OR Traction[MH] OR "Clinical Reasoning" OR "Exercise Therapy" OR "Joint Range of Motion" OR Joint Stabilization* OR Manipulation* OR Manual Intervention* OR "Massage" OR Mobilization* OR Motor Control* OR "Motor Learning" OR "Muscle Relaxation" OR "Muscle Strength Training" OR Neurodynamic* OR "Orthopedic Manipulation" OR Osteopathic* OR "Osteopathic Medicine" OR "Passive Range of Motion" OR "Passive Stretching" OR "Physical Therapy" OR Physiotherapy OR PNF OR Postural OR Postural Adjustment* OR "Postural Balance" OR "Postural Control" OR "Postural Stability" OR "Range of Motion" OR "Reflexology" OR Stabilization* OR Stretching OR Thrust* OR Traction) NOT (animals[MH] NOT humans[MH]) AND *name(s)-of-the-disease*

erature demand a robust methodological strategy. Once a question is formulated, physical therapists must plan their search strategy including identification of search terms and databases. The aim of this study was to construct PubMed search strings that could efficiently retrieve studies on manual therapy (MT) for time-constrained clinicians.

Methods. Our team chose eleven Medical Subject Heading (MeSH) terms describing MT along with 84 additional potential terms. For each term able to retrieve more than 100 abstracts, we systematically extracted a sample of abstracts from which we estimated the proportion of studies potentially relevant to MT. We then constructed two search strings: one narrow (threshold of pertinent articles ≥40%) and one expanded (including all terms for which the proportion was calculated). We evaluated the efficiency of the proposed PubMed search strings to identify relevant articles included in a systematic review on MT for chronic low back pain.

Results. Fifty-five search terms were able to extract more than 100 citations. The narrow search strategy retrieved all the randomized controlled trials included in the selected systematic review.

Discussion. The narrow string demonstrated its efficiency. Nevertheless, our included terms emphasize that published research on MT is heavily biased towards manipulative techniques. The expanded search string could be useful when less precision, when a larger number of articles might be acceptable to the user.

Conclusions. The proposed PubMed search strings are able to locate potentially pertinent articles and could assist health care professionals to review the large number of MT studies efficiently.

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Systematic review of randomized trials on the effect of taping in spinal pain and disability

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Aims. Taping is a widely employed therapeutic tool for the treatment of several musculoskeletal disorders, nevertheless its effectiveness is still uncertain. This study aims to conduct a systematic review of randomized controlled trials (RCTs) concerning the effects of taping on low back and neck pain and disability and summarize current knowledge.

Methods. We searched MEDLINE, CINAHL, Embase, PEDro, Cochrane Central Register of Controlled Trials (CENTRAL), Scopus, ISI Web of Knowledge, and SPORTDiscus™ databases. All published RCTs without any publication time or language restriction were considered. Study subjects had to be symptomatic adults with a diagnosis of spinal pain, myofascial pain syndrome or whiplash associated disorders (WAD). Two reviewers independently selected the studies, extracted the results and conducted the assessment of quality and clinical relevance. The methodological quality of the studies was assessed by the PEDro scale. The minimal clinically important difference (MCID) for each measurement scale and for each outcome was identified by referencing the literature.

Results. Six studies met inclusion criteria: three on low back pain and three on neck pain. The quality of these studies, assessed with the PEDro score, was generally high, especially for LBP studies. Concerning low back pain, taping proved to have significant effect on pain and disability in immediate post-treatment. At 1 month follow-up, the significant effect on pain was confirmed, whereas the effect on disability became rather small and not significant. As regard to neck pain, taping appeared as effective only on pain in people with WAD and with specific neck pain related to cervical disc herniation, cervical spondylosis, or cervical radiculopathy.

Discussion. Taping might improve lumbar pain and disability short-time after application. Concerning neck pain, the little amount of the studies, the heterogeneity of the samples and the different results do not allow us to draw any conclusion.

Conclusions. Taping can be significantly effective on pain and disability in common LBP, WAD and specific NP at short-term after treatment and it may be a viable option, especially when a immediate effect is needed. There is insufficient evidence to suggest its use for a prolonged effect on time.

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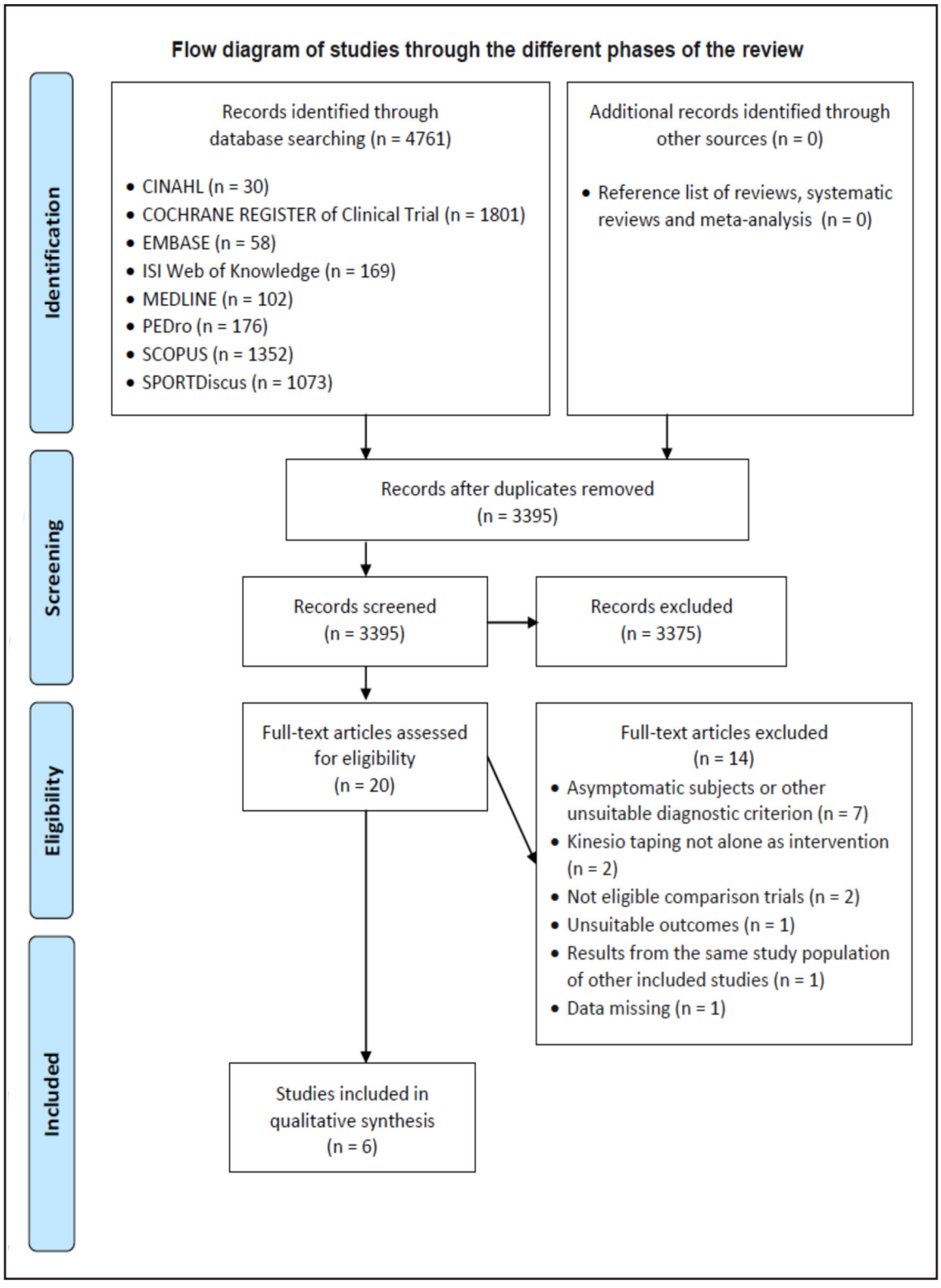
Flow diagram of studies through the different phases of the review
Identification
Screening
Eligibility
Included
Records identified through database searching (n = 4761)
• CINAHL (n = 30)
• COCHRANE REGISTER of Clinical Trial (n = 1801)
• EMBASE (n = 58)
• ISI Web of Knowledge (n = 169)
• MEDLINE (n = 102)
• PEDro (n = 176)
• SCOPUS (n = 1352)
• SPORTDiscus (n = 1073)
Additional records identified through other sources (n = 0)
• Reference list of reviews, systematic reviews and meta-analysis (n = 0)
Records after duplicates removed (n = 3395)
Records screened (n = 3395)
Records excluded (n = 3375)
Full-text articles assessed for eligibility (n = 20)
Full-text articles excluded (n = 14)
• Asymptomatic subjects or other unsuitable diagnostic criterion (n = 7)
• Kinesio taping not alone as intervention (n = 2)
• Not eligible comparison trials (n = 2)
• Unsuitable outcomes (n = 1)
• Results from the same study population of other included studies (n = 1)
• Data missing (n = 1)
Studies included in qualitative synthesis (n = 6)

Figure 1.

Table I.—*Minimal clinical important difference results.*

First author	Outcome	Scale	Follow-up (months)	Cut-off MCID	Experimental group difference (absolute value)	Experimental group difference (percentage)	MCID Result
LOW BACK PAIN							
Castro-Sanchez	Pain	VAS (0-10)		30%	/	14,00	Non-attained
Castro-Sanchez	Pain	VAS (0-10)	0	30%	/	9,00	Non-attained
Castro-Sanchez	Disability	ODI (0-100)	1	10 points	5,00	/	Non-attained
Castro-Sanchez	Disability	ODI (0-100)	0	10 points	4,00	/	Non-attained
Castro-Sanchez	Disability	RMDQ (0-24)	1	2 points	1,40	/	Non-attained
Castro-Sanchez	Disability	RMDQ (0-24)	0	2 points	1,10	/	Non-attained
Chen	Pain	VAS (0-100)-worst pain	1	30%	/	35,50	Attained
Chen	Pain	VAS (0-100)-worst pain	0	30%	/	33,90	Attained
Chen	Pain	VAS (0-100)-worst pain	1	30%	/	36,60	Attained
Chen	Disability	ODI (0-100)	2,5	10 points	13,60	/	Attained
Chen	Disability	ODI (0-100)	0	10 points	14,60	/	Attained
Chen	Disability	ODI (0-100)	1	10 points	15,10	/	Attained
Paoloni	Pain	VAS (0-10)	2,5	30%	/	39,00	Attained
Paoloni	Disability	RMDQ (0-24)	0	2 points	2,20	/	Attained
NECK PAIN							
Kavlak	Pain	VAS (0-10)-resting pain	0	20%	/	33,90	Attained
Kavlak	Pain	VAS (0-10)-activity pain	0	20%	/	37,10	Attained
Kavlak	Pain	VAS (0-10)-night pain	0	20%	/	33,40	Attained
Kavlak	Disability	NDI (0-50)	0	3.5 units	14,45	/	Attained
Lee	Pain	VAS (0-10)	0	20%	/	24,40	Attained
Lee	Disability	CMS (0-20)	0	No MCID	/	/	/
Gonzáles-Iglesias	Pain	NPRS (0-10)	0	25%	/	10,00	Non-attained
Gonzáles-Iglesias	Pain	NPRS (0-10)	0	25%	/	11,00	Non-attained

MCID= Minimal Clinical Important Difference; VAS= Visual Analogue Scale; ODI = Oswestry Disability Index; RMDQ = Roland & Morris Disability Questionnaire; NDI = Neck Disability Index; CMS = Constant Murley Score; NPRS = Numerical Pain Rating Scale.

Isometric endurance testing of cervical flexor and extensor muscles in subjects with neck pain.

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Aims. Several tests can evaluate the isometric endurance of the cervical flexor (NFME) and extensor (NEE) muscles. This study aims to investigate the relationship between neck flexors endurance and extensor endurance and among cervical muscle endurance, disability, pain amount and pain stage in subjects complaining of non-specific neck pain (NP).

Methods. Thirty subjects (18 women, 12 men, mean age=43.9 SD 12.78) with NP filled out the 100 mm Visual Analogue Scale (VAS) and the Neck Pain and Disability Scale - Italian version (NPDS-I). They also completed the timed endurance tests for the cervical muscles.

Results. The mean endurance was 246.7 SD 150 seconds for the NEE test, and 44.9 SD 25.3 seconds for the NMFE test. A significant correlation emerged between the results of these tests (r=0.52, p=0.003). A positive relationship was also found between VAS and NPDS-I (r=0.549, p=0.002). The endurance rates were similar for acute/subacute and chronic subjects, whereas females demonstrated significantly lower values compared to males in NFME test.

Discussion. Our study showed significantly higher endurance of neck extensor muscles compared to flexor ones and significant relationship between pain and disability and between NFME and NEE tests. Nevertheless, we did not demonstrate any relevant relationship between each of the endurance tests, pain and disability. The results of these tests did not signifi-

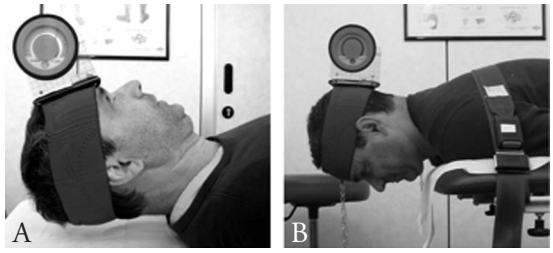

Figure 1.—Isometric endurance thest of the cervical flexor (A) and extensor (B) muscles.

Table I.—*Between groups differences for pain intensity, neck disability and muscle endurance tests*

	Acute pain (n=13)	Chronic pain (n=17)	p
VAS, X(SD)	41.23 (24.48)	33.18 (23.23)	0.36
NPDS-I, X(SD)	34.46 (17.64)	49.44 (15.01)	0.01
NFME test, mo (range)[a]	44 (27-60)	30 (23.5-61.5)	0.50
NEE test, X(SD)	261.92 (137.46)	235.12 (162.13)	0.63

[a]Measures with a non-Gaussian distribution are expressed as median and interquartile range (25th-75th).

cantly differ between acute/subacute and chronic subjects, despite chronic subjects appeared more disabled. The different endurance between males and females can be interpreted on the light of physiological characteristics related to genetic factors. Comparison between this study and other similar ones demonstrated some variability of endurance during the NMFE or NEE tests between different samples.

Conclusions. These findings suggest that neck flexors and extensors endurance are related and cervical endurance is not significantly altered with the duration of symptoms in subjects with NP.

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Is the internal validity of randomized controlled trials able to predict their citation rate?

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Aims. The randomized controlled trial (RCT) is traditionally considered the gold standard for examining the efficacy of interventions. The number of citations to a journal article can be considered to reflect the article's value due to its impact on the scientific community. The aim of this study is to test the hypothesis that the internal validity is a predictor of citation rate of RCTs on the physiotherapy field.

Table I.

Variable	Frequency
Language	
English	575 (95.0 %)
Others	30 (5.0 %)
Subdiscipline	
Musculoskeletal	184 (30.4 %)
Neurology	87 (14.4 %)
Cardiothoracics	88 (14.5 %)
Pediatrics	17 (2.8 %)
Gerontology	51 (8.4 %)
Continence/womens' health	25 (4.1 %)
Oncology	28 (4.6 %)
Sport	11 (1.8 %)
Occupational health	6 (1.0 %)
Endocrinology	67 (11.4 %)
Others	41 (6.8 %)
Indexing in Pubmed	
Yes	569 (94 %)
No	36 (6%)
Type of access	
Open access	75 (12.4 %)
Delayed open access	174 (28.8 %)
Restricted access	351 (58.0 %)

Methods. All articles abstracted in the PEDro database, indexed in Scopus database and published in 2008 were included. For each article, the internal validity, expressed by the PEDro score, the language of publication, indexing in Pubmed database, the type of access to articles (open, delayed open or restricted access) and the subdiscipline were recorded. Citation rate untill december 2013 was extracted from Scopus database. *Data analysis:* data were put in a linear stepwise regression analysis with citation rate as dependent variable and the other variables as independent variables.

Results. A total of 605 articles were included (Table I). The regression analysis showed that independent variables have a moderate effect on the citation rate. The variable included in the models were the type of access to articles (adj R^2 = .029) (mod_1), the indexing on Pubmed (adj R^2 = .048) (mod_2), and the PEDro score (adj R^2 = .058) (mod_3). The other variables were excuded from the model.

Discussion: Included variables are generally poor predictors of citation rate of RCTs in the physiotherapy field. The main predictor is the type of access to the articles. The PEDro score explain only a very small part of variability of the citation rate.

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A systematic review with meta-analysis of proprioceptive and balance exercises after surgical reconstruction of the anterior cruciate ligament

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Aims. The anterior cruciate ligament (ACL) is the most frequently injured ligament of the knee. People who suffer this type of injury are usually young adults practicing sports or heavy physical activity. Treatment can be either conservative or surgical with ligament reconstruction. In both cases, rehabilitation should try to restore the correct knee function and permit the return to pre-injury activity and sport participation levels.

Objectives. To evaluate the efficacy of proprioceptive and balance exercises in subjects with anterior cruciate ligament reconstruction.

Search strategy. We searched The Cochrane Central Register of Controlled Trials (The Cochrane Library), Pubmed, EMBASE, PEDro and CINAHL.

Selection criteria. Only randomized controlled trials on adults subjects following anterior cruciate ligament reconstruction comparing neuromuscular rehabilitation programs with more traditional strengthening programs were included. The primary outcomes measures of interest were functional assessment, percentage of return to pre-injury sport participation level and percentage of re-injury.

Data collection and analysis. After independent study selection, the authors independently assessed trial quality and risk of bias, and extracted data.

Results. Six trials involving 215 participants were included. Articles were characterized by a high variability in the outcome measures and frequent risk of bias, especially lack of assessor blinding and description of randomization. None of the studies assessed the return to sport and the presence of re-injury, and only in one study a long term follow-up (>6 months) was present. Pooling of data was rarely possible due to the wide variety of comparisons, outcome measures and time points reported, and lack of appropriate data. Insufficient evidence was found to support the efficacy of neuromuscular training over another (Figure 1).

Conclusions. The neuromuscular training can be considered a viable alternative or addition to traditional rehabilitation programs in patients undergoing surgical reconstruction of the ACL. Further studies with better methodological quality are necessary to assess the return to sport and re-injury percentages by a long term follow-up evaluation.

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Are *vibrations* always *positive*? A case of hematuria following whole-body-vibration training.

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Aims The use of whole-body-vibration (WBV) is far from being standardized and the optimal threshold for a beneficial effect is undetermined.[1,2]Here, we present a case of an élite runner who had gross hematuria (HT) after a few sessions of WBV.

Methods. A 34-year-old male steeplechase runner came to our observation after two episodes of reddish-colored urine. One month earlier, he added a weekly session of WBV (5rep. of 1' at 30Hzin a semi-squat position) on a Galileo Fitness plate to his usual training(Figure 1).Shortly after the third session, heexperienced an episode of bright red urine, continuing his usual running schedule without any other symptom. The urine became macroscopically normal the day after. Seven days

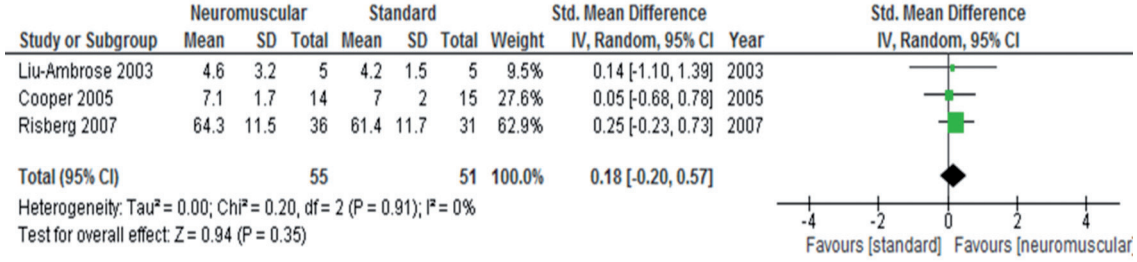

Figure 1.—**Plot of random effects meta-analysis of effect size for the primary outcomes (questionnaire on function). Outcome measures:** Lysholm and Gillquist (Liu-Ambrose *et al.*, 2003), Patient Specific Functional Scale (Cooper *et al.*, 2005), Cincinnati Knee Score (Risberg *et al.*, 2007).

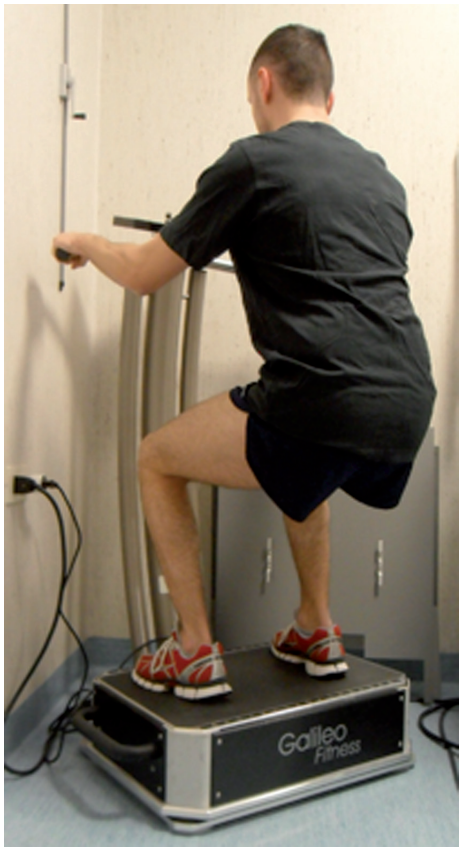

Figure 1.—The Galileo platform (Novotec Medical GmbH, Germany) used for WBV training oscillates around a central axis. A crankshaft principle on each sideof the platform translates the rotating motion of the electromotor into a vertical displacement, inducing a seesaw vibration.

later, following the next WBV session, a HT reappeared and he stopped any physical activity and reported to our center. The patient's general condition was goodand no problems were found or reported in the abdomen, flank, back, scrotum, genitalia or rectum. The next morning, blood screening analysis and the urinalysis were unremarkable. A complete abdominal ultrasonographic evaluation showed no abnormalities. Blood and urine analyses performed 2 days later were normal.

Results. The patient was advised to stop WBV training and to take fluid before and during exertion. He did not experience any episode of HT during a 1-year follow-up.

Discussion. Considering the clinical course, analyses, and basedon the algorithm[3] suggested for the evaluation of HT in athletes, we ruled out renal and metabolic mechanisms of HT. The most probable explanation seems to be a bladder injury, which was produced by repeated impact of the posterior bladder wall against the bladder base, in turn, causing focal mucosal and vascular lesions. In fact, the theoretic peak vertical acceleration of the plate of about 14gis potentially harmful for the human body, even if the frequency and position are within the appropriate range.[5]

Conclusions. Caution with respect to potential health risks due to WBV is always indicated,and future studies are neededto establish clear rules for maximizing training results while avoidingthe potentially dangerous effects.

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The scars are a contraindication for whole-body-vibration? A case report.

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Aims. Contraindications for whole-body vibration (WBV) include recent wounds, but little -if any- attention has been paid to scars. Furthermore, studies addressing the physiological effects of WBV on upper extremities are lacking, although exercises (such as push-up) with the hands bearing on the vibrating platform are currently proposed.[1] Here, we discuss the case of a patient who had skin complications in his hand after WBV session.

Methods. A 55-year-old man was seen for pain, erythema, and small blisters in the thenarvregion of his right hand (Figure 1). He reported that he had placed his palm -as a self-prescribed treatment- on a synchronous WBV platform for home

Figure 1.—Right thenar eminence of the patient showing the palmar scar, erythema, and small blisters.

use (2 bouts of 2' each, at 30Hz, 2mm amplitude) the day before. Five months before, the patient had a traumatic hand injury whereby his hand had been crushed by a press machine. He had also undergone surgical treatment that consisted of K-wire fixation for phalangeal fractures at the third, fourth, and fifth fingers, myorrhaphy, and median nerve release. On physical examination, a palmar scar -not thick but with low pliability, surface irregularities, and adhesion between skin and underlying soft tissues- was observed. Thenar atrophy and mild hypoesthesia distal to the scar tissue were also present.

Results. The patient was followed conservatively and the lesion resolved completely within the following 4 days.

Discussion. The patient's clinical condition was not listed as contraindication in the WBV platform manufacturer's instruction booklet. On the other hand, when adhesion of the scarred tissue causes reduced shifting movements between the more superficial epidermal strata and the underlying layers, high-level friction and shear forces (such as those produced by the vibrating platform and its textured rubber cover) can induce a compromised tissue tensioning with the development of a cleft.[2] Then, the area of separation is filled with fluid as a result of hydrostatic pressure, resulting in a blister.

Conclusions. There is need for further research about the effects of closed kinetic chain exercises of the upper extremity on WBV platforms. Meanwhile, the authors caution against applying direct vibration on skin with poor tribological quality.

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Reliability and diagnostic accuracy of the Upper Limb Neurodynamic Tests 1 and 3.

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Aims. Neurodynamics is the discipline that integrates mechanics and physiology of the nervous system for the treatment of neuromusculoskeletal disorders.[1] A number of neurodynamic tests for upper and lower limbs peripheral nerves are being increasingly used, including the Upper Limb Neurodynamic Test 1 (ULNT1) and 3 (ULNT3) which generate forces biased toward the median and the ulnar nerves, respectively. However, published data on the tests metric properties are inconsistent.[2]

To study the inter-rater and intra-rater reliability and diagnostic accuracy of ULNT1 and ULNT3.

Methods. *Subjects*. 86 individuals (54 women, age 55.7± 13.8 years) with neuromusculoskeletal disorders seen at the "Piero Palagi" Hospital (Florence) for surgery and/or rheumatology examination. All consecutive patients from November 2012 to March 2014 were enrolled, provided that neuropathies or musculoskeletal disorders had been diagnosed using MRI, CT and/or EMGraphy. *Procedure*. 4 examiners (2 physiotherapists, PT, and 2 graduating students, GS) administered the ULNTs three times on two sessions (T1, T2) at a distance of 3-5 days. Patients were assessed once by one of the GSs at T1, and twice, by the same GS and by one of PTs, at T2. *Data analysis.* Agreement among assessments was estimated using the Cohen's kappa coefficient. Sensitivity, specificity and Likelihood Ratios with the 95% CI were calculated using the instrumental diagnosis as gold-standard.

Results. 58 subjects were diagnosed for median nerve neuropathy while only 5 were diagnosed for ulnar nerve neuropathy. The intra- and inter-rater reliability were estimated in 55 and 53 patients, respectively. A substantial agreement was found for the ULNT1 (intra-rater: k=0.781; inter-rater: k=0.772), whereas the ULNT3 showed a moderate reliability (intra-rater: k=0.475; inter-rater: k=0.519). The diagnostic accuracy of the two tests, estimated in the entire sample (N=86), was similar. ULNT1: sensitivity, 0.603 (0.475-0.719); specificity, 0.786 (0.605-0.898); LR+, 2.816 (1.345-5.898); LR-, 0.505 (0.348-0.732). ULNT3: sensitivity, 0.600 (0.231-0.882); specificity, 0.728 (0.623-0.813); LR+, 2.209 (0.993-4.915); LR-, 0.549 (0.186-1.620).

Conclusions. The ULNT1 is reliable and quite specific but lacks sensitivity. The relatively poor reliability of the ULNT3 limits somewhat its clinical application. Conflicting results on this topic indicate that more agreement is needed among researchers about the sequencing of neurodynamic tests.

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Validity of the Slump Test for diagnosing lumbar roots compression

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Aims. Neurodynamics integrates mechanics and physiology of the nervous system for the treatment of neuromusculoskeletal disorders.[1] The Slump test (ST), a neurodynamic test designed to place the sciatic nerve roots under increasing tension, evaluates the dynamics of the neural structures from the head to the foot along the spinal cord and the sciatic nerve but is mostly used in the assessment of the lumbar spine.[1] A number of studies found that the ST has good reliability but data about its validity are somewhat inconsistent.[2-5]

To study the validity of ST in patients with low back pain (LBP) with or without radiation to the lower limbs.

Methods. 30 patients (15 women, age 57.3±19.1) with LBP admitted for physiotherapy to the "Piero Palagi" Hospital in Florence were enrolled in the study, provided that they were older than 18 years, had not undergone orthopedic surgery to the lower limbs or the trunk in the previous 12 months, and had not been diagnosed for any other pathology that might have compromised the test execution or interpretation. Tests were administered and interpreted by an expert physiotherapist who was blind to patients' symptoms and anamnesis and wrote in a body chart the symptom evocated by the test. Another physiotherapist checked the medical report of instrumental diagnosis, interviewed patients and analyzed data. The outcome of the ST was compared with gold standard (RMI or TC) for diagnosis of nerve roots compression, bulging or herniation of intervertebral disc. Sensitivity, specificity, Likelihood ratios were calculated with the 95% CI. The agreement among ST and gold standard diagnosis was estimated using the Cohen's kappa coefficient.

Results. The diagnostic accuracy of the ST was high: sensitivity, 0,84 (0,62-0,94); specificity, 0,82 (0,52-0,95); LR+, 4,63 (1,3-16,47); LR-, 0,19 (0,07-0,57). The agreement with the gold standard diagnosis was substantial (k=0.65) when esti-

mated in the entire sample, and almost perfect when estimated in patients with pain at rest (k=0.88).

Conclusions. Though the present study has the important limitation of the small sample enrolled, data presented show that the ST is a valid test for diagnosing the presence of lumbar nerve roots compression.

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Pain pattern description using pain frequency maps: a study in chronic neck pain and chronic low back patients

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Aims. The current availability of user friendly digital devices for the direct acquisition of digital pain drawings (PD) and the use of softwares for automated PD's analysis, allow easier and more accurate estimation of the extent and the location of pain. These data can be used to generate pain frequency maps (PFM), graphical representations of pain patterns. The aim of this study was to present the use of PFM to investigate and describe the pain patterns in chronic neck pain (CNP) and chronic low back pain (CLBP) patients.

Methods. Eighty-four CNP (61 women, 23 men) and eigthy-eight CLBP (47 women, 41 men) patients participated. Each patient shaded a digital PD using a stylus pen on an iPad®. All PD belonging to the same group were simultaneously superimposed and PFM generated with a customised software. Two different colour scales were used to visualize each PFM (Fig 1). Each colour/tonality represents the percentage

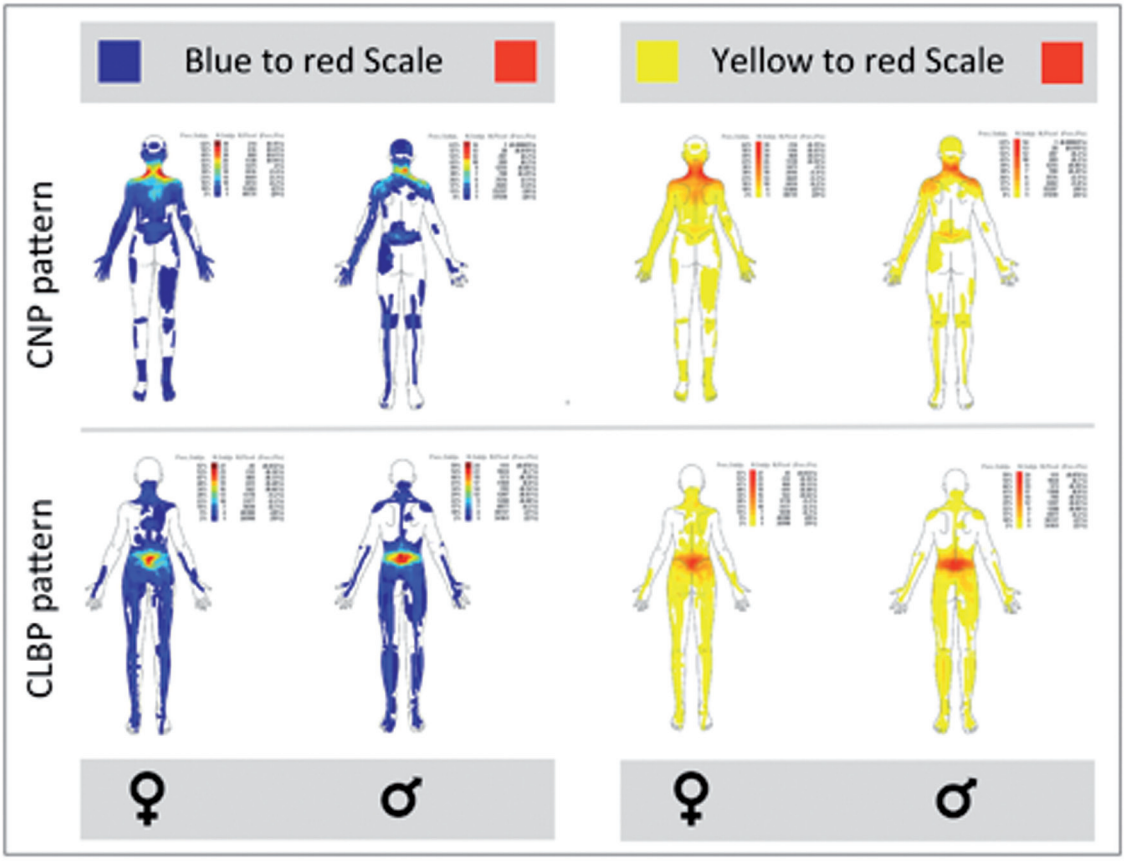

Figure 1.—Pain patterns in CNP and CLBP patients. Frequency maps are presented with two different colour scales: "blue to red" and "yellow to red". Female and male maps are visualized separately.

of patients who shaded that area on PD. The corresponding number of patients is also reported for each percentage.

Results. 2-17% of CNP and CLBP patients reported pain in the limbs, CNP patients in the low back and CLBP ones in the neck. 23% of female CNP patients reported pain in the infra-scapular region, compared to the 4% of male. The most frequently reported pain area in CNP patients corresponded to the bilateral upper trapezius for the female (56-62%), and to the median part of the middle-cervical spine for the male (57-61%). The most frequently reported pain area in CLBP patients was the median part of the lower lumbar spine for the female (53-57%), and the medio-lateral part of the middle lumbar spine for the male (54-59%).

Discussion. The use of PFM was tested in CNP and CLBP patients, and pain pattern described.Female and male PFM were generated separately and visualized with two different color scales. Differences and similarities concerning frequency of reporting pain with PD have been pointed outbetween and within the groups.

Conclusions. PFM generation through the automated analysis of pain extent and pain location seems to be a promising approach for pain patterns' investigation.

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Bilateral cam femoroacetabular impingement: the case of a Nanbudo athlete self-referral to physiotherapy

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Aims. This case report describes the physiotherapy management of a self-referral patient with bilateral groin pain and unclear prognosis.

Femoroacetabular impingement (FAI), sport's hernia, pubic bone injuries, nerve entrapment, psoas tendon and adductor muscle lesions, are typical causes of groin pain. Cam FAI derives from a prominence of the femoral neck which, forcing into the acetabulum, results in a labrum tear or avulsion. Anamnesis, negativity to clinical tests for other conditions, and positivity to the anterior impingement test (AIT) suggest the hypothesis of Cam FAI. The diagnosis is confirmed with an antero-posterior X-ray of the pelvis.

Case report. A 40 years old male beginner Nanbudo athlete presented with a bilateral groin pain. Pain started two weeks before after training with high kicks, so that he stopped training. At the moment pain occurred during fast walking, walking uphill and coming out of the car. Five months before similar symptoms completely regressed after two weeks of rest. Physical examination didn't revealed any RoM restrictions, muscle weakness or paraesthesia. The cough impulse test was negative. No pubic tubercles, psoas tendon or adductor muscles

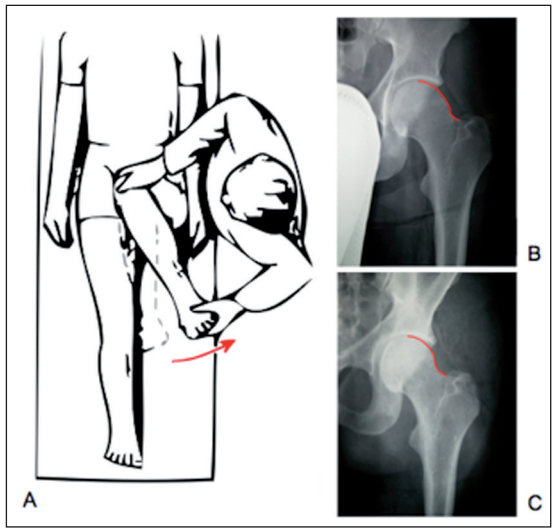

Figure 1.—Anterior impingement test (hip flexion to 90°, internal rotation, adduction) (A). Preoperative X-rays of the left hip with the "pistol-grip deformity" (B). Postoperative X-rays of the left hip, with the femoral neck resection (C).

tenderness was found. Hip muscles testingand passive movements were negative for pain provocation except hip flexion, slightly painful. The AIT (Figure 1A) was positive bilaterally and evoked patient's complain.

Intervention. Hypothesizing a reversible anterior hip joint tissues overload**,** a two-weeks low-intensity short-wave local diathermy treatment was planned, combined with functional rest. Since the symptoms didn't regressed the treatment was stopped and in agreement with the medical doctor an X-rays performed. Any bone lesion was detected but a bilateral "pistol-grip deformity" (Figure 1B) was found. An arthro-MRI was then performed and a bilateral anterosuperior labrum tear was diagnosed. Patient undertook an arthroscopic intervention with femoral neck resection (Figure 1C) and debritment of the labrum tears. Then physiotherapy for RoM recovery and muscle reconditioning was carried out. Four months after surgery the patient came back training Nanbudo without pain.

Conclusions. FAI early recognition allows to prevent irreversible articular tissues damages. Differential diagnosis skills including referral to medical doctors when necessary, are strongly recommended to physiotherapists to properly manage self-referral patients.

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Muscles activation during upper limb elevation in subjects with shoulder pain

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Aims. A correct scapular kinematic during upper limbs movements is necessary to permit the scapula-humeral rhythm. Some muscles involved in scapular mobility as rhomboid, levator scapulae and sternocleidomastoid are little investigated by surface electromyography (sEMG) cause of their cross talk phenomena [1]. The aim of the study is to analyse sEMG activation of these muscles during upper limb movement of elevation on the scapular plane by the use of specific filter algorithms in subjects with shoulder pain and in healthy subjects.

Methods. 19 healthy subjects and 10 subjects with shoulder pain were enrolled. Right upper arm elevations on the scapular plane, with extended elbow and neutral shoulder rotations were recorded. The movements were performed upright, with a range of motion of 120° and 30°/sec of angular speed (base movement). Four different tasks were performed: 1) the base movements; 2) the base movements with 2 kilos held in the right hand; 3) five maximal isometric contractions in five different positions; 4) repetition of the base movement. The sEMG signal of right anterior deltoid, upper, middle and lower trapezius, serratus anterior, rhomboids, elevator scapulae and sternocleidomastoid were recorded. By a customized software (EVA1.1, B10NIX Srl) with special filter algorithms ("wavelet denoise" and "independent component analysis" [2]), it was possible to reduce the phenomena of noise and cross-talk. SEMG outcome measures were: onset and offset timing of the muscles, duration of muscles activation; intensity of activation; frequency content of the sEMG signal. Statistical analysis was performed by non-parametric tests.

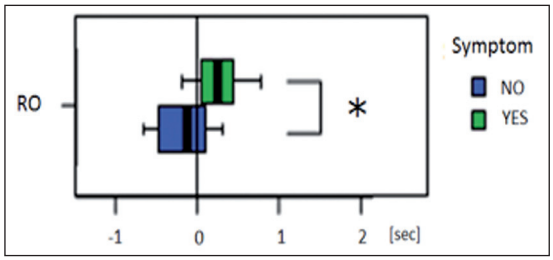

Figure 1.—Offset timing variation of rhomboids muscle. Comparison between healthy subjects (blue) and subjects with shoulder pain (green) **p=0,005.*

Results. During the base movement the middle trapezius of the subjects with pain compared as healthy subjects showed a delayed offset (p=0,035), an higher duration of activation (p=0,049) and an higher signal frequency content (p=0,035). After the second and third tasks, the rhomboids of the subjects with pain delayed the offset timing (p=0,005; Figure 1) and reduced the signal frequency content (p=0,021), showing premature fatigability (Table I).

Conclusions. The presence of shoulder pain seems to be connected to the alteration in middle trapezius and rhomboids muscles activation. This alteration could be involved in the deficit of the scapula-humeral rhythm (reduction of upward rotation and increase of scapula adduction).

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Mirror Therapy in central post-stroke pain: case report

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Aims. Stroke generally causes loss in movement control but also impairs perception. Central post-stroke pain is often characterized by neuropathic pain emerging from thalamic lesions.[1-2]This problem is less responsive to physiotherapy treatment. Mirror Therapy (MT), defined as the use of a mirror reflection of unaffected limb movements superimposed on the affected extremity, is often used to treat many perception related problems.[3-4] This case study describes the use of MT to reduce central post-stroke pain secondary to thalamic-capsular stroke.

Materials and methods. The patient is an 42-year-old woman with left hemiparesis secondary to an intracerebral thalamic-capsular haemorrhage occurred 3 years prior to examination for an arteriovenous malformation rupture.

Table I.—*sEMG signal frequency content variation of rhomboids muscle after fatigue: between groups comparison.*

var = post-pre	CONTROL GROUP	STUDY GROUP	p
VAR_RO_AR [index]	0,0011 [-0,0886;0,0757]	-0,0337 [-0,0889;-0,0052]	0,011
VAR_RO_MDF [Hz]	-1,0006 [-10,879;9,8826]	-4,7899 [-10,8329;0,2679]	0,084
VAR_RO_MMDF [Hz]	-1,7392 [-11,82;13,6]	-6,029 [-10,011;0,1604]	0,049
VAR_RO_MMNF [Hz]	-0,3634 [-10,8167;11,6752]	-5,8343 [-7,8053;-0,3648]	0,021
VAR_RO_MNF [Hz]	-1,5493 [-9,9831;12,0374]	-5,8949 [-10,6684;-0,0073]	0,068

Table I.—*Patient characteristics and pre-post outcome measures values.*

Patient description			
FIM	120		
BBS	49		
MAS	1		
	Left	Right	
Jamar (N)	21.3	31.6	
Pinch (N)	4.6	3.8	
9Hole Peg Test (sec.)	21”	16”	
Test	Pre-training	Post-training	Delta
Results			
VAS - Hand	5.3	0.8	4.5
VAS - Hand (MVC)	7.2	3.3	3.9
VAS - Shoulder	6.7	5.5	1.2
VAS - Shoulder (MVC)	9.6	7.3	2.3

Functional Independence Measure (FIM), Berg Balance Scale (BBS), Modified Ashworth Scale (MAS), Maximal Voluntary Contraction (MVC).

The subject complained burning pain in all left side of her body and was autonomous in everyday life, presenting slight spasticity and sensory loss. During the MT intervention she was asked to perform symmetrical movements of forearm prono-supination, wrist extension, and opening and closing the hand. She was told to watch at the image of the sound limb reflected in a parasagittal mirror and superimposed to the affected limb, suggesting that movements were made by the paretic arm. Each movement was performed continuously for ten minutes; the training lasted for five days a week for two consecutive weeks. Pain level of the hand and the shoulder were measured at rest and during maximal grip isometric strength test (Jamar) on a visual analogue scale (VAS) before and after the intervention.

Results. After MT sessions the patient’s perceived level of pain recorded by VAS showed a 3.9 point reduction at rest and a reduction of 4.5 point during maximal voluntary isometric strength testof the trained hand. A slight reduction in VAS pain score occurred also at the shoulder.

Discussion. Central post-stroke pain is a common condition. It is possible that the mismatch between the motor command and its ‘expected’ but missing visual and proprioceptive input may be perceived as pain.[4] The training in a sensory confounding condition can re-modulate the perception.

Conclusion. The application of MT may be useful to control the central post-stroke pain in a patient presenting somatosensory deficits and altered perception after a thalamic stroke.

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Effects of action observation on balance

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Aims. The use of action observation for facilitating motor relearning has been reported in motor rehabilitation[1,2]. No studies investigated the possibility to improve the postural component of movement by action observation. Aim of this study was to analyze the effect of action observation on balance performance in healthy subjects.

Methods. Thirty-five healthy subjects (17 female and 18 male, mean age 21.1±1.3 years) were randomized into 4 groups. Eight subjects performed only the action observation of balance exercises (AO), 9 subjects combined the action observation of exercises with their effective training (AOB), 10 subjects performed only the balance exercise watching control movies (landscapes) (EX) and 9 subjects composed the control group (CO). Thirty movies of balance exercises with increasing difficulties were realized using two athletes. Subjects were trained for 30 minutes, five times a week for three weeks. Before and after the period of training the subjects’ balance was measured by a force platform in the following conditions: 1) bipodalic stance with open eyes, 2) bipodalic stance with closed eyes, 3) monopodalic stance with open eyes, 4) bipodalic stance on a foam support. The Centre of Pressure (COP) path length and area and the Romberg index of the bipodalic tests were analyzed[3,4].

Non-parametric tests was used for statistical analysis.

Results. The four groups were homogeneous at baseline. Measures of stabilometric performance were better after training for all groups, except for CO group. The pre-post difference was statistically significant for EX group during the monopodalic conditions (p=0.04) and for EX and AOB during bipodalic stance on a foam support (p=0.03 and p=0.04 respectively). The inter-groups comparison showed a trend toward a better performance of AO, EX and AOB group in comparison to CO group. This difference was statistically significant for the left monopodalic condition (p=0.02; figure 1) and for the Romberg index (p=0.01; figure 2).

Conclusions. Both the action observation and the balance training appears useful to improve postural control due to balance performance. If a larger healthy subjects sample will confirm these findings, it will be interesting to study the application of this action observation modality in clinical practice.

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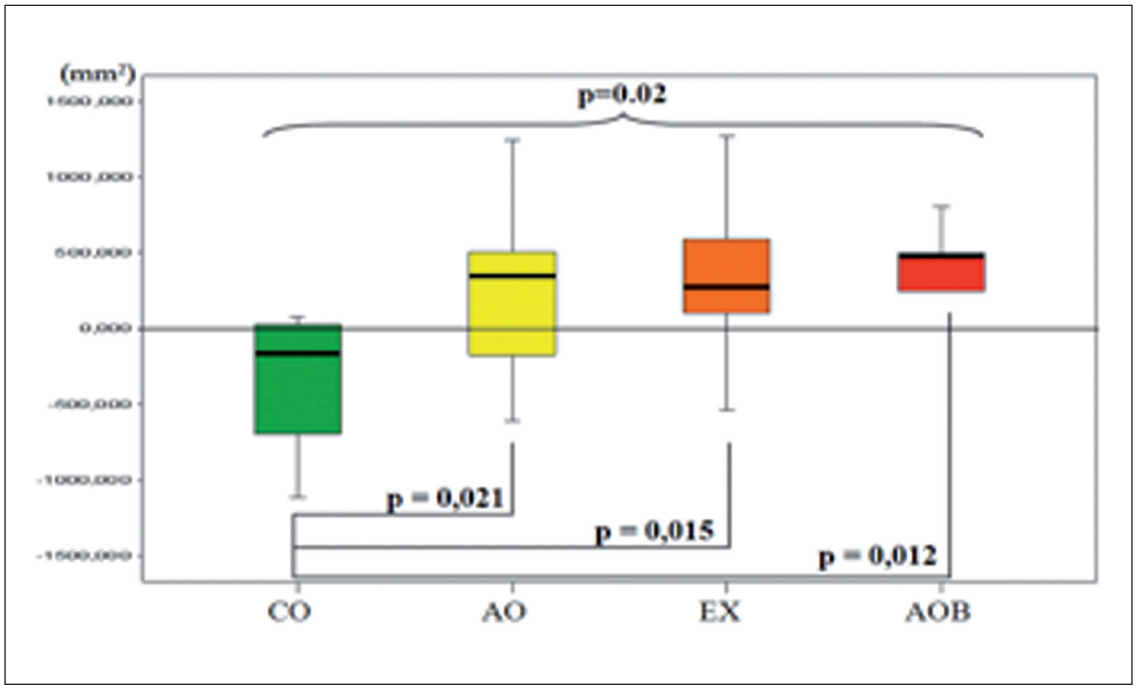

Figure 1.—Post training reduction of COP area during left monopodalic stance.

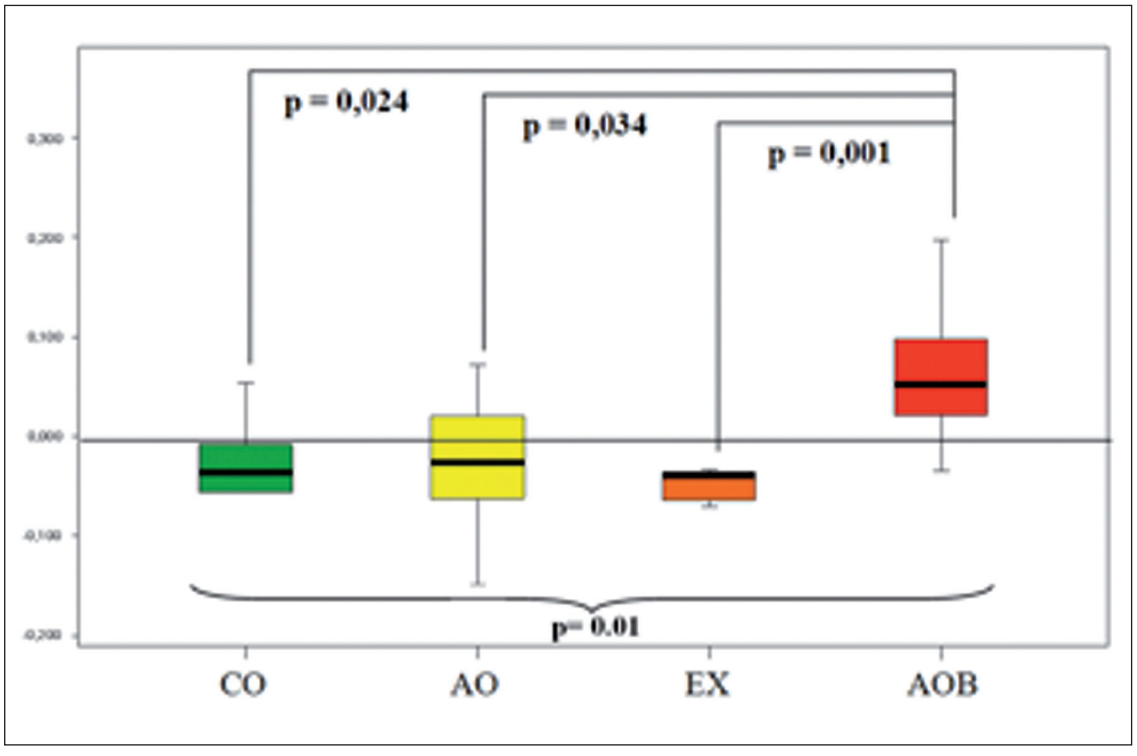

Figure 2.—Change of the Romberg index during bipodalic stance.

Correlations between pain extent and clinical features in chronic low back pain and chronic neck pain patients

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Aims. The extent of pain reported with pain drawings (PD) by chronic low back pain (CLBP) and chronic neck pain (CNP) patients may correlate and even predict some clinical features such as pain related disability, psychological distress and pain intensity.Due to the paucity of studies on this topic and to the heterogeneity of methods used for pain extent estimation, data on these correlations are lacking and often conflicting. The aim of this study was to investigate the correlations between pain extent and clinical features in CLBP and CNP patients.

Methods. Fifty-one CLBP (20 men, 31 women), and fifty-six and CNP (15 men, 41 women) patients participated.Each patient shaded a PD using a stylus pen on aniPad® (Fig 1). A custom designed software was used to quantify the pain extent, expressed as the number of pixels coloured inside the body chart perimeter. Data on clinical variables were then collected as follows: pain-related disability using the Roland and Morris Disability Questionnaire and the Neck Disability Index (NDI) for the CLBP and the CNP patients respectively, psychological distress using the Kessler Psychological Distress Scale (K-10), and pain severity using the visual analog scale (VAS).

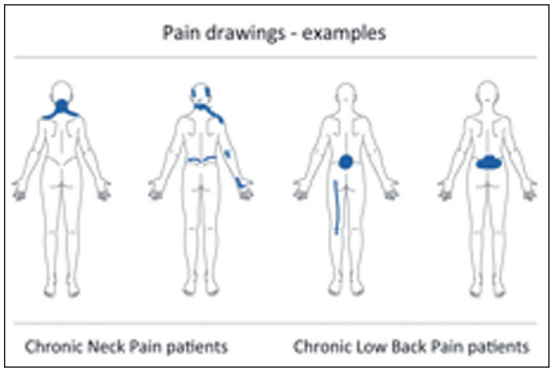

Figure 1. Examples of digital pain drawings shaded by female and male CNP and CLBP patients.

Table I.—*Correlations between pain extent and clinical features. Mean, standard deviations and Pearson correlation coefficient are reported for each variables.*

Clinical features	Patients groups	
	CLBP Mean±SD Pearson correlation (R) with PD extent	CNP Mean±SD Pearson correlation (R) with PD extent
PD_1 extent (pixels)	5469±3631	5925±4762
	1	1
VAS	4,3±2,2	4±2
	.264	0.375*
RMDQ	5,5±3	n/a
	0.199	
NDI	n/a	10,59±5,3
		0.404*
K-10	17±5	17,3±4,3
	0.079	-0.104

Results. Pearson correlation coefficient within CNP group showed that pain extent was positively associated to pain-related disability (r:0.404, p=0.002) and pain severity (r:0.375, p=0.004). No significant correlationswere found between pain extent and clinical variables within CLBP group (Table 1).

Discussion. It's reasonable to expectthat patientsreferring widespread pain or pain in multiple spots report also more severe pain. The same reasoning could be made about pain related disability, where higher pain extent is likely to reduce more the ability to carry out activities of daily living. Thesehypothesiswere confirmed only in CNP patients but not in CLBP ones where any correlation was observed between pain extent and clinical features.

Conclusions. These findings provide a better understandingof the clinical relevance of pain extent in CLBP and CNP patients. Future investigation should establish whether the clinical relevance of pain extent depends on the pain nature and/or on its anatomical distribution.

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The thoughts of patients with aspecific lower back pain. A cross-sectional pilot study.

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Aims. Patients with non-specific lower back pain may have thoughts and behaviours anomalous to their clinical condition, with scarce ability to control pain and disability in daily life[(1,2)].

In patients with non-specific LBP, to verify: 1) the prevalence of fear of movement and self-efficacy in managing activities; 2) the correlation between fear of movement, self-efficacy, pain and disability; 3) and between fear of movement, self-efficacy and anamnestic and socio-demographic characteristics.

Methods. Before beginning treatment 39 consecutive patients with aspecific back pain were given a booklet that included: a permission form for informed consent and handling of personal details, a sheet for recording anamnestic and socio-demographic data, Numerical Rating Scale (NRS) for pain, Oswestry Disability Index (ODI) for disability [(3)], Tampa Scale

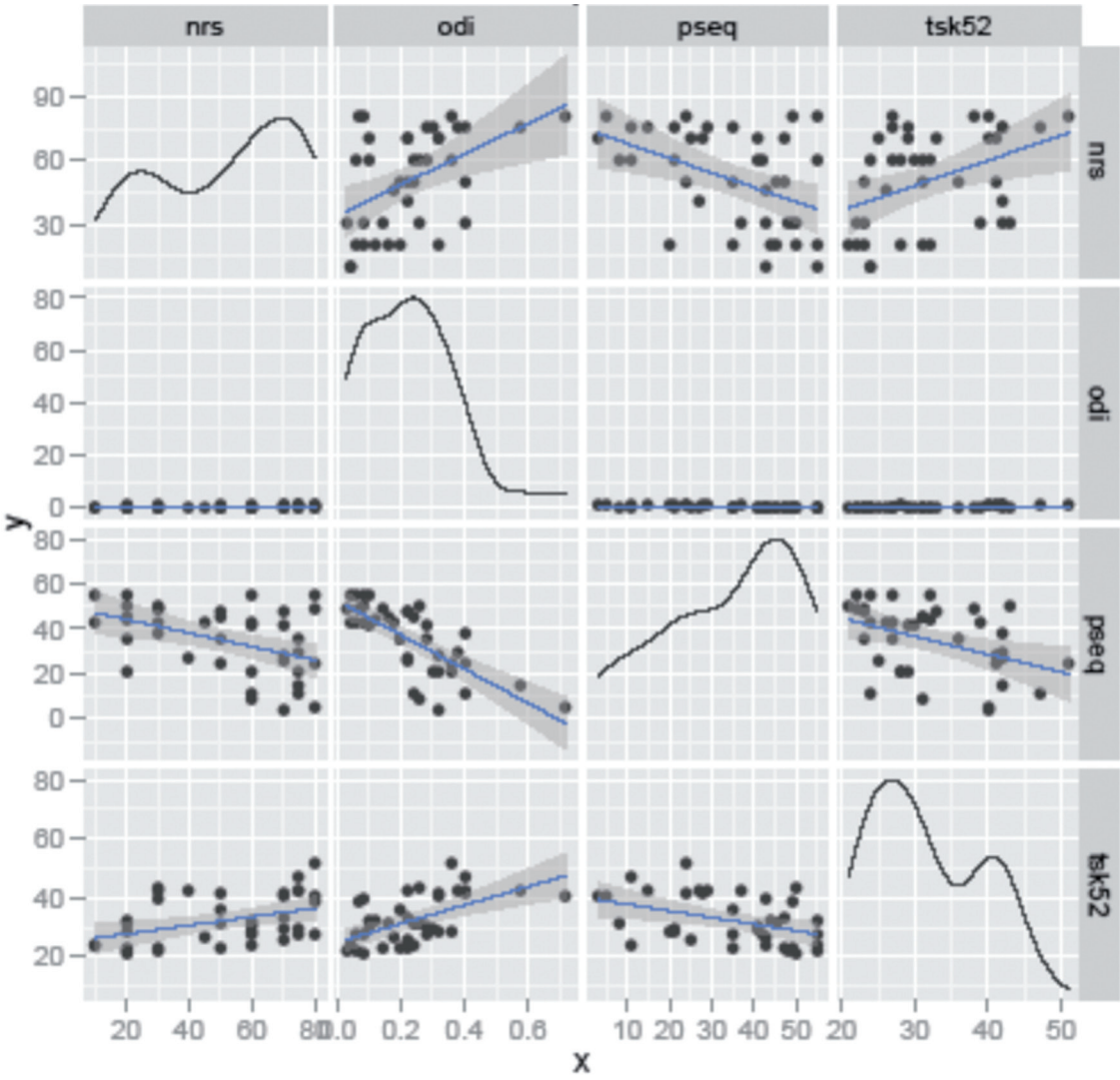

Figure 1.—Dispersion matrix.

of Kinesiophobia (TSK) for fear of movement [4] and a Pain Self-Efficacy Questionnaire (PSEQ) for self-efficacy [5]. The obtained data was elaborated by an independent operator. The statistical analysis was carried out according to the suitable descriptive analysis, Pearson correlation analysis or bivariate analysis with parametric association tests.

Results. The study group examined comprised 7 patients in acute phase (18%), 15 in sub-acute phase (38.5%) and 17 in chronic phase (43.5%). The average age of patients was 48 years old (range 26-76). The prevalence of chinesiophobia was about 60% (TSK > 28); the prevalence of low self-efficacy was equal to 48.72% (PSEQ < 40), with 17% of patients who resulted in being heavily focused on pain (PSEQ < 20). Statistically significant negative correlations emerged between PSEQ and the other indicators (NRS, TSK and ODI). Statistically significant bivariate associations emerged as far as socio-demographic characteristics are concerned between age and TSK, type and PSEQ.

Table I.—*Descriptive statistics of the variables.*

Variabile	N.	Min	$\bar{X}$	$\tilde{X}$	Max	DS
NRS	39	10.0	60.0	50.8	80	23.0
ODI (%)	39	2,8	22	23,2	72	15,1
PSEQ	39	3.0	41.0	34.9	55	15.2
TSK52	39	21.0	31.0	32.2	51	8.1
TSK1	39	6.0	13.0	14.0	23	4.1
TSK2	39	10.0	18.0	18.4	28	4.9

N. = number of patients, Min =minimum value, $\bar{X}$ = average, $\tilde{X}$ = mediana, Max = maximum value, standard deviation. NRS = Numeric Rating Scale (0-100); ODI = Oswestry Disability Index (%) ; PSEQ = Pain Self-Efficacy Questionnaire (0-60); TSK = Tampa Scale of Kinesiophobia (../52); TSK1 = Activity Avoidance (../24); TSK 2 – Harm (../28).

Limits. The reduced number of participants.

Discussion and conclusions. This study has evidenced a high percentage of patients with chinesiophobia and a significant percentage of patients with low self-efficacy in managing their back pain. These results would suggest considering the thoughts of patients with back pain in clinical practice, so as to pre-emptively recognise which patients could respond better to increasing activity or to an exercise programme compared to those who could benefit more from treatment based on cognitive-behavioural principles. Further studies are required.

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A time course study on strength training in multiple sclerosis

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Aims. Muscle weakness and fatigue dramatically affect the overall quality of life (QoL) of patients with multiple sclerosis (MS). Research has shown that maximal resistance training (RT) has a significant positive effect on the performance of daily living activities in people with MS, resulting in increased QoL[1]. Several methods are currently employed for reducing strength impairment in MS but the optimal "dose-response" relationship is still debated[2]. Aim of the present study was to investigate the time course of RT-induced strength changes in MS.

Methods. Eight patients with relapsing-remitting MS (5 females, 3 males; 46.5±11.2 y.o.; 64.5±14 kg) participated in this study. RT consisted of a 6-week unilateral isokinetic/concentric training (3 times/week for a total of 18 sessions at two angular velocities: 45 and 10°/s) of the tibialis anterior muscle (TA). Peak torque (PT: at 45°/s and 10°/s) and total work (TW: 30 repetitions at 180°/s) were measured on a Biodex isokinetic dynamometer before (baseline), after 3 weeks (intermediate) and after 6 weeks (post) of RT. A repeated-measures analysis of variance was employed to process data.

Results. Compared to baseline, data showed that: 1) at 45°/s PT increased by 23.2% at 3 weeks ($p<0.05$) and by 10.2% at 6 weeks ($p>0.05$) of training; 2) at 10°/s PT increased by 24% at 3 weeks ($p<0.05$) and by 5.9% at 6 weeks ($p>0.05$); 3) TW increased by +69.8% after 3 weeks ($p<0.05$) of training and by 33.9% at 6 weeks ($p>0.05$). Notably, when comparing post to intermediate assessments both PT and TW decreased (PT: -11% and -14.6% at 45°/s and 10°/s, respectively; TW: -35.9%, $p<0.05$).

Conclusions. These preliminary data showed that a 6-week RT was effective in increasing maximal strength and work endurance in MS patients. However, after a significant initial improvement in muscle performance a trend to plateau occurred. This suggests that intensive and short training periods might be more cost-effective, so that long lasting protocols are not likely to induce additional gains in strength. Further studies are needed to clarify how muscle performance can be improved best-dealing with fatigue.

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Kinesio taping does not improve standing balance in subjects with multiple sclerosis. A pilot single blind, randomised controlled trial

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ABSTRACT

Aim. The aim of this pilot randomized non-blinded controlled trial is to compare the short-term effect of Kinesio Taping and sham (non-elastic) taping in improving body standing stability in adults with multiple sclerosis (MP).
Methods. 20 patients were randomly assigned to the experimental (Kinesio Taping, KT) or control (Sham Taping, ST) treatment. Participants were assessed immediately before taping application (T0), and after tape removal (T2), with the Berg Balance Score (BBS), a Visual Analogic Scale (VAS) assessing the perceived confidence in walking skills, and the 10 Meter Walk Test (10MWT). The area of the center of pressure sway and the mean sway in the anterior-posterior and medial-lateral axes, measured though the Nintendo Wii balance board, was also performed immediately after taping application (T1).
Results. All patients improved their BBS score and decreased VAS scores between T0 and T2, while no significant changes were found for 10MWT. When compare to the control group, KT treatment induced better performances only in terms of BBS. No differences were found for VAS and 10MWT scores. Instrumental assessment showed no significant changes both within and between subjects.
Conclusions. The present study does not support the therapeutic effects in the body standing stability achieved by the application of KT across the posterior part of the ankle joints in adults with MS. Further trials with larger samples and stronger internal validity should be conducted to confirm our results. *(It J Physiotherapy 2014;4:84-9)*

Key words: Multiple sclerosis - Balance - Tape.

Balance and gait disturbances are commonly observed, but poorly managed, in individuals with multiple sclerosis (MS).[1,2] A recent review of postural control in MS demonstrated that people with MS have balance impairments characterized by increased sway in quiet stance, delayed responses to postural perturbations, and reduced ability to move towards their limits of stability.[3]

In order to maintain balance, some neuromuscular responses or postural strategies are commonly used by adults and three models have been proposed.[4] The first model is known as "inverted pendulum" or "ankle strategy", where the oscillations of head and hip are concordant. The second, called "hip strategy", is more flexible and characterized by discordant oscillations of head and hip. A third strategy, useful with greater external disturbance, is known as "dynamic step strategy". A recent article by Chua *et al.* (2013),[5] suggests that people with MS have a greater impairment in the ankle than in the hip strategy, and, consequently, they rely more strongly on hip control than ankle control for functional balance and walking.

Kinesio taping (KT) uses elastic adhesive tape with an elasticity rate that is similar to that of the skin to treat all kinds of musculoskeletal pain

and functional abnormalities. KT may either inhibit or promote muscular tension according to the application method to the relevant muscles, in order to normalize the action of moving agonists. Generally, KT does not seem to directly have an "orthotic" effect on the joints and the ability of KT to enhance functional stability of the ankle relies on its purported effects on proprioception and muscle activation rather than mechanical support.[6]

However, when compared to non-elastic tape, the benefits of KT are unclear. For example, a study comparing in a group of athletes with ankle instability the effect of KT and non-elastic tape showed no differences in muscle activation of the fibularis longus tested with an ankle inversion perturbation.[6] No different effects between non-elastic adhesive tape and KT were also found on the neuromuscular performance of femoral quadriceps, postural balance and lower limb function in healthy subjects.[7] Moreover, Parreira Pdo *et al.* (2014) [8] found that KT applied with stretch to generate convolutions in the skin was no more effective than simple application of the tape without tension for pain intensity and disability.

In neurological disorders, it has been suggested that KT may facilitate a weakened or hypotonic muscle and sensory deficits recover, reduce spasticity and relax an overused muscle. Some uncontrolled studies showed that KT may improve upper limb function,[9] facilitating body alignment and providing proprioceptive feedback. However, a recent systematic review by Karlon and Bar-Sela (2013)[10] concluded that no evidence supports the effectiveness of KT for neurological conditions and that more research is needed in this field.

Recently, preliminary uncontrolled data on 15 MS patients [11] showed that the appliance of KT to calf muscles improve postural control. However, the different effects of KT and nonelastic tape on postural control have not been studied in this population. The aim of this pilot randomized non-blinded controlled trial is, therefore, to compare the short-term effect of KT and sham (non-elastic) taping in improving body standing stability in adults with MS.

Methods

Participants

A total of 20 adult subjects with MP was enrolled in the study. All they met the following inclusion criteria: more than 18 years of age, EDSS (Expanded Disability Status Scale)[12] score ranging from 0 to 6,5, ability to stand independently in the upright position for 30 seconds, ability to walk 6 meters with or without an assistive device, ability to passively dorsiflex the ankle to the neutral position withat 90 degrees of knee flexion. Patients were excluded when they were enrolled for other experimental studies, had allergy to the tape or had severe cognitive impairment (Mini Mental State Examination [13] [MMSE] < 24). All patients gave their written informed consent.

Patients were randomly assigned to the experimental (KT) or control (Sham Taping, ST) treatment. The randomization sequence was created using computer generated random number tables.

Treatment

The treatment group received the application of therapeutic KT directly to the skin of both calves, as described by Cortesi *et al.* (2011).[11] The KT was maintained for two days and then removed. The control group received an ineffective ST application. It consisted of a non-elastic tape, without a specific anchor start point, direction and amount of stretch placed on the tape when applied, or a tape application ending point). The ST was applied with the same procedure of the therapeutic application and, in this way, the experimental and the sham applications appeared to be very similar.

All participants were taped by the same investigator who administered the outcome assessment.

Assessment

A number of measures were used to assess balance and gait abilities. The Berg Balance Scale (BBS) was used to assess balance. The BBS comprises 14-item, each scored through a five-point

Table I.—*Sample characteristics. Data are expressed as median (range), unless specified.*

	KT tape (N.=10)	ST (N.=10)	P value	Total (N.=20)
Age, years	54.0 (47.0 - 64.0)	47.5 (41.0-54.5)	.315	50.5 (46.0-59.5)
Gender (males/females)	2/8	4/6	.314	6/14
Time from diagnosis of MS, years	19.5 (13.25-26.5)	13.0 (7.0-23.0)	.247	16.5 (9.25-25.0)
EDSS	4.25 (3.25-5.88)	3.5 (1.5-4.0)	.315	4.0 (2.25-5.63)

EDSS: Expanded Disability Status Scale; MS: Multiple Sclerosis.

ordinal scale ranging from 0-4, where "0" indicates the lowest level of function and "4" the highest level of function. Overall, added scores can range from 0 (severely impaired balance) to 56 (excellent balance). The BBS has been shown to be reliable in patients with MS.[14]

A Visual Analogic Scale (VAS) was used for the assessment of the perceived confidence in walking skills. The end of a 10 cm line was defined as the better perception of walking skills.

Gait speed was measured in meters per second using the 10 Meter Walk Test (10MWT), which has been shown to be valid in patients with MS.[15]

In addition, the area of the oscillations of the center of pressure (SWAY_area), the mean COP sway in the anterior-posterior (SWAY_AP) and in the medial-lateral (SWAY_ML) axis were measured through the Nintendo Wii balance board (WBB), which has been shown to be reliable and valid for assessing COP area.[16]

All measures were performed for all patients immediately before taping application (T0), and after tape removal (T2). The stabilometric assessment using the WBB was also performed immediately after taping application (T1).

Data analysis

Differences in clinical and demographic data was assessed at baseline with the Mann–Whitney *U* test for continuous variables, since data were not normally distributed (according to the Kolmogorov–Smirnov statistical test), and with the chi-square test for comparisons of proportions.

The Wilcoxon rank-sum test and the Friedman test were used for within-group analysis, for estimating the changes from pretest to posttest. For between-groups analysis the Mann–Whitney *U* test was used, comparing changes for each outcome measures. All statistical analyses were performed with SPSS 13.0.

Results

Table I compares gender and age distribution and patients' clinical characteristics, including time from diagnosis of SM and EDSS score. No significant differences between the two groups were found in any of these parameters.

All patients improved their BBS score (p = .010) and decreased VAS scores (p = .023) between T0 and T2, while no significant changes were found for 10MWT. When compared to the control group, KT treatment induced better performances only at the BBS (p = .015). No differences were found for VAS and 10MWT scores. The median scores and the interquartile range of BBS, VAS and 10MWT are reported in Table II.

COP sway was not affected by the interventions. The instrumental assessment performed at T0, T1 and T2 showed no significant changes in any parameters both within and between subjects (Table III).

Discussion

In the present study, all patients showed an improvement in the perception of their walking skills as indicated by the VAS scores, in accordance with the results reported by Cortesi *et al.* (2011).[11] Since KT does not seem to directly have an "orthotic" effect on the joints,[6] this improvement may be explained by the placebo effects of KT on this subjective variable. In fact, this effect has been previously shown for non-elastic taping [17] and suggested for KT.[18]

We also found an improvement of BBS scores

Table II.—*Clinical outcome measures for both groups. Data are expressed as median (interquartile range).*

	T0	T2
Berg Balance Scale		
KT group	45.00 (36.50-46.00)	47.5 (40.50-50.50)
ST group	48.50 (43.25-52.50)	49.5 (44.75-52.75)
Total	46.00 (37.50-51.50)	48.5 (42.75-52.25)
VAS		
KT group	5.00 (4.00-5.75)	5.00 (5.00-6.00)
ST group	6.00 (3.00-6.75)	6.00 (5.00-6.75)
Total	5.00 (4.00-6.25)	5.50 (5.00-6.25)
10MWT		
KT group	17.46 (14.81-22.42)	15.67 (13.62-19.63)
ST group	12.97 (8.75-17.41)	12.45 (8.60-17.33)
Total	15.12 (12.00-20.77)	14.53 (11.53-18.62)

KT = Kinesio Taping; ST=Sham Taping

Table III.—*COP sway measures for both groups. Data are expressed as median (interquartile range).*

	T0	T1	T2
SWAY_area			
KT group	3.37 (0.97-7.45)	1.29 (0.82-2.67)	1.53 (1.07-5.45)
ST group	2.64 (1.44-3.99)	1.69 (1.01-2.90)	2.08 (0.88-4.49)
Total	3.07 (1.10-6.81)	1.51 (0.88-2.96)	1.83 (1.01-5.0)
SWAY_AP			
KT group	1.77 (1.01-3.32)	1.32 (1.02-2.75)	1.79 (1.06-2.93)
ST group	1.73 (1.22-2.30)	1.53 (1.20-1.99)	1.95 (1.56-3.89)
Total	1.73 (1.11-2.62)	1.37 (1.19-2.31)	1.95 (1.12-3.36)
SWAY_ML			
KT group	2.69 (2.35-4.08)	2.27 (2.09-3.43)	2.69 (2.14-3.67)
ST group	2.29 (2.09-3.52)	2.41 (1.91-2.95)	3.18 (2.01-3.81)
Total	2.56(2.10-3.91)	2.29 (2.00-3.42)	2.85 (2.00-3.83)

KT = Kinesio Taping; ST = Sham Taping, SWAY_area = area of center of pressure oscillations; SWAY_AP, SWAY_ML = mean center of pressure sway in the anterior-posterior and in the medial-lateral axis, respectively.

in the whole sample, and greater gain in the KT group. Despite the Minimum Detectable Change (MDC) of the Berg Balance Scale in MS patients is not presently available, the improvement found in this study seems to be very small. Romero *et al.* (2011) [19] reported that a 6.5 point change in the BBS is necessary to be 95% confident that a change in function occurred between 2 assessments in elderly people. Donoghue (2009) [20] found that in older persons the MDC for the BBS depends on the severity of balance impairment: a change of 4, 5 or 7 points is needed to be 95% confident that a true change has occurred when the subject's initial score is 45-56, 35-44, or 25-34, respectively. Stevenson (2001) [21] investigated this issue in neurologically impaired participants (patients who had a stroke), finding the value of 6 points change as the MDC for BBS in this population.

Differently from the study by Cortesi *et al.* (2011),[11] we found no significant changes in 10MWT, SWAY_area, SWAY_AP and SWAY_ML, despite the study protocols were similar. This difference can be explained by the presence of less severe disability in the patients enrolled in the present study. Indeed, our sample had a EDSS median score of 4 (range 1-6.5), while the sample enrolled by Cortesi *et al.* (2011) [11] had a EDSS median score of 5.5 (3.5–7.5). We might assume that patients with less severe disability have less benefit from treatment with KT, but this hypothesis requires further investigation.

In the present study, no significant differences between groups in outcome measures were found with the exception of the BBS. However, also in the between-group analysis, changes did not achieved the appropriate MDC.

No significant changes within and between subjects were observed using the instrumentation for COP sway measuring, i.e. the Nintendo Wii Balance Board (WBB) record system. Despite the psychometric properties of WBB have been recently questioned, [22] a number of studies suggested that it is a reliable and valid tool for assessing COP area and characteristics of body sway .[14, 23-25]

Cortesi *et al.* (2011)[11] suggested a mechanical (i.e. improvement of the stiffness of the ankle due to greater muscle strength) and/or a sensory (i.e. increase of peripheral information) potential effect of taping in the modification of the balance control system. Our results do not confirm these hypotheses. Actually, the lack of effect of KT was found for both the strength and the sensory mechanisms. In fact, a recent trial [26] reported no significant effect on the quadriceps femoris maximal strength immediately after the application of KT in healthy people. In addition, some studies addressing the effect of ankle taping on proprioception in healthy subjects found no evidence of increased proprioception.[27,28] Moreover, our results are consistent with Lins *et al.* (2013),[7] who reported no different effects between nonelastic tape and KT on quadriceps neuromuscular performance, balance and lower limb function in healthy subjects.

Limitations

This pilot study has some limitations. First, the assessor was not blinded and this may have biased the results, as regards BBS scores in particular. The other outcome measures, in fact, were instrumental (gait speed, COP sway) or self-assessment (perceived walking ability) measures. In addition, the number of participants is small. The differences pretest-posttest and between groups could have been statistically significant if we had enrolled more patients. Cortesi *et al.* (2011) [11] estimated a sample size of 74 subjects per group. For this reason a larger sample is necessary to verify our results and their generalizability. Lastly, the intervention had short duration (two days) and no follow up was performed, therefore no inferences may be made about long-term effects of the intervention.

Conclusions

Our findings indicated no significant effect in the body standing stability in adults with MS immediately after the application of KT or sham tape. The present study does not support the short-term therapeutic effects in the body standing stability achieved by the application of KT across the posterior part of the ankle joints in adults with MS. Further trials with larger samples and stronger internal validity should be conducted to confirm our results.

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