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PHYSIOTHERAPY UPDATES

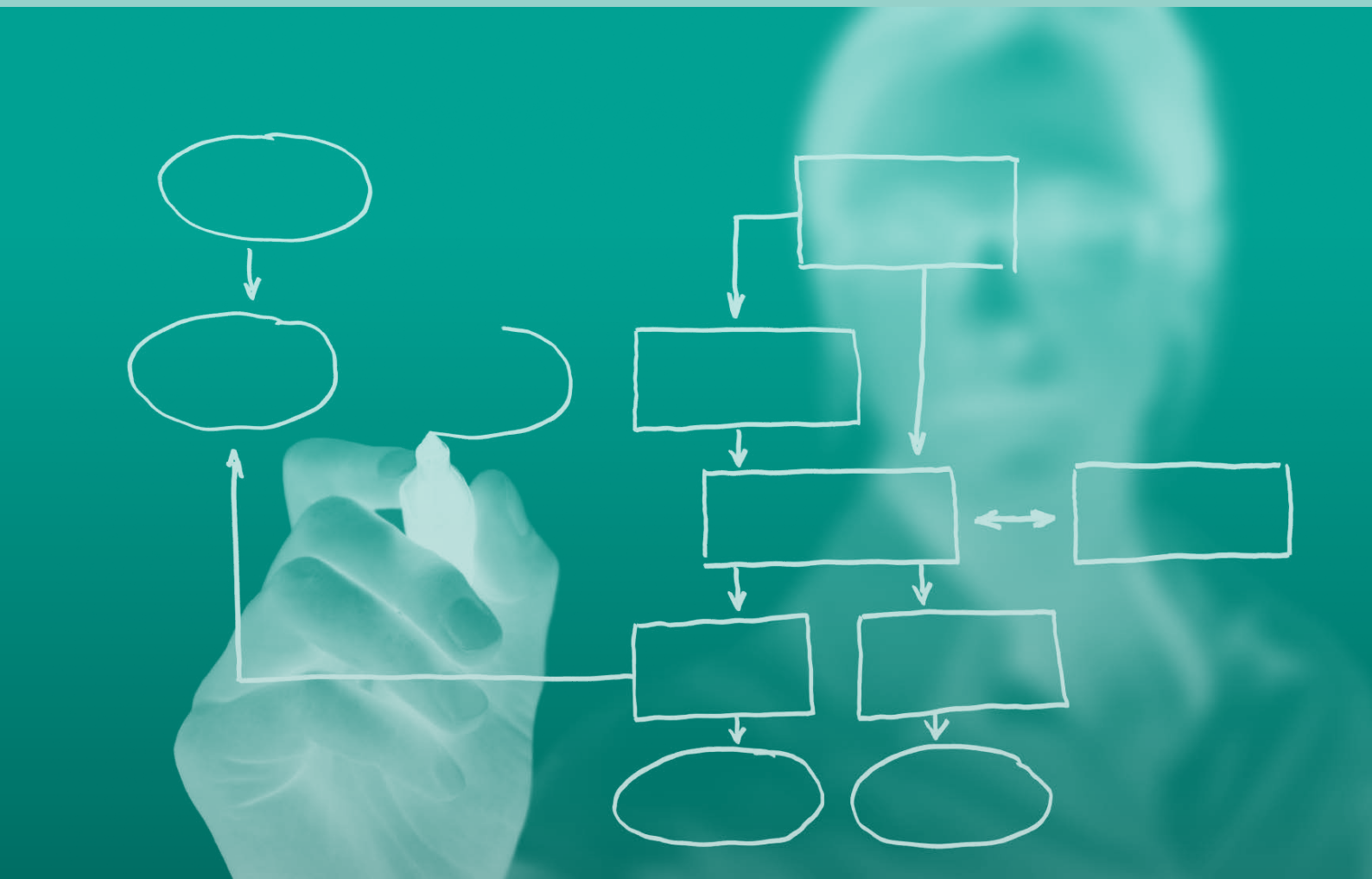

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TABLE OF CONTENTS

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PHYSIOTHERAPY UPDATES

EDITORIAL

SCIENTIFIC EVIDENCE AND ART IN PHYSIOTHERAPY. ARE THEY COMPATIBLE?

Ramon Aiguadé
Treasury manager and responsible
for the Scientific Journal

Some days ago, I tweeted that physiotherapy is a form of art based on scientific evidence. Some colleagues commented on the incompatibility of the two concepts: scientific evidence and art. In my view, healthcare sciences have to be applied with art. If we base our professional practice only on scientific evidence, we run the risk or falling into an impersonal and cold practice. We know that this human touch is essential. Several factors would influence this:

- We spend more time with our patients than other healthcare providers.
- The duration of the processes that we treat tend to last several weeks or months.
- The personal contact involved in the treatments we provide.

Physiotherapy is a form of art because it is closely related to communication and to the capacity of doing things and doing them well. Art is perceived differently by each and every one of us. A work of art some of us love is rejected or not understood by others.

Physiotherapy is not detached from this reality. When we treat our patients, we establish a relationship with them, we communicate with our hands, we transmit our mood... and this is something we physiotherapists do quite well. A physiotherapy treatment can be, for many of us, a fully justified action but a colleague may think this treatment could be improved complementing it with a different manoeuvre or technique. This is the reason why it is important to join physiotherapy and art. Because we must base our treatment on what scientific evidence shows to be the most effective way of treating our patients but we cannot forget about our communication skills, we cannot forget to transmit what we are doing.

Our profession is constantly growing and scientific evidence in physiotherapy is growing exponentially. The future is ours. Let's grab it!

This new issue of our journal presents some original articles on breast cancer and fascial treatment in sports; translated articles and abstracts by some of the participants in the International Physiotherapy Congress #FTP18 that will be held in Barcelona on 4th and 5th May. You will also find the section "Learn how to do research", little information capsules on research methodology. There is a very interesting poster on electrical stimulation in sleep apnoea-hypopnoea syndrome, a physiotherapy degree final project (TFG) about the treatments to improve spasticity in patients with cerebral palsy, and a summary of the SEPAR Conference. As usual, you can have a look at the agenda of conferences and meetings that will take place in the next months, which are really interesting and engaging.

If you have done a master's course and would like to send us your master's degree final project (TFM), do not hesitate to send it to us so that we can help you to disseminate your work, which will surely contribute significantly to the improvement of our profession. Let's go on!

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PHYSIOTHERAPY UPDATES

ORIGINAL ARTICLE

RESULTS OF EXERCISE IN BREAST CANCER SURVIVORS

Magdalena Jiménez Montes

Master's degree in chest physiotherapy. Degree in physiotherapy

ABSTRACT

Aim. Evaluating the results of exercise in breast cancer survivors, taking the following variables into account: quality of life, fatigue, depression, anxiety, and adherence to exercise.

Search strategy. The Pubmed archive was searched using the search equation: *physical therapy and adjuvant therapy and breast neoplasm*.

Study selection. The search produced 47 articles within the established framework, based on the inclusion and exclusion criteria 14 articles were selected.

Conclusion. The results obtained are published in a table, observing a significant improvement in terms of quality of life, fatigue, as well as in other parameters.

Discussion. Some limitations have been found such as unspecified adjuvant therapies as well as important aspects like the greater health benefits derived from exercise in breast cancer survivors.

KEYWORDS: Physical therapy. Adjuvant therapy. Breast neoplasm.

STATE OF THE ART

Breast cancer is currently the most common type of cancer affecting women (1). In Spain, in 2012, there were 25,215 new cases, with an incidence of 11.7% (1). In the same year, it was published that breast cancer was the type of cancer with the highest five-year prevalence with 17.9% and a mortality rate of 9% per 100,000 inhabitants/year (1). These figures confirm the importance of this disease in our society.

The treatment of breast cancer can be divided into different variants and will depend on the characteristics of the tumour. Taking into account the patient's characteristics, we can summarise them into: surgery, radiotherapy, chemotherapy and/or hormonal therapy. The treatment will be different depending on the stage of the disease, neodajuvant treatment before surgery, adjuvant treatment after surgery, and palliative treatment in case of metastasis (2). If we focus on the adjuvant treatment, we must stress it increases survival rates and decreases the risk of relapses. At this stage of the treatment, we can distinguish different types of radiotherapies (depending on the approach and type of carcinoma), hormone treatment, chemotherapy and/or monoclonal medication (Herceptin) (2).

Mortality rates show the efficiency of the medical treatment but it is essential to know the consequences and complications that it has on patients. The literature on the subject provides evidence of its psychological effects (such as anxiety and/or depression, body image and self-esteem problems (3,4), and physiological effects (such as fatigue (described by 80% of patients) (5), muscle weakness, lymphedema, shoulder and postural disorders, heart and lung complications, etc.). All of them affect and are detrimental to the quality of life of sufferers and reduce their tolerance to exercise (6). Physiotherapy can improve this situation (7).

AIM

The main aim of this review was to know the effects of physical exercise on breast cancer survivors based on the variables of quality of life, fatigue, depression, anxiety, and adherence. Although other variables included in the reviewed articles were also registered.

DATA SOURCES

The review in Pubmed was done in January 2016 using the *physical therapy and adjuvant therapy and breast neoplasm*, equation and using the following limitations: studies published prior to the previous five years, studies done on humans, and randomized controlled trials. A total of 47 studies were found.

STUDY SELECTION

The population in the articles were breast cancer survivors who had been treated with adjuvant therapy either before or during the study intervention period.

To select the articles obtained in the search, the following inclusion and exclusion criteria were used:

The inclusion criteria were:

- Studies including physical exercise in their interventions.
- Experimental studies.
- Studies on patients treated with adjuvant treatments.
- Studies including information about their interventions, comparisons and results in their descriptions.

The exclusion criteria were:

- Study protocols.
- Observational studies.
- Studies out of the previously established limits.
- Studies with non-adjuvant treatments.
- Studies with adjuvant pre-treatment interventions.

Out of the 47 studies, 14 met the selected criteria.

DATA EXTRACTION

The results of the obtained studies are shown in the table below:

In order to summarise the results, from the 14 reviewed studies, 5 articles with no significant results and 8 articles with significant improvement in some of the studied variables were obtained.

According to the articles shown in the table, we can see the different outcomes of physical exercise on breast cancer survivors like benefits in terms of quality of life (4), reduced fatigue4 (4,5,13,18), increased strength (8,15,18), increased muscular endurance (8) and less pain (13). The intervention periods of these results vary from 8 weeks to a year and the sample size varies from 41 to 230 patients.

Moreover, we also found non-significant results when analysing the same variables (6,12,14,16,17).

OUTCOME ANALYSIS

When doing the search, it was quite limiting not to know exactly the adjuvant treatment that the patient had received, which could affect the different results. That is why it is important to specify precisely what the administered treatment was. This may be due to the fact of trying to get as many patients as possible but it would be necessary to know **more** about the treatment in order to better understand the effects of exercise. Another limiting factor when doing this review was the lack of information in some articles regarding the patient's basal state, regarding the amount of exercise that that person

did before starting the oncologic treatment, since this could also affect outcome variability.

It must be emphasised that there is currently a considerable interest in the field of exercise and breast cancer survivors, resulting in several articles on this topic. Considering this, we can see greater importance being placed on the survival rate of these patients and the physical and psychological effects resulting from the treatment. Taking the results into account, it would be interesting to know more about the patient's adherence to the exercise programme since only Cournueya *et al.*'s study [16] includes this variable, which is essential for the long-term benefits in these patients' life. It would also be necessary to know about the minimum required time to find improvements related to the variables, since there are interventions of minimum 8 weeks up to a year.

Regarding clinical practice, regular physical exercise should be a part of the treatment given to these patients because, as we can see in the treatments described in the reviewed studies, they are informed of its benefits [1,4,5,7,10,14] but quite often this is not done. Clarifying the cause of this (lack of information, lack of motivation, etc.) would help us find a solution and ensure its implementation. In addition, this could improve the relationship between the healthcare providers and the patient, who sometimes feels neglected after the drug treatment.

Scientific research must continue investigating within this field to demonstrate how the physical and psychological state of these survivors can be improved, and consequently improving their quality of life.

In this article review, we can find the results of the 14 studies with 5 articles presenting non-significant outcomes and 9 articles presenting significant improvements in some of the analysed variables. Nevertheless, further studies in this field are needed.

Thus, after reviewing the articles, we can learn the psychological and physical benefits of exercise on breast cancer survivors treated with an adjuvant treatment.

Ethical responsibilities

L'autora declara que s'han pres les mesures correctes de sobre protecció de persones i animals, confidencialitat de dades i dret a la privacitat i consentiment informat durant la realització d'aquest article.

Conflict of interests

The author of this manuscript declares no conflict of interests related to this article.

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Table I: Result table

Author/s	Year	N	Intervention	Comparison	Results
Saarto, T *et al.* (6)	2012	573	12-month supervised domiciliary exercise programme for breast cancer survivors compared to a control group doing exercise without supervision.	Quality of life, fatigue, and depression.	Non- significant although there is a relative increase in the intervention group in terms of physical activity and quality of life.
Hayes, S *et al.* (4)	2012	194	Physical exercise intervention for 8 weeks in post-surgical breast cancer patients, randomised into a face-to-face intervention group versus a telephone delivered exercise intervention group.	Quality of life, function, and Treatment-related side effects (fatigue, BMI, lymphedema, anxiety, menopausal symptoms, depression, and pain).	Significant increase $p<0.05$ of quality of life and fatigue in the face-to-face group compared to the telephone delivered exercise group.
Winters-Stone, K *et al.* (8)	2012	106	1-year impact + resistance training programme compared to a stretching exercise programme in post-menopausal breast cancer survivors.	Grip strength, maximum muscular strength, fatigue, and physical function.	Significant increase of limb strength in the impact + resistance training group compared to the stretching group.
Reis, D, Walsh, E, Young-McCaughan, Jones, T (5)	2013	41	12-week domiciliary exercise Nia programme in women with breast cancer undergoing radiation therapy compared to a control group instructed to continue their usual physical activity routine.	Fatigue, quality of life, aerobic capacity, and shoulder flexibility.	Significant reduction ($p = 0.05$) in fatigue in the intervention group versus the control group with no changes in the rest of variables.
Hornsby, W *et al.* (9)	2013	19	Study done on patients treated with antracyclines. The intervention group had an aerobic exercise programme and the control group had their usual care routines.	ECG parameters, treatment-related clinical effects (nausea, pain, etc.) $V0_2$ peak.	Non- significant.
Goodwin, P *et al.* (10)	2014	333	24-month study done on post-menopausal women receivingletrozole for breast cancer. The two groups received information on healthy habits (including physical exercise) and a subscription to a health magazine. The intervention group were supervised on the phone unlike the control group.	Weight, quality of life, diet questionnaire, physical activity level.	Significant reduction (p=0.001) in weight in the intervention group. Non-significant increase in physical activity level and quality of life in the intervention group compared to the control group.

Author/s	Year	N	Intervention	Comparison	Results
Husebø AM, Dyrstad SM, Mjaaland I, Søreide JA, Bru E [11]	2014	54	Study on patients during breast cancer treatment and 6-month post-chemotherapy. The intervention group had a home-based exercise intervention during chemotherapy; the control group had their usual routine.	Comparison of the effects of the programme on fatigue, physical activity level or physical condition.	Significant increase in physical activity level in the intervention group compared to the control group.
Schimdt, M, Wiskeman, J, Armbrust, P, Ulrich, C, Steindorf, K [12]	2014	95	The study compared an intervention group following a resistance exercise training programme and a control group having a group relaxation programme for 12 weeks during chemotherapy.	Fatigue and quality of life.	Non-significant improvements.
Steindorf, K *et al.* [13]	2014	155	Resistance exercise training in the intervention group versus a relaxation programme in the control group for 12 weeks during adjuvant radiotherapy.	Comparison of fatigue and quality of life.	Significant difference (p=0.004) in the reduction of physical fatigue in the intervention group compared to the control group, as well as those items regarding quality of life, function (p=0.0035) and pain (0.040).
Taso, C, Lin, H, Lin, W, Chen, S, Huang, W, Chen, S [14]	2014	60	The intervention group had a yoga programme for 8 weeks and the control group had their usual care.	Depression, anxiety and fatigue were analyzed.	No significant results were obtained.
Courneya, K *et al.* [16,17]	2014	301	Patients with breast cancer receiving chemotherapy were assigned to three exercise programmes: STAN (30' of aerobic exercise), HIGH (60' of aerobic exercise), COMB (60 of aerobic exercise + resistance exercise).	Adherence to exercise in the different programmes.	Non-significant results.
				Depression, self-esteem, stress, and anxiety.	Regarding baseline levels, there was a significant improvement in the COMB and HIGH groups (p = 0.027).
Travier, N *et al.* [15]	2015	204	The intervention group had an aerobic and resistance exercise programme versus the control group with usual care. For 18 weeks, measures were taken at 18 and 36 weeks during breast cancer treatment.	Quality of life, anxiety, depression, physical condition, fatigue.	Significant reduction in physical fatigue in the intervention group compared to the control group. Significant increase in submaximal cardiorespiratory fitness in the intervention group compared to the control group at 18 weeks but not at 36 weeks.
Waart, H *et al.* [18]	2015	230	Three intervention programmes in women with breast cancer during chemotherapy: low-intensity physical activity programme, moderate to high-intensity physical activity programme, and usual care programme.	Fatigue, quality of life, physical functioning and condition.	The exercise groups obtained significant outcomes for cardiorespiratory fitness (p <0.001), improvement of physical functioning (p <0.001), less nausea and vomit (p=0.029) and less pain (p=0.003) compared to the usual care group. The high-intensity group got better outcomes for muscle strength (p=0.002) and physical fatigue (0.001).

N=sample, VO_2peak = peak oxygen uptake

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PHYSIOTHERAPY UPDATES

ORIGINAL ARTICLE

FASCIAL TREATMENT IN SPORTS. A BIBLIOGRAPHICAL REVIEW

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Fascial tissue is a structure of mesenchymal tissue of mesodermic origin, which develops together with muscular tissue (1). It forms a viscoelastic, functional and three-dimensional type of tissue, mainly made up of collagen fibres (2,3) and surrounding nervous tissue (neurofascia), viscera (viscerofascia), and muscular tissue (myofascia). Some of its main functions are the absorption and dissemination of tensions (4), movement coordination (5,6) and compartmentalization and division of both, anatomical regions and tissues (forming the epi-, endo-, and peri- structures).

This close interconnection between fascial tissue and the rest of anatomical structures gives fascia a central importance within the field of sports and movement. Fascial restrictions or adhesions can cause movement of flexibility limitations (7,8), take part in inflammatory and painful processes (9-11) and lead to certain muscular or tendinous lesions (12), neuropathies and nerve compressions (13,14). However, it has also been demonstrated that manipulation of fascial tissue has many positive effects in the therapeutic and physiological fields like, for example, vascular plasticity, tissue restoration (15-17) and muscle tone reduction (18).

Taking into account the close relationship between fascia, muscular tissue and sports, the aim of the current study is to do a systematic review of the literature to determine the type of fascial treatments applied in the field of sports, the pathologies studied and the variables analysed.

MATERIALS AND METHODS

Research methodology and inclusion criteria

The bibliographic search was done using the MEDLINE and PEDro databases. The terms used for the search derived from the combination of the words: *fascia AND manual therapy AND sport*. The search resulted in 22 potential articles. The first information analysis was done by two independent reviewers and the opinion of another reviewer was taken into account when there were any discrepancies. Research selection was based on the information analysis provided by the abstract, title, and key words. Finally, 12 articles were selected for this study, which were carefully studied, taking the whole text, for the assessment stage. Figure 1 shows the flow diagram of this article research. The last day the research was carried out was 10th February 2017.

The inclusion criteria were the following:

1. Clinical studies related to fascial tissue.
2. Studies in which the therapeutic intervention is managed within the field of physiotherapy.
3. Articles with their full text available, published in a language the authors understood.

The exclusion criteria were the following:

1. Anatomical, histological, or biomechanical research on fascial tissue.
2. Systematic reviews.
3. Studies whose full text was not available.

Methodology for assessing the studies and their scientific evidence

In order to assess the methodological quality of the studies the Jadad Scale was used, as it is a reference (19), one of the oldest scales, and shows a good interrater reliability (20). According to this scale, clinical trials are described along an interval from 0 to 5. Good quality clinical trials score 3 or more and low quality clinical trials score under 3.

A scale developed by *the Canadian Task Force on the Periodic Health Examination,* ubsequently adapted by the same group (21), was used to assess the level of scientific evidence of the studies.

Two independent reviewers, using the same methodology, carried out both assessments. Any disagreement between the reviewers was resolved including a third reviewer, who helped to achieve a consensus.

RESULTS AND DISCUSSION

We found 12 articles to be analysed. The reading of the bibliography in these articles did not increase the total. Table 1 describes the descriptive analysis of the publications and journals where the articles were published.

The methodological quality and scientific evidence of the analysed publications are low. Some of the articles could not be assessed as they were not clinical trials or did not use any of the designs intended by the scales. Table 1 shows the scores obtained.

The pathology with the highest incidence in this review is plantar fasciitis (in 3 out of the 12 articles). This condition is due to the inflammation, thickening, and microdegeneration of the plantar aponeurosis (22) and affects 10% of the population (23). The specific fascial treatments used in the articles were: stretching, mobilization of connective tissue and fascial treatment of trigger points. The treatments that these specific treatments complemented or were compared to were shock waves and ultrasounds. The outcome analysis shows that there was an improvement in movement and in pain relief when either using a method with a higher incidence in fascial tissue (24) or when combining different types of treatments specifically working on the fascia. No significant differences were observed when the fascial treatment was complemented with flexion-extension ankle mobilizations (26).

Another pathologic entity that was quite present in this review was back problems, found in 3 articles. In these studies, both the posture adopted by the hyperkyphotic patient (27) and the presence of pain in patients with unspecific back pain (28). In one of the publications, there is reference to the treatment of spinal canal stenosis in a patient with hypocondroplasia (29). In all the studies, the treatment used was specific for fascial tissue and the methods used were: nonspecific soft tissue techniques, myofascial massage and *Fascial Manipulation*® (MF). Whereas the first two treatments do not strictly stick to any particular method, MF, developed by Luiggi Stecco, focuses on treating deep fascia, its three-dimensions and interconnections (30). Regardless of the treatment being more or less protocolised, applying fascial therapy improved the assessed variables in all cases.

In one of the publications, the medial tibial stress syndrome (MTSS) is studied. MTSS is described as a syndrome characterised by complex pain suffered by some athletes on the medial aspect of the tibia. Its incidence varies between 4% and 35% (31,32), although it seems to be more frequent in runners or jumpers (33,34). Even though the aetiology of MTSS is not very clear, some researchers suggest that it can be caused by repetitive traction of the connective tissue on the medial aspect of the tibia (35). In the analysed article, the applied treatment intended to have a direct incidence on the crural fascia and used the *Fascial Distortion Model*® developed by Stephen Typaldos.

In some other publications, what was analysed was whether the influence of soft tissue stretching could improve function and relieve pain in patients with acetabular problems (36) or soccer players with inguinal hernias (37). In both cases, the results were positive in terms of pain relief and movement but not in comparison to a control group and when combining fascial and muscular therapies, the observed improvement could not be assigned to the treatment on the fascia.

Two studies analysed the effects of self-myofascial release in healthy patients. One of the publications examined whether the use of a foam roller before a sports performance test improved the results and reduced fatigue (38), the results showed only a reduction in the sportsperson's fatigue. The other publication examined the effects of using a foam roller on arterial physiology (39), observing significant results in arterial rigidity and endothelial vascular function.

Table 2 shows the pathologies and treatments used in each of the studies, the characteristics of the samples and the results obtained.

CONCLUSIONS

The most commonly used therapies in the analysed trials were *Fascial Manipulation*®, general techniques of soft tissue manual therapy, and self-myofascial release. Although the analysed trials do not show a high level of evidence and methodological quality, the results presented in this review suggest that fascial techniques can be effective in the treatment of pain and the improvement of mobility, both in healthy and unhealthy subjects in sports and clinical settings.

The review shows that the parts of the body mostly represented in this study are those in which fascial tissue has a major role in tension transmission such as the plantar aponeurosis and lumbosacral aponeurosis. The most commonly observed pathologies in this review are, by far, plantar fasciitis and back problems. We were quite surprised not to find any pathology directly related to the muscle or tendon, which are very frequent problems in sports.

Future clinical trials in which manual fascial treatments are applied must determine, in a more precise way, the methodology of the fascial technique used in order to improve the replication of the study and the results. The methodological quality of the studies should also be improved so that the publication of future research has a greater impact. It is also important to highlight the fact that there are unspecified treatments like fascial therapy that directly work on this tissue.

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Figure 1. Flux diagram

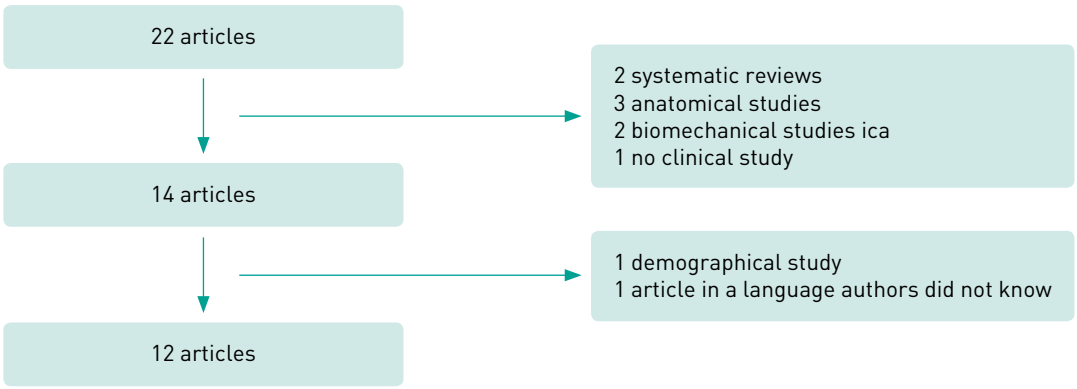

Table 1

Authors	Title	Publication	Year	Jadad scale	US Preventive Task Force
Branchini, M.; Lopopolo, F.; Andreoli, E.; Loreti, I.; Marchand, A. Stecco, A.	Fascial manipulation for chronic aspecific low back pas : a single blinded randomized controlled trial	F1000Research	2015	4	I
Shashua, A.; Fletcher, S.; Avidan, L.; Ofir, D.; Melayev, A.; Kalichman, L.	The effect of additional ankle and midfoot mobilizations on plantar fasciitis: a randomized controlled trial	Journal of Orthapaedic& Sports Physical Therapy	2015	4	I
Rompe, J.; Furia, J.; Cacchio, A.; Schmitz, C.; Maffulli, N.	Radial shock wave treatment alone is less efficient than radial shock wave treatment combined with tissue-specific plantar fascia-stretching in patients with chronic plantar heel pain	International Journal of Surgery	2015	4	I
Cashman, G.; Mortenson, B.; Gilbart, M.	Myofascial treatment for patients with acetabular labral tears: a single-subject research design study	Journal of Orthapaedic& Sports Physical Therapy	2014	-	II-3
Schulze, C.; Finze, S.; Bader, R.; Lison, A.	Treatment of Medial Tibial Stress Syndrome according to the Fascial Distortion Model: A Prospective Case Control Study	The Scientific World Journal	2014	-	II-2
Okamoto, T.; Masuhara, M.; Ikuta, K.	Acute effects of self-myofascial release using a foam roller on arterial function	Journal of Strength and Conditioning Research	2014	1	I
Ćosić, V.; Day,J.; Iogna, P.; Stecco, A.	Fascial Manipulation method applied to pubescent postural hyperkyphosis : a pilot study	Journal of Bodywork and Movement Therapies	2013	-	II-3
Healey, K.; Hatfield, D.; Blanpied, P.; Dorfman, L.; Riebe, D.	The Effects of Myofascial Release With Foam Rolling on Performance	Journal of Strength and Conditioning Research	2013	1	I
Yuill, E.; Pajaczkowski, J.; Howitt, S.	Conservative care of sports hernias within soccer players: A case series	Journal of Bodywork & Movement Therapies	2012	-	II-3
Renan-Ordine, R.; Alburquerque-Sendin, F.; Rodrigues de souza, D.; Cleland, J.; Fernandez-de-las-peñas, C.	Effectiveness of Myofascial Tigger point Manual Therapy Combined With a self-stretching protocol for the management of plantar heel pain : a randomized controlled trial	Journal of Orthapaedic& Sports Physical Therapy	2011	1	I
Hanson, A.	Improving mobility in a client with hypocondroplasia (dwarfism) : a case report	Journal of Bodywork and Movement Therapies	2010	-	-
Wang, H.; Shih, T.; Lin, K.; Wang, T.	Real-time morphologic changes of the iliotibial band during therapeutic stretching; an ultrasonographic study	Manual Therapy	2008	-	II-3

Table 2

Authors	Subjects	Physiotherapy treatment and analysed variable	Results
Branchini *et al.*	24 subjects with unspecific low back pain	Each subject had 8 sessions over 4 weeks. The treatment was administered based on the groups. Control group: physiotherapy programme including relaxation, control of diaphragmatic breathing, stretching, postural and functional rehabilitation, etc. Study group: the same programme combined with FASCIAL MANIPULATION®. The analysed variables were pain, function, and the most significant outcome for each individual patient.	The subjects who received the combined treatment (study group) obtained better results in all the variables at the end of the treatment and 1 month afterwards.
Shashua *et al.*	50 subjects with plantar fasciitis	The experimental and control groups had a total of 8 sessions, two sessions a week, of stretching exercises and ultrasounds. In addition, the intervention group received mobilization of the ankle and midfoot joints in the first sessions. Dorsiflexion range of motion, pain, and lower limb function were measured.	Both groups had positive results in all the variables but there were no significant differences between them.
Rompe *et al.*	152 subjects with chronic plantar fasciitis	Group 1: three sessions of shock wave therapy at weekly intervals. Group 2: a stretching programme with specific exercises for the plantar fascia for 8 weeks, 3 times a day; three sessions of shock wave therapy at weekly intervals. Variables: pain (nine-item pain subscale of the validated Foot Function Index) and outcomes (subject-relevant outcome questionnaire).	The combined treatment of shock waves + stretching programme is more effective than just the shock wave therapy in all the variables after 8 weeks.
Cashman *et al.*	4 subjects with acetabular labral tears	The patients were treated for 6 to 8 weeks. Therapy consisted of a combination of soft tissue therapy, stretching, and strengthening of the hip muscles. The analysed variables were hip pain and function.	Significant improvement of hip pain, particularly in the posterolateral area, and better hip function.
Schulze *et al.*	32 subjects with medial tibial stress syndrome	The subjects received fascial treatment using the Typaldos® fascial distortion model and they were not allowed to perform any sport activity on the days the treatment was administered. They received therapy every day until the symptoms disappeared (6 days of treatment on average).	Significant improvement of pain and tolerated exercise.
Okamoto *et al.*	10 healthy subjects	The subjects had two sessions with different treatments in random order at intervals of 3 days. One of the treatments consisted of myofascial therapy with a foam roller on the thigh muscles and trapezius. The other treatment (control) had the patients resting supine. The variables used were: brachial-ankle index, blood pressure, heart rate, and plasma nitric oxide concentration.	A foam roller reduces arterial stiffness and improves vascular endothelial function.
Ćosić *et al.*	17 adolescents with postural hyperkyphosis	The subjects received between 2 and 4 weekly sessions of FASCIAL MANIPULATION®. All the subjects were evaluated for psychological aspects, sport, pain; anteposition of shoulders, head, and pelvis, distance between C7 and L3 from plumb-line, distance from fingers to floor on forward bend.	Significant improvement in all the parameters after the treatment and 7 months afterwards.

Authors	Subjects	Physiotherapy treatment and analysed variable	Results
Healey *et al.*	26 healthy subjects	he treatment was divided into 2 different sessions with an interval of 5 days. The subjects had to do a series of exercises and some athletic performance tests whose results were used to determine the analysed variables. The exercises were planking exercises in one of the sessions and foam rolling exercises in the other session. Fatigue, soreness, and exertion were also measured.	There were no significant differences between the two treatments for the athletic performance tests but there was a reduction in post-exercise fatigue for those who had the foam rolling session.
Yuill *et al.*	3 soccer players with inguinal hernia.	The subjects were treated 1-2 times a week for 6-8 weeks. The treatment consisted of soft tissue therapy, six joules of laser at the site of the chief complaint, microcurrents applied to the area of chief complaint, acupuncture, Wobenzyme for the pain and inflammation, hip rehabilitative exercises, and plyometric training. The analysed variables included pain (AS) and muscular resistance.	Significant reduction of pain 8 weeks after treatment.
Renan-Ordine *et al.*	60 subjects with plantar fasciitis	The subjects had 4 sessions a week for 4 weeks with different treatments for each group. Group 1: lower limb self-stretching exercises. Group 2: lower limb self-stretching exercises + soft tissue trigger point manual therapy. The analysed variables were function, pain and pain thresholds.	The outcomes were significantly better in all the variables for the group that received the combined therapy programme (group 2).
Hanson	A subject with hypochondroplasia (dwarfism) and spinal stenosis	The subject had 8 sessions in which he received myofascial massage, from less to more specific techniques as the treatment progressed. She also had stretches of the iliopsoas and specific massage for the muscle.	The patient showed positive results in reducing adhesions in the thigh, improving circulation, and increasing the distance the client could walk before resting.
Wang *et al.*	44 healthy subjects	The subjects were treated with the Ober maneuver in three positions: neutral, adducted and adducted with weight. Iliotibial band width was measured.	There was significant reduction in iliotibial band width in neutral position.

Col·legi de Fisioterapeutes de Catalunya

PHYSIOTHERAPY UPDATES

TRANSLATED ARTICLE

ASSESSMENT OF ELECTROMYOGRAPHY ACTIVITY OF PELVIC FLOOR MUSCLES DURING POSTURAL EXERCISES USING WII FIT PLUS© VIRTUAL VIDEO GAMES. ANALYSIS AND PERSPECTIVES IN RE-EDUCATION

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ABSTRACT

Introduction. The aim of this work was to evaluate the effect of postural awareness by using the Wii Fit Plus© on the quality of the baseline (automatic) activity of the pelvic floor muscles (PFM) measured by intravaginal surface electromyography (SEMG).

Methods. Four healthy continent female subjects, all able to perform a voluntary contraction, undertook 2 sets of 3 various exercises offered by the software Wii Fit Plus© using the Wii balance board© (WBB): one set without any visual control and the second set with postural control and SEMG visual feedback. Simultaneously, we recorded the SEMG activity of the PFM.

Results. Mean baseline activity of PFM in standing position at start was 2.87 mV, at submaximal voluntary contraction the SEMG activity raised at a mean of 14.43 mV (7.87—21.89). In the first set of exercises on the WBB without any visual feedback, the automatic activity of the PFM increased from 2.87 mV to 8.75 mV (7.96—9.59). In the second set, with visual postural and SEMG control, mean baseline SEMG activity even raised at 11.39 mV (10.17—11.58).

Conclusion. Among women able of a voluntary contraction of PFM, visualisation of posture with the help of the WBB and of SEMG activity of the PFM during static and dynamic Wii Fit Plus© activities, may improve the automatic activation of the PFMs.

Level of evidence. 4.

KEYWORDS: Pelvic floor muscle. Electromyography. Biofeedback. Posture. Wii Fit Plus©. Awareness.

INTRODUCTION

The perineal muscular complex is mainly made up of type-I muscle fibres of a small diameter, resistant to fatigue, and characterised by low amplitude voluntary contractions. These muscle cells present a long period of post-activity hyperpolarization that limits their maximum discharge rate (1). These anatomical and histological specificities provide pelvic floor muscles (PFMs) with a key role in the control of micturition (2) and defecation, in sex (3), and in the maintenance of lumbopelvic stability (4,5), In order to preserve these functions, the PFMs are activated by the somatic and emotional motor systems (SMS and EMS) (6). These different activation pathways permit voluntary contractions through the lateral SM whereas the medial SMS permits postural adjustments (*feedback*) during axial movements. The lateral EMS, in turn, controls contractions in preparation for imminent perturbation (*feedforward*) or anticipated postural adjustment (APA). If the relationship between the loss of these anticipatory postural activations and chromic low back pain has been widely described in the literature by Hodges *et al.*, it was Smith in 2007 who first showed the role of APAs in the context of stress urinary incontinence (SUI) (7). Based on this new evidence in the field of pathophysiology, Bakker *et al.* (2008) proposed a functional model of incontinence for the management of SUI (8). This hypothesis is supported by Capson *et al.* (2011), who observed an improved automatic response of PFMs to postural changes in the lumbopelvic region if the subject is standing (self adjustment position) through lumbopelvic stabilization (9).

Virtual reality video games offer potentially innovative approaches that still need to be further examined. The concept of the Wii Fit Plus© gaming software is based on ideas that could affect re-education (10): mirror images, reward and stimuli presented as scores during outcome progression. This game also involves an interesting cognitive workload fractionated into a phonological loop and a visuospatial sketchpad (11). We can find numerous conditions that will favour a progressive recruitment of static or dynamic postural activity. The activity of mirror neurons could be strongly promoted with the concept in which a virtual trainer shows you, throughout the exercise, what the ideal posture and right movements are (take-off pose and tree pose). In the third proposed exercise, it is an avatar (hula-hoop). During the exercises, the patient visualises her centre of pressure (COP) or her avatar's activity, which, in turn, is based on COP recordings. At the end of each exercise, the software presents numerical results, using a reward system of points and feedback stimuli that favour performance. We know that PFMs are modulated by the emotional motor system (6) and that there is great cohesion in the virtual concept of motor learning. Leisure activities like hula-hoop involve a dynamic activity of the pelvis and lumbar region and help a dynamic postural activity of the PFMs (12,13). We have examined the contribution of visualisation through double biofeedback: control of PFM activity with a surface electromyography (SEMG) and control of COP of postural activity. We expect that this visualisation while doing the re-education exercises stimulates the awareness process of a better postural activity of PFMs and the muscles in the lumbopelvic region in general.

METHOD

This is a preliminary observational study, done in September 2013 at CHU in Rouen, France.

PARTICIPANTS

Four continent nulliparous female volunteers who were verbally recruited: aged between 28 and 50 years (mean = 42.7), weighing from 48 to 68 kg (mean = 60 kg), between 1.58 and 1.68 m tall (mean = 1.62 m) with a BMI between 19.5 and 24.1 (mean = 22.6), number of births ranging from 1 to 3 (mean = 2)), all vaginal births, episiotomy 3, forceps 2, and no urogynecological surgery. They all filled in a questionnaire on general health that is routinely used in our service. They did not have any history of neurological, psychiatric or gastroenterological problems.

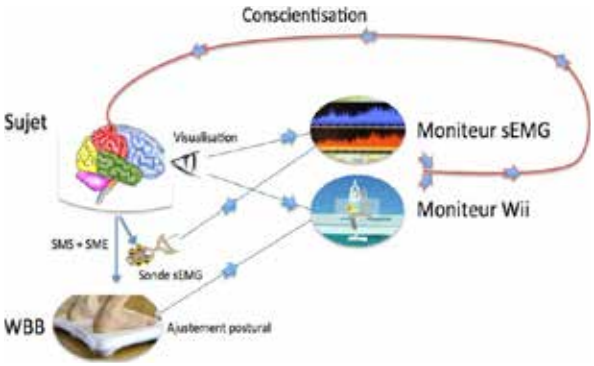
EXPERIMENTAL PROTOCOL

All the participants completed an informed consent form to take part in a biomedical study following the French guidelines for public health. Each participant had a BFB (Perisize 4+©) vaginal probe inserted vaginally with the use of some hypoallergenic gel. The probe has 4 independent hemispherical electrodes in backward and lateral position, connected with 4 2-mm banana plugs. This is a non-obturation probe used to limit the artefacts caused by the increase of endocavitary pressure during the exercises (14). Several studies have demonstrated the reliability of SEMG activity recordings of PFMs with surface electrodes (15,16). Junginger found a strong correlation between bladder neck elevation assessed with ultrasound and a SEMG of PFMs (17). A *snap* Dura Stick Plus® reference surface electrode was placed on the osseous rim of the pelvis. The vaginal probe and reference electrode were connected to an SEMG device: Myotrack® (Thought Technology Ltd.) assisted by INFINITY® software (18) with an automatic recording measurement of SEMG output of PFMs in microvolts RMS (root mean square) (19). The acquisition frequency of Myotrack® is 1Khz and the chosen acquisition gain, 0.5%. For the assessment, the first second of SEMG activity was excluded. In this study, we calculated the mean of the 10 RMS of the reference submaximal contractions in order to compare them with the mean of SEMG activity during postural exercises. We used a Wii Balance Board© (WBB), a platform for the general public assessing COP assisted by Nintendo© Wii and Wii Fit Plus© software. The WBB allows a right-left and back-forth control of COP. Users can therefore modify their postural activity (20) visualising their COP on a screen of considerable dimensions (640 × 400 mm). The Wii Fit Plus© software proposes postural

activities based on yoga (21) and fitness (22), as well as COP-controlled video games (Fig. 1).

Figure 1.

Diagram of experimental protocol.



EXERCISE PROTOCOL

Participants stand on the WBB and do some exercises, transferring body weight on their feet in the horizontal plane, following the instructions of a virtual trainer. These instructions are presented both as an oral and written text giving instructions on the movements the user has to make and, at the same time, the user can see how the virtual model makes the right movements to adapt a certain position. In order to maintain the board in the necessary horizontal position, the user has to distribute body weight homogeneously, as if it were a Freeman plate. The COP is represented by a red point, which must be kept within a limited area on the screen to have the minimum possible deviation, as if it were a stabilometric platform (23). We recorded SEMG activity of the PFMs for each exercise. We measured basal activity, mean activity, and calculated mean activity gain. Data were gathered on one day, divided into 2 3-hour sessions with a 15-minute break in between.

Each exercise was done 5 times in 2 different modes: visualised and non-visualised.

Non-visualised mode: the subject, on the WBB© turned off, tried to do the exercise following the instructions given orally by the therapist.

Each exercise was done then in a visualised mode from the very beginning.

Visualised mode: the subject stands on the WBB© turned on facing the Wii and SEMG activity of PFMs monitors. The participant does what is on the Wii monitor and, at the same time, she can visualise SEMG activity of the PFMs on the control screen. The participant can see the increase in SEMG automatic activity of the PFMs on the control screen and therefore check the quality of the exercise with the assistance of the biofeedback visualisation of her feet on the board (COP).

EXERCISE DESCRIPTION

The participants were asked to perform a few analytical voluntary contractions of the PFMs while standing and assessed by a SEMG, supervised by the therapist, so that data were normalised (24). Then, they did the exercises proposed by the therapist in the following order:

- contract the PFM and sphincter 10 times in a row for 6 seconds, with 6-second breaks in between. There are no studies on muscle strength performance (25): to determine submaximal voluntary contraction (SVC), the participants were asked to perform a contraction of the PFMs and anal sphincter (26);
- tree pose. The therapist asked the participant to place the sole of one foot on the inner side of the opposite thigh, interlace fingers with the palms of the hands together, have the index fingers pointing up at the centre of the chest, and raise the arms above the head maintaining the index fingers in the same position. The participant kept this posture for 20 seconds. This exercise forces an upright posture. This erect posture is a self-extension position in which some anatomical reference points (the ear tragus, the tip of the acromion, the greater trochanter, and the outer malleolus) are aligned ;
- take-off pose: the therapist asked the participant to raise both arms above their head, with the palms of the hands facing forward, stand on the toes and bring the arms backwards with elbows straight at shoulder lever and with the thumbs pointing up. The participant kept the position for 20 seconds. This exercise forces an upright posture;
- hula-hoop. The therapist asked the participant to stand upright. Then the patient had to bring both hands, with interlaced fingers and palms facing up, in front. The patient was then asked to describe circles with the pelvis in one direction, as if she was using a hula-hoop. The activity lasted 20 seconds.

  In the second session, the participants, standing facing the Wii and EMG monitors, did the exercises but this time using the Wii Fit Plus© software. Then they were showed a visualisation and consequently they were aware of the COP + SEMG activities of the PFMs;
- tree pose on the WBB© with SEMG visualisation of the PFMs. This exercise forces an erect posture (Fig. 2);
- take-off pose on the WBB© with visualisation of the COP and EMG of the PFMs. This exercise forces an upright posture;
- hula-hoop on the WBB© while standing upright (Fig. 3).

Figure 2.
Tree pose.

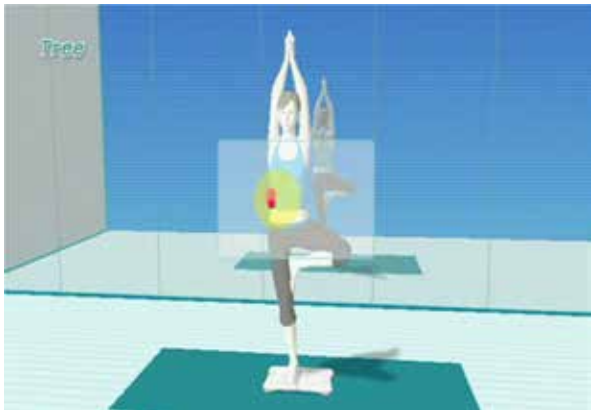


Figure 3.
Hula-hoop exercise.

Table 1.
Surface electromyography (SEMG) results of pelvic floor muscle (PFM) activity during the visualised and non-visualised postural exercises.

Type of exercise	SEMG mean values in mV	
	Non-visualised position	Visualised position
Standing at rest	2,87	2,87
Take-off pose	7,96	10,17
Tree pose	9,59	12,44
Hula-hoop exercise	8,71	11,58

RESULTS

When standing at rest, the SEMG activity of the PFMs has a mean value of 2.87 mV, ranging from 1.91 to 4.69 mV depending on the subject (Table 1). When performing PFM submaximal contractions, the mean value of SEMG activity is 14.43 mV, ranging between 7.87 and 21.89 mV depending on the subject. This represents a percentage of gain with a mean PFM activity of 403%, with values between 307% and 514% (27). The percentage of gain is calculated as a percentage in comparison to CVS activity.

During the take-off pose, the mean value of SEMG activity of PFMs is 7.96 mV, going from 3.12 and 12.16 mV, whereas in the same position with visualisation, the mean value of SEMG activity of PFMs is 10.17 mV, ranging between 4.12 and 14.98 mV. Therefore, the mean gain of SEMG activity of PFMs during the conscious and normal take-off pose is +27% with values between 13.25% and 36.4%.

During the tree pose, the mean value of SEMG activity of PFMs is 9.59 mV, from 3.91 and 15.08 mV, while in the same pose with visualisation we found a mean value of SEMG activity of PFMs of 12.44 mV, ranging from 5.44 and 19.59 mV. The gain in mean SEMG activity of PFMs during the conscious and the normal tree pose is +30%, with values from 22.8% and 50.1%.

During the hula-hoop exercise, the mean value of SEMG activity of PFMs is 8.71 mV, going from 3.91 to 14.08 mV, the visualised hula-hoop exercise yields a mean value of SEMG activity of PFMs of 11.58 mV, between 5.13 and 18.56 mV. The gain in mean SEMG activity of PFMs for the conscious hula-hoop exercise when compared to the normal hula-hoop exercise is +33%, with values ranging from 10.4% to 48.8%.

DISCUSSION

The visualisation technique by means of a BFB probe within PFM re-education has been widely described. It is done in the traditional way, with the patient lying on a couch with either a vaginal or surface probe performing voluntary contractions of different intensity and longitudes (28). There is no consensus in the literature, with a low level of evidence. The EAU 2013 guidelines also establish that BFB offers better immediate results but this difference does not persists in the long term (NP1). In post-prostatectomy stress incontinence, the results are even contradictory in terms of the interest of the association of BFB or electrical stimulation in comparison to PFM re-education alone (NP2) (29).

The Wii Fit Plus© video game is a gentle, motivating technique that includes the concept of mirror therapy thanks to visualisation, available for most patients. The studies by Wallet *et al.* demonstrate that the results obtained with virtual reality can be applied to everyday activities (30). The software has a reward and score sys-

tem that affects motivation and, consequently, the EMS. There are no studies, as far as we know, on pelviperineal re-education using the WBB© of the Wii Fit Plus© software. Following the physiotherapist's indications, the participant can become aware of her activity thanks to the visual biofeedback of her COP, even at home.

In our observational study, we have quantified the automatic SEMG activity of PFMs during the exercises in the game, with and without visualisation of ground support (COP) and SEMG curves of PFMs. Visualisation, and therefore awareness of postural activities and SEMG of PFMs, improve PFM recruitment.

Our observations on this automatic activation of PFMs during physical activity agree with those by Luginbuehl on running (31), and evidence a non-voluntary activity of PFMs on static and dynamic standing. This mechanism of automatic activation may explain the clinical improvement observed in a group of post-prostatectomy patients who had had a programme of postural exercises for lumbopelvic stability (32). This seems to confirm the importance of a postural and proprioceptive approach in pelviperineal re-education and our re-education must tend then, after regaining PFM voluntary contraction, to the rehabilitation of this automatic postural activity more adapted to the muscular physiology of PFMs.

Wulf *et al.* described the improvement of learning and performance processes thanks to the use of self-controlled practice (33). In our study, we observed a difference in comparison to the mean SEMG activity of PFMs while doing the exercises with or without this self-control. Active awareness through a video demonstrates the contribution of these learning techniques by simultaneously visualising the recordings of COP fluctuations and SEMG of PFMs. This awareness seems to restore a PFM function more adapted to its muscular physiology and it also seems to help restore neuronal plasticity and rehabilitate non-compensatory cortical functions (34-36).

In spite of our encouraging results regarding the use of these postural techniques using active awareness through a video, our study shows some bias: the small sample prevents any significant statistical analysis and the variability of success of these exercises in each participant. It would be necessary to have bigger cohorts and perform random recordings in the order of the series (with and without visualisation) in order to make sure that the observed differences are properly connected with visualisation. Further research is needed to confirm whether postural re-education with self-control could effectively complement validated pelvic re-education techniques.

CONCLUSION

Visualising posture with a WBB and SEMG activity of PFMs in a small cohort of participants, while doing static and dynamic exercises included in the Wii Fit Plus© software, could increase automatic SEMG activity of the PFMs in females able to perform voluntary contractions of PFMs. Based on these results, we intend to examine a more global and comprehensive care of pelviperineal re-education in a bigger sample.

DECLARATION OF INTERESTS

The authors declare that they have no conflicts of interest regarding this article.

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Col·legi de Fisioterapeutes de Catalunya

PHYSIOTHERAPY UPDATES

TRANSLATED ARTICLE

BALANCE AND MOBILITY IN COMMUNITY-DWELLING OLDER ADULTS: EFFECT OF DAYTIME SLEEPINESS

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OBJECTIVES. To examine the effect of self-reported daytime sleepiness on performance-based balance measures and self-reported balance confidence in community-dwelling older adults.

DESIGN. Cross-sectional secondary analysis of an observational cohort study designed to develop and refine measures of balance and mobility in community-dwelling older adults.

SETTING. Community.

PARTICIPANTS. Older adults (aged 78.2 ± 5.9) (n = 120).

MEASUREMENTS. The performance-based gait and balance measures included gait speed, double support time, and step width. Narrow walk, obstacle walk, and timed standing balance were also assessed. The Activities-Specific Balance Confidence Scale was included as a self-reported measure. Daytime sleepiness was defined as an Epworth Sleepiness Scale score of 9 or greater. Body mass index, fall-related comorbidities, and use of central nervous System (CNS) medications were considered as covariates.

RESULTS. Forty-five percent of participants reported daytime sleepiness. Participants reporting daytime sleepiness differed significantly from those without in gait speed (adjusted difference (standard error (SE)) -0.09 (0.04) m/s, P = .03), step width (adjusted difference (SE) 0.02 (0.01), P = .03), and self-reported balance confidence (adjusted difference (SE) _1.02 (0.38), P = .01) even after adjusting for covariates. Two way analysis of variance of CNS medication use and daytime sleepiness showed no significant interaction effects.

CONCLUSION. Self-reported daytime sleepiness is associated with slower gait speed and poor balance confidence in community-dwelling older adults. Subjective sleep assessment should be considered when assessing balance and implementing interventions for improving balance in older adults. Further study is needed to examine the role of CNS medication use **J Am Geriatr Soc 65:1019–1025, 2017**.

KEY WORD: Daytime sleepiness. Balance. Mobility. Elderly..

More than one-third of adults aged 65 and older fall each year (1). Falls are known to be associated with substantial morbidity and lead elderly adults to restrict daily activities, resulting in further mobility loss and even premature nursing home placement (2,3).

Diminished ability to maintain balance is associated with fear of falling and risk of falling (4). Physiological changes related to aging, for example, in cognitive function (5), muscle strength (6,7), lack of proprioception (8), joint range of motion (9), reaction time (10) and sensory systems (11) may negatively affect balance control and affect the functional ability of older adults. Central nervous System (CNS) medications—hypnotics in particular (12-14) – have also been implicated as strong factors affecting balance and falls in older adults. Insomnia is an independent predictor of falls (15,16) and untreated insomnia is a stronger predictor of falls (adjusted odds ratio (aOR) = 1.55) than hypnotic use (aOR = 1.11) (17).

There is growing evidence that balance is sensitive to sleep deprivation (18-20), and aging worsens the effect of sleep deprivation on postural control (21). Poor sleep with daytime sleepiness is prevalent in older adults. Even in healthy older adults with no specific sleep disorders, there is a decrease in deep, restorative sleep and an increase in light, transitory sleep as a function of age (22). As a result, more than half of older adults complain about poor sleep (23), and 46% of those aged 75 and older report daytime drowsiness or napping (24). Self-perceived poor sleep and daytime sleepiness have been identified as independent predictors of falls and fall-related injuries in older adults (25).

Sleepiness resulting from acute sleep deprivation adversely affects postural balance (20,21,26,27),but the effects of daytime sleepiness in community-dwelling older adults has not been examined. An observational cohort study provided an opportunity to evaluate the association between daytime sleepiness and balance measures in community-dwelling older adults (28). The goal of the present secondary analysis was to examine the association between self-reported daytime sleepiness and mobility and balance in community-dwelling elderly adults. It was postulated that daytime sleepiness would be adversely associated not only with gait speed, but also with performance-based balance measures and subjective balance confidence in this cohort. A secondary aim of this analysis was to examine the effect of CNS medication use on any such association.

METHODS

Study Design

This was a cross-sectional secondary analysis of baseline data from an observational cohort study designed to develop and refine measures of balance and mobility in community-dwelling older adults (28). Baseline data were collected at the University of Pittsburgh Claude D. Pepper Older Americans Independence Center from December 2006 to August 2007. The University of Pittsburgh institutional review board approved study procedures. The parent study was a 1-year cohort study with clinic visits at baseline, 6 months, and 12 months that included 120 participants. For this secondary analysis, data collected at baseline for all participants who completed the Epworth Sleepiness Scale (ESS) for daytime sleepiness assessment (n = 116) were included. All participants provided written informed consent before the study was initiated.

Participants were recruited from the Pittsburgh Pepper Center Research Registry of community-dwelling older adults who previously consented to be contacted for participation in mobility studies. Participants were cognitively intact community-dwelling older adults aged 65 and older with the ability to walk a minimum of a household distance with or without an assistive device but without the assistance of another person. Participants were excluded if they had any of the following conditions that would affect safety during testing or that would affect mobility over the following year: neuromuscular disorders that impair movement, cancer with active treatment, hospitalization for a life-threatening illness or major surgery in the previous 6 months, severe pulmonary disease, or chest pain with activity or a cardiac event such as a heart attack in the previous 6 months.

Daytime Sleepiness

Daytime sleepiness was assessed using the ESS (29), a 4-point Likert-style questionnaire designed to assess average sleep propensity and likelihood of dozing during a number of activities, including active and soporific situations. ESS has good psychometric characteristics, such as good overall internal consistency (Cronbach alpha = 0.88, $P < .001$) and test–retest reliability (Pearson correlation coefficient = 0.82, $P < .001$) (30), and has demonstrated good internal consistency, reliability, and construct validity in older community-dwelling adults (31,32) Although there is no universally accepted cutoff for the ESS in older adults, a score of 9 or greater was used to indicate daytime sleepiness, as done in similar studies (22,33).

Performance-Based Measures of Mobility and Balance

Gait Speed

Gait speed (m/s) was measured using a 6-m automated gait analysis system that uses the opening and closing of pressure- sensitive switches to generate footprints on a computer screen as participants walk on a walkway (GaitMat II, EQ Inc., Chalfont, PA). Reliability and validity have been established (34, 35). Gait speed was measured over the central 4 m, allowing 1 m on either side for acceleration and deceleration. Assistive devices were allowed if used for household ambulation. Two practice passes were taken and then four passes at self-selec-

ted walking speed for data collection. Gait speed was recorded as the distance traversed divided by the time between the first and last steps (switch closure). Mean gait speed was calculated by averaging the four trials.

Gait Characteristics

In addition to gait speed, other gait characteristics obtained from the instrumented walkway and analyzed in the current report included step width (a spatial parameter) and double support time (DST; a latter temporal parameter) because these measures indicate balance control [36]. As defined for the GaitMat II automated analysis of recorded footprints, step width is the distance between the outermost borders of two consecutive footprints, and DST is the time during which both feet are in contact with the floor. Gait variability (step width or DST) was defined as the standard deviation (SD) of overall steps, right and left, recorded during four passes of walking on the GaitMat II.

Narrow Walk. As previously described [37], participants were asked to walk a 7-m course at their usual pace and step over two obstacles of different heights. One obstacle was 6 cm tall and positioned 2 m from the starting line, and the other was 30 cm tall and positioned 4 m from the starting line. Participants were instructed to "get past the obstacles without touching them." The time for each participant to complete the task was recorded. Each participant completed two trials, and the mean of the two trials was calculated.

Timed Standing Balance Tests

Tandem Stance Time. The tester stood to one side of the participant, providing support at one arm if needed until the participant felt stable in tandem stance, with one foot directly in front of and touching the other foot [38]. Participants self-selected the forward foot. The support provided was the minimum needed to prevent loss of balance and was not recorded on the data collection form or otherwise factored into the score. Timing began as support was released and continued for 10 seconds or until the participant moved out of tandem or contacted external support. Multiple attempts were not allowed.

Single-Leg Stance Time. Participants balanced themselves for up to 30 seconds while standing on the right leg without external support [38]. The position was demonstrated with the left foot lifted behind the body, knee bent to 90°, and hip neutral. The tester stood next to the participant, but no support was provided. Instructions were given to position the arms, bend the right knee, or move the body as needed to maintain balance, but the left foot could not touch down. Participants who were unable to get into position without initial support were classified as unable to perform. Timing began when the participant appeared stable and ended after 30 seconds or when external contact was made for support, including touching the left foot to the floor. Only one attempt was allowed, and hold time was recorded only if the participant was stable in the single-leg stance for at least 1 second. The test was performed on the right and left sides.

Self-Report Measures of Balance and Mobility

Activities-Specific Balance Confidence Scale

The Activities-Specific Balance Confidence (ABC) Scale measures confidence and fear of falling and has proven reliability and validity in elderly adults [39,40]. Individuals rate their balance confidence from 0% to 100% on each of 16 tasks. Overall score is calculated by adding item scores and then dividing by the total number of items (possible range 0–10) [41].

Other Measures

Demographic Characteristics

Data were collected on age, sex, race or ethnicity, and education level.

Comorbidity Index

This measure is a self-report of common physician-diagnosed medical conditions, including cardiovascular disease (angina pectoris, congestive heart failure, heart attack), neurological conditions (stroke, Parkinson disease), lung disease, musculoskeletal conditions (arthritis, osteoporosis, fracture, joint replacement), general conditions (depression, sleep problems, chronic pain syndrome), cancer, diabetes mellitus, and visual conditions (glaucoma, cataracts) [42]. For each medical condition, participants were asked whether a physician had ever told them that they had the condition.

Medication Use

A detailed medication use history, prescription and over the counter, was obtained from each participant at the initial visit. This information was used not only to examine the effect of total medication use on balance and mobility in older adults, but also to isolate and test the effect of CNS medications, which were defined as opioid receptor agonist analgesics, antipsychotics, antidepressants, and benzodiazepine receptor agonists [12]. Antidepressants noted to be used in this cohort included selective serotonin reuptake inhibitors (citalopram, escitalopram, fluoxetine, paroxetine, sertraline, and tricyclic antidepressant amitriptyline).

Fall History

Participants were asked to respond the following questions: Are you afraid of falling? Have you had a fall in the previous year? Responses to the questions were recorded as yes or no. One-week test–retest reliability (kappa) was established as 0.89 for falling in the previous year in a subsample of 43 participants from this cohort (unpublished data).

Body Mass Index

Study staff measured height using a digital scale (BWB-800, Tanita, Arlington Heights, IL) and weight using a wall-mounted rod (HR-200, Tanita). Assistance was given to obtain the position for height and weight measurements, including cues to stand up straight with heels against the wall for assessment of height, but measurements were recorded in an unsupported stance. Weight was recorded to the nearest tenth of a kilogram, and height was measured to the nearest tenth of a centimeter. Height and weight measures were used to determine body mass index (BMI).

Statistical Analysis

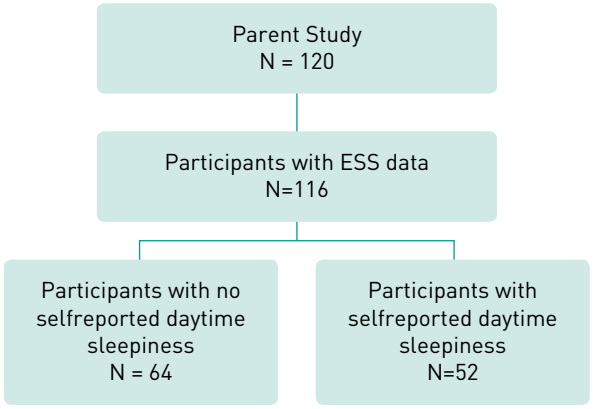
Appropriate summary statistics were used to describe the sample, with and without stratification according to daytime sleepiness. A series of analysis of variance and analysis of covariance models were fitted, with each of the gait and balance measures as the dependent variable, daytime sleepiness and CNS medication use as factors of interest, with and without interaction in separate models, and with and without covariates mentioned as additional independent variables. The covariates used for adjusted analysis include BMI, dummy variable for presence of any fallrelated comorbidity (including musculoskeletal conditions (arthritis, osteoporosis, fracture, joint replacement), general condition (depression, sleep problems, chronic pain syndrome), neurological condition (stroke), or visual condition (glaucoma, cataracts)), use of CNS medication, and total medication use. SAS version 9.3 (SAS Institute, Inc., Cary, NC) was used for all statistical analyses.

RESULTS

Of 120 enrolled participants, 116 had data available for the ESS (Figure 1). Table 1 provides the baseline characteristics of the entire study cohort and the cohort stratified according to daytime sleepiness. Briefly, the study sample was 72% female and 12% black and had a mean age of 78 ± 6 (range 64–92). Gait speed was 1.07 ± 0.26 m/s, and ESS score was 7.8 ± 4.3 (range = 0–18).

Forty-five percent of participants reported daytime sleepiness. Participants reporting daytime sleepiness had a significantly higher BMI (30.9 ± 5.0 vs 27.7 ± 4.8 kg/m^2, < .001) than those without and reported more comorbid illnesses (3.2 ± 1.5 vs 2.7 ± 1.3, P = .03). Despite that, the total number of medications used was comparable between groups (7.0 ± 4.0 vs 6.7 ± 3.9, P = .66), as was the proportion using CNS medications (21% v. 14%, P = .21). Thirty percent of participants without daytime sleepiness reported having fallen in the previous year, compared with 48% of those with daytime sleepiness (P = .06) (Table 1).

Figure 1.
Analytical design.



ESS= Epworth Sleepiness Scale

The interaction between CNS medication use and daytime sleepiness was not statistically significant with respect to any of the considered gait and balance measures (P = .26–.91). Participants with daytime sleepiness walked slower than those without (1.01 ± 0.25 vs 1.13 ± 0.24 m/s; P = .01), and the difference persisted after controlling for covariates (adjusted difference -0.09 ± 0.04; P = .03). Similarly, participants with daytime sleepiness had a wider step width than those without (0.06 ±0.03 vs 0.04 ± 0.03 m; P = .01), and the difference persisted after controlling for covariates (adjusted difference = 0.02 ± 0.01 m; P = .03). Participants reporting daytime sleepiness scored poorly on the ABC Scale, and the difference in their reported balance confidence remained significantly lower than that of those without daytime sleepiness even after controlling for covariates (adjusted difference -1.02 ± 0.38; P = .01). Step width variability, DST, narrow walk time, and right and left unilateral stance time were significantly different between those with and without daytime sleepiness but lost significance after adjusting for confounders (Table 2).

DISCUSSION

Forty-five percent of participating community-dwelling older adults reported daytime sleepiness. This cross-sectional secondary analysis found that gait speed and selfreported balance confidence are significantly related to daytime sleepiness even after controlling for BMI, any fallrelated comorbidity, use of CNS medication, and total medication use, whereas none of the assessed performancebased balance measures except step width had any significant association.

More than one-third of older individuals fall every year (1). In this study, 48% of participants reporting daytime sleepiness sustained a fall in the previous year, compared with 30% of those without daytime sleepiness. The effect of BMI on falls in this dataset was explored previously and was not found to have an influence (43),

Table 1.

Baseline Participant Characteristics Stratified According to Self-Reported Daytime Sleepiness.

Characteristic	Total Cohort, N = 116	No Daytime Sleepiness, n = 64	Daytime Sleepiness, n = 52	P-Value
Demographics				
Age, mean ± DS	78,1 ± 6	77,8 ± 6,2	78,3 ± 5,8	,86
Caucasian, n (%)	105 (88)	58 (90)	45 (87)	,51
Female, n (%)	86 (72)	44 (68)	39 (75)	,30
Health related				
Fallen in previous year, n (%)	47 (39)	19 (30)	25 (48)	,06
Number of chronic conditions, mean ± DS	2,9 ±1,4	2,7± 1,3	3,2 ± 1,5	,03
Number of medications used, mean ± DS	6,9 ± 4,0	6,7 ± 3,9	7,0 ± 4,0	,66
Use of central nervous system medications, n (%)	20 (17)	9 (14)	11 (21)	,21
Body mass index, kg/m^2, mean ± SD	29,1 ± 5,2	27,7 ± 4,8	30,9 ± 5,0	<,001
Use of assistive device, n (%)	9 (8)	5 (8)	4 (8)	,90
Omorbidities, n (%)[a]				
Cardiovascular disease	19 (16)	11 (17)	8 (15)	,80
Musculoskeletal disease	103 (88)	56 (88)	47 (90)	,55
General conditions	42 (36)	22 (34)	24 (47)	,06
Lung disease	28 (24)	11 (17)	14 (27)	,11
Cancer	35 (30)	17 (27)	18 (34)	,33
Diabetes mellitus	17 (15)	9 (14)	8 (15)	,83
Visual conditions	82 (71)	43 (67)	39 (75)	,33

[a] Cardiovascular pathologies (angina, congestive heart failure, heart attack), musculoskeletal pathologies (arthritis, osteoporosis, fractures, prosthesis), general pathologies (depression, sleep problems, chronic pain syndrome), lung problems, cancer, diabetes mellitus, ocular problems (glaucoma, cataracts).

SD = standard deviation.

but the effect of fall-related comorbidities or medication effect on falls cannot be excluded. The current findings corroborate those of other larger studies that have shown that reporting daytime sleepiness have a significantly higher percentage of falls (44,45). The ESS cutoff used in the current analysis was more conservative than in those larger cohort studies (≥10) (44,45), yet 48% of participants with daytime sleepiness reported falling in the previous year, which may indicate the importance of subjective sleep complaints in this population.

The analysis showed that, even after controlling for various covariates, daytime sleepiness is related to slower gait speed. One possible reason might be that the accompanying sleepiness-related decrease in attention leads to slower or inappropriate sensory integration. Maintaining mobility and balance requires the continuous integration of visual, vestibular, and proprioceptive inputs by the CNS (46,47). This sensory integration requires a high level of attention, particularly with aging, when sensory inputs may not be as effective. Subjective daytime sleepiness adversely affects attention (48) and may thus affect gait speed.

The association between gait speed and survival and disability is known (49-53). Pooled analysis of nine cohorts from multiple diverse populations of community-dwelling older adults showed that accuracy of gait speed, age, and sex in assessing expected survival is comparable with accuracy of more-complex models involving multiple healthrelated factors or functional status (54). A similar pooled analysis of seven cohorts established the association between gait speed and disability (55). Therefore, the difference in gait speed demonstrated in the current cross-sectional analysis between those with and without daytime sleepiness

Table 2.

Comparison of Performance-Based and Self-Reported Balance Measures in Participants with and without Daytime Sleepiness

Variables	Total Cohort N = 120	Mean ± Standard Difference		Difference (Standard Error) *P*-Value	
		No Daytime Sleepiness n = 64	Daytime Sleepines, n = 52	Unadjusted	Adjusted
Gait speed	1,07± 0,26	1,13 ± 0,24	1,01 ± 0,25	-0,12 (0,04), ,01	-0,09 (0,04), ,03
m/s Step width					
Meters	0,05 ± 0,04	0,04 ± 0,03	0,06 ± 0,03	0,02 (0,007), ,01	0,02 (0,01), ,03
Variability	0,04 ± 0,02	0,04 ± 0,02	0,03 ± 0,01	-0,007 (0,003), ,03	-0,004 (0,003), ,20
Double support time					
Seconds	0,12 ± 0,05	0,11 ± 0,04	0,13 ± 0,04	0,02 (0,01), ,03	0,003 (0,01), ,71
Variability	0,03 ± 0,01	0,03 ± 0,02	0,03 ± 0,01	0,001 (0,002), ,74	<,001 (0,002), ,92
Narrow walk time, seconds	5,18 ± 1,8	4,89 ± 1,6	5,60 ± 2,0	0,72 (0,36), ,04	0,69 (0,37), ,06
Obstacle walk time, seconds	8,77 ± 4.78	8,34 ± 5,4	9,37 ± 3,96	1,04 (0,93), ,07	0,34 (1,0), ,73
Tandem stance time, seconds	21,41 ± 11,28	22,62 ± 10,32	19,79 ± 12,53	-2,85 (2,45), ,29	-3,03 (2,6), ,24
Unilateral stance time, seconds					
Right	8,69 ± 9,50	9,98 ± 9,62	6,50 ± 8,66	-3,6 (1,9), ,05	-2,38 (2,06), ,25
Left	8,86 ± 8,7	9,46 ± 9,10	7,44 ± 7,48	-1,89 (1,4), ,06	-0,84 (1,94), ,66
Activities-specific Balance Confidence Scale score	7,53 ± 2,07	8,22 ± 1,8	6,82 ± 2,14	-1,28 (0,37), <,001	-1,02 (0,38), ,01

[a] Adjusted for body mass index, fall-related comorbidities (musculoskeletal conditions (arthritis, osteoporosis, fracture, joint replacement), general conditions (depression, sleep problems, chronic pain syndrome), neurological conditions (stroke), visual conditions (glaucoma, cataracts), use of central nervous system medications (opioid receptor agonist analgesics, antipsychotics, antidepressants (selective serotonin reuptake inhibitors, tricyclic), benzodiazepine receptor agonist), and total medication use in analysis of variance and analysis of covariance model.

is of extreme importance. Although age and sex are nonmodifiable risk factors, sleep quality is modifiable with nonpharmacological approaches, with proven efficacy (56). This provides an opportunity for the yet-unexplored effect of sleep assessment and treatment on mobility in addition to the standard modalities of physical therapy and gait training.

This analysis also revealed an association between daytime sleepiness and poor balance confidence. It has been argued that poor balance confidence in elderly adults reflects accurate self-knowledge of impaired balance as balance deteriorates with age because of changes in sensorimotor and cognitive systems (e.g., loss of sensory acuity, muscle mass, and executive functioning) (57). Poor balance confidence in older people is associated with greater postural sway (58), and studies have demonstrated interconnections between limbic and motor control circuitry, which provides evidence that emotion can influence cortical activity for balance control (59,60). The current study demonstrates that daytime sleepiness is significantly associated with poor balance confidence, so subjective sleep and its daytime symptoms should be assessed when assessing balance and implementing interventions for improving balance in older adults.

Several other spatiotemporal performance based balance measures were also assessed to explore the association between balance and daytime sleepiness symptoms. Many of these measures were significantly different between those with and without daytime sleepiness in unadjusted analysis. All but one lost significance when data were adjusted for fall-related covariates. One possible explanation could be that confounders, namely higher BMI, fall-related comorbidities, and use of CNS medication, mediate the association between daytime sleepiness and performance-based balance measures. However, the primary study was neither designed nor powered to detect these associations. Despite that limitation, difference in step width was significant between groups, and narrow walk times were also different between groups, although the difference did not reach statistical significance. Larger prospective studies are warranted to reach conclusive results.

This study has several strengths. Although large cohort studies have explored the effect of insomnia on falls [16,44], this is the first study, to the authors' knowledge, to examine the effect of subjective daytime sleepiness on gait speed and performance-based balance measures and subjective balance confidence in community-dwelling older adults. The ESS cutoff score used to determine daytime sleepiness was conservative to include those with subtle daytime symptoms, yet a significant association with gait and balance was seen. Participants were community-dwelling older adults with comorbidity profiles and medication use similar to those seen in a geriatric clinic population, which further increases the study's generalizability.

This study also has some limitations. First, there is the potential that unmeasured confounders could have affected the association detected between daytime sleepiness and gait and balance, although most common potential confounders were controlled for within the constraints of the data collected in the parent study. Second, the primary aim of the parent study was to develop and refine measures of balance and mobility in community-dwelling older adults, so the study was neither designed nor powered to detect significant differences in gait speed and balance based on daytime sleepiness symptoms. Despite this limitation, significant differences were observed. Third, participants were divided into subgroups in this analysis based on ESS score. No formal nighttime sleep assessments were completed because this was not the focus of the primary study, although studies have shown that subjective sleep complaints do not correlate well with objective sleep data [61]. Daytime sleepiness symptoms are usually reflective of a poor night's sleep, but contribution of other behavioral disturbances (e.g., depression) cannot be reliably be excluded. Nevertheless, antidepressant use and selfreported depression and pain were controlled for. Fourth, CNS and sensory impairments have been shown to effect gait variability and balance [62],), and CNS medications are known to affect balance and falls in older adults [12], but it was not the focus of the present analysis, nor did we find significant associations independent of covariates. Nevertheless, the analysis was adjusted for all medication use and use of CNS medications, and the balance measures remained significantly different according to the presence of daytime sleepiness. Finally, no interactive effect of CNS medication use and daytime sleepiness was found with respect to any of the gait and balance measures. Although an interaction was not found between CNS medications and daytime sleepiness, it is likely that study was underpowered to do so.

Further studies are needed to elucidate the complex pathophysiology of daytime sleepiness and mobility and balance in older adults.

CONCLUSION

Daytime sleepiness is associated with slower gait speed and poor balance confidence in community-dwelling older adults. Studies are needed to formally assess the effect of potential contributors to daytime sleepiness, such as insomnia or sleep apnea, and the effect of its treatment on gait and mobility in this population and to definitively examine complexities of the association between CNS medication use and balance and mobility.

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Author Contributions: Tyagi, Perera: study concept and design, data analysis and interpretation of data, preparation of manuscript. Tyagi, Brach: study design, data interpretation, preparation of manuscript.

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PHYSIOTHERAPY UPDATES

ABSTRACT

EFFECTS OF AN ISCHIOSURAL ELASTICITY PROGRAMME ON THE ACTIVATION AND FATIGUE OF POSTERIOR STABILIZING MUSCLES IN THE LUMBOPELVIC REGION

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The aim of this study is to assess if an ischiosural elasticity programme can modify the activation and fatigue process of paravertebral, gluteous, and ischiosural muscles when undergoing continuous endurance like with the Biering-Sorensen test.

A prospective randomised clinical trial was designed for junior handball male players in a sports technical programme. The 12 subjects in the sample are members of the Futbol Club Barcelona Handball team, the only team with a sports technical programme in Spain. The participants in the study were randomly distributed into a control group and a study group, with 6 subjects in each group. For a whole season, the control group did their usual training plan and the study group complemented that with an ischiosural elasticity programme specifically designed to improve muscle elasticity. Assessment of muscle activation and fatigue was done with a surface electromyography of the paravertebral, gluteous, and ischiosural muscles. More specifically, muscle activation was assessed with normalised RMS mean amplitude and fatigue with the normalised descent in relation to intersection of mean frequency, both measures were obtained with the Biering-Sorensen test. Statistical data analysis was performed using SPSS and a significance level of 5%. Descriptive statistics were calculated for each individual variable, then the Mann-Whitney U test was used to check group homogeneity and the baseline and final increase of each outcome variable was compared. Finally, effect size was calculated using δ-Cohen. There was a significantly high (>0.80) or moderate (>0.60) effect size in all the electromyographic variables of paravertebral and gluteous activation and in all the variables of muscle fatigue. In conclusion, there was a reduction in the activation of paravertebral and gluteous muscles and in muscle fatigue in the group receiving an ischiosural elasticity programme.

KEY WORDS: Ischiosural elasticity programme, muscle activation, muscular, paravertebral, ischiosural fatigue and surface electromyography.

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PHYSIOTHERAPY UPDATES

ABSTRACT

INTERACTION OF STABILIZING MUSCLES IN THE PATHOPHYSIOLOGY OF STRESS URINARY INCONTINENCE

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During rapid voluntary movements of the upper limb there is an anticipatory postural adjustment (APA) involving the trunk stabilizing muscles, the transversus abdominis muscle (TrA) and the pelvic floor muscles (PFMs) (1,2). In women with stress urinary incontinence (SUI), there is no APA: the contraction of PFMs is delayed beyond the initial activation of the deltoid muscle (2). The same occurs with the TrA in patients with low back pain (LBP) (3-5). Could this similar change in the postural response of patients with LBP or SUI be due to the same mechanism? In the case of patients with LBP, the APA deficit in the TrA during rapid arm movement could be related to a widening and a displacement in the motor cortex area that evokes a motor response of this muscle (6). The magnitude of this cortical reorganization is related to the delayed activation of the TrA.

In women with SUI, a 12-week PFM training programme with *biofeedback*, affects the brain activation connected with the voluntary contraction of these muscles. There is a global reduction in the number of cortical regions that are activated, a more focalised activation of sensory and primary motor cortical areas regarding the lower urogenital tract, and a reduction in the activation of the right insula and the anterior cingulate cortex (7). According to the authors of the study, these changes would be related to a more efficient motor control and a better emotional management of sensations.

The deterioration of postural control in patients with LBP and the re-education of PFMs in women with SUI seem to be associated with aspects of cerebral plasticity, in the first case with diffusion of cortical activation and, in the second case, with its re-focalization. The change in postural strategies observed in these two clinical situations could be controlled by the cortical area. It could be due to a cognitive adaptation caused by fear: fear of feeling pain in the case of patients with LBP and fear of an involuntary loss of urine in the case of women with SUI. Patients would try to relieve the symptoms and make their situation more emotionally manageable using a different variety of stabilizing motor responses. There is evidence along this line. A study shows that patients with SUI voluntarily contract the PFMs before and during the application of some load at the level of the upper limbs, quite likely with the aim of preventing urine losses (8). In patients with LBP, the delayed activation of postural muscles seems to be related to a change in postural strategies in order to increase vertebral stability and not to a reaction to pain (9-11). In spite of this, this modification of the postural response in patients with LBP would be harmful in the long term: losing selective motor control and intensified compression at the level of vertebral structures would be risk factors themselves that would lead to pain and lesions and the patient would be caught in a vicious circle (12).

There is an improvement in the APA involving the TrA in patients with LBP after an isolated activation of this muscle (13,14). Just as it happens to women with SUI after PFM activation, this improvement of postural response of the TrA may be related to a re-focalization of the motor cortical representation area of the muscle, which is also involved in voluntary orders and messages for the reticular formation that controls APA (15).

When treating SUI problems, we must keep in mind the long-term benefits for the lumbopelvic girdle stabilizing mechanisms, first by strengthening the trunk stabilizing muscles, PFMs included, and then by their involvement in APA-related exercises. During re-education, we must take into account not only the peripheral effects (increase of muscle strength) but also the central effects (modifications of motor control organization) of the techniques employed. It is essential to understand better the adaptation mechanisms that the patient used

KEY WORDS: Urinary incontinence. Stabilizing muscle. Pelvic floor.

to relieve the symptoms and their possible impact on the organization of motor control circuits. Only by reinforcing an adequate postural control can we guarantee, in the long run, lumbopelvic stability and the integrity of the structures of the minor pelvis..

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PHYSIOTHERAPY UPDATES

ABSTRACT

THE VALIDITY OF O'SULLIVAN'S CLASSIFICATION SYSTEM (CS) FOR A SUB-GROUP FOR A SUB-GROUP OF NS-CLBP WITH MOTOR CONTROL IMPAIRMENT (MCI): OVERVIEW OF A SERIES OF STUDIES AND REVIEWOF THE LITERATURE

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ABSTRACT

Chronic Low Back Pain (LBP) remains a common, recalcitrant and costly problem for the individual sufferer and for society. Effective treatments that reduce the social and economic burden have yet to be established for the majority of chronic LBP cases. Lack of evidence for specific interventions has been blamed on the heterogeneity of the chronic LBP population as well as a lack of a patient centred biopsycho-social approach. This issue of heterogeneity has resulted in classification being considered the highest research priority in the area of chronic LBP. The potential for a 'wash-out effect' caused by the heterogeneity of the chronic LBP populations sampled for randomized controlled clinical trials (RCTs), has driven the need for classifying patients with nonspecific chronic LBP. A summary of a series of studies is outlined in this review paper. They represent a comprehensive investigation into the validity of O'Sullivan's proposed mechanism-based classification system (CS) for a sub-group of localized mechanically provoked nonspecific chronic LBP with motor control impairment (MCI). Further, the findings of these studies are discussed in relation to the relevant literatura and the clinical implications arising are presented. Finally, the limitations of this research are outlined and recommendations for future research are made.

KEYWORDS: Chronic low back pain. Motor control. Classification.

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PHYSIOTHERAPY UPDATES

ABSTRACT

STAKEHOLDER INVOLVEMENT IN THE DESIGN OF A PATIENT-CENTERED COMPARATIVE EFFECTIVENESS TRIAL OF THE "ON THE MOVE" GROUP EXERCISE PROGRAM INCOMMUNITY-DWELLING OLDER ADULTS

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ABSTRACT

Background: Group exercise programs for older adults often exclude the timing and coordination of movement. Stakeholder involvement in the research process is strongly encouraged and improves the relevance and adoption of findings. We describe stakeholder involvement in the design of a clinical trial of a group-based exercise program that incorporates timing and coordination of movement into the exercises.

Methods: The study was a cluster randomized, single-blind intervention trial to compare the effects on function, disability and mobility of a standard group exercise program and the "On the Move" group exercise program in older adults residing in independent living facilities and senior apartment buildings, and attending community centers. Exercise classes were twice weekly for 12 weeks delivered by study exercise leaders and facility activity staff personnel.

Outcomes: The primary outcomes function, disability and mobility were assessed at baseline and post-intervention. Function and disability were assessed using the Late Life Function and Disability Instrument, and mobility using the Six-Minute Walk Test and gait speed.

Stakeholders: Patient and provider stakeholders had significant input into the study aims, design, sample, intervention, outcomes and operational considerations.

Summary: A community-based exercise program to improve walking can be developed to address both investigator identified missing components in current exercise to improve walking and stakeholder defined needs and interest for the activity program. Involvement of stakeholders substantially improves the relevance of research questions, increases the transparency of research activities and may accelerate the adoption of research into practice.

KEYWORDS: Stakeholders. Exercise. Community-based. Aging. Disability.

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PHYSIOTHERAPY UPDATES

ABSTRACT

NEURODYNAMIC TREATMENT IMPROVES LEG PAIN, BACK PAIN, FUNCTION AND GLOBAL PERCEIVED EFFECT AT 4 WEEKS IN PATIENTS WITH CHRONIC NERVE-RELATED LEG PAIN

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We are concerned about the reporting of the trial 'Neurodynamic treatment did not improve pain and disability at two weeks in patients with chronic nerve-related leg pain (1). There is a tendency to simplify the findings of clinical trials into binary conclusions (either positive or negative) based on the analysis of the primary outcomes (2). Often, a more nuanced interpretation is required by thoroughly examining the totality of the evidence, not just the primary outcomes (2). In our opinion, this nuance is lacking in the study by Ferreira *et al* (1). If we follow their conclusions, we risk discarding valuable interventions, as is evident from their own (1) and other studies (3).

In line with their protocol paper, the authors prioritised immediate treatment effects (ie, immediately after a 2-week intervention) over intermediate follow-up (4 weeks after baseline, or 2 weeks after the last treatment session). This is unconventional. Intermediate and long-term effects should have priority over immediate effects (4). The choice of primary outcomes was, in our view, suboptimal and unfortunate, and greatly impacted the study's conclusions. A different and probably more logical selection of primary outcomes (eg, leg or back pain, function or global perceived effect at 4 weeks) would have led to the opposite conclusion. This favourable conclusion would have been consistent with the findings from a clinical trial on neurodynamics for nerverelated neck-arm pain (3) on which the design of this study was modelled. Although our somewhat provocative title might suggest otherwise, we obviously do not advocate selective reporting of planned secondary outcomes. More nuance is and was required.

The study aimed to compare, at two timepoints, the effect of neurodynamic treatment versus wait-and-see on leg pain, disability, back pain, function, global perceived effect, and the proportion of participants whose leg pain centralised. The title, conclusions and choice of primary outcomes should better reflect all aims of the study. Leg pain and disability were primary outcomes immediately after treatment, but were not considered important enough to be primary outcomes at 4 weeks. We fail to see the rationale behind this. In a trial where rapid change would be unexpected, 4-week outcomes seem more important because: only four treatment sessions were prescribed in patients with a chronic condition, and neuropathic pain and nerve root compromise, which are likely indicators of a less favorable prognosis for neurodynamic (5,6) and other interventions, were prevalent (26/60 and 33/60 patients, respectively). There was indeed a significantly larger improvement for leg pain, back pain, function and global perceived effect in favour of neurodynamic treatment at 4 weeks (as well as function and global perceived effect immediately after treatment). We believe that these are valuable outcomes.

Another concern is the choice of Oswestry Disability Index as a primary outcome over the Patient Specific Functional Scale, which was secondary. Maughan and Lewis (7) revealed that the Patient- Specific Functional Scale was more responsive than the Oswestry Disability Index and Roland-Morris Disability Index in people with back pain. In the study by Ferreira *et al.* (1), the Patient-Specific Functional Scale results favoured neurodynamic treatment at both timepoints.

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TRIAL OF NEURODYNAMIC TREATMENT WAS REPORTED ACCURATELY AND APPROPRIATELY

We would like to thank the editor-in-chief of Journal of Physiotherapy for the opportunity to address Hall and colleagues' concerns about our randomised trial of neurodynamic treatment for chronic nerve-related leg pain.1 Hall and colleagues stated that: the reporting of our results, emphasising the findings of the primary outcomes, has led to a binary and oversimplified conclusion that neurodynamic treatment 'does not work' despite the findings of some secondary outcomes; the choice of leg pain and disability as primary outcomes only at 2 weeks, but not at 4 weeks also, was illogical; the selection of the intermediate follow-up (4 weeks) as the primary outcome would have been more adequate than the short-term follow-up that we chose; and we should have considered using the Patient-Specific Functional Scale (PSFS) rather than the Oswestry Disability Index (ODI).

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PHYSIOTHERAPY UPDATES

ABSTRACT

EFFECTS OF STANDING PROGRAMMES IN ABDUCTION ON THE PREVENTION OF HIP DYSPLASIA IN CHILDREN WITH SPASTIC DIPLEGIC CEREBRAL PALSY

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ABSTRACT

Introduction. Hip dysplasia ranks second as the most important musculoskeletal deformity in children with cerebral palsy (CP) and is due to spasticity and contraction of the adductor and flexor hip muscles. The delay in standing, lack of muscular balance of the muscles around the hip, and reduction of range of motion of adductor muscles with development characterise children with spastic CP. The aim of this study is to examine the effects of a standing programme in abduction in early childhood for the prevention of hip dysplasia and maintenance of flexibility of adductor muscles in children with spastic diplegia.

Material and methods. Thirteen children with spastic diplegic cerebral palsy, classified as level III according to the Gross Motor Function Classification System (GMFCS), who were treated at CDIAP (Center for Child Development and Early Intervention), received a standing programme in abduction from the age of 12-14 months to 5 years. At 12-14 months, the children had a frame or stander with hip abduction in addition to be used at home for 45 minutes a day. The parents were informed of the aim of this programme and received advice and follow-up sessions tailored to the needs of each family. Range of motion (ROM) of hip abduction at baseline and at 5 years was assessed. At the age of 5 years, migration percentage (MP) and hip's acetabular index (AI) were measured through radiological measures since these are the most commonly used measures to determine acetabular state. Then the radiological results of both MP and AI of this study group (SG) were compared to those of a control group (CG), made up of children with the same diagnosis and level of affection who did not participate in a standing programme. The MP of the right and left hip were calculated in both groups using an X-ray taken at the age of 5 years. The mean maximum and minimum MPs, which indicate the best and worst values in acetabular development in both groups, were calculated as well as the MP difference between these values to compare if symmetry in acetabular development was any different between the groups.

Results. In all the children in the SG, MP was within stable limits (13-23%) at theage of 5 years, in comparison to those children who did not take part in the programme (12-47%) (p <0.000). There was a significant difference for the left hip (p-value = 0.019) between the SG and the CG. For maximum and minimum MP values (MP-Max and MP-Min), there was only a significant difference for the maximum values (p-value = 0.762). The MP-Max and AI-max values were more symmetrical and within stable values for the hips of the cohort of children who had the standing programme in abduction.

Conclusions. A standing programme in hip abduction used daily in the first years of life prevents hip dysplasia, helps asymmetrical hip development and within stable values, and maintains the range of motion of hip adductor muscles in children with spastic diplegic CP at level III according to GMFCS, in comparison to the SG, who did not have the standing programme.

KEY WORDS: Cerebral palsy. Spastic diplegia. Prevention of hip dysplasia. Spasticity. Range of motion. Standing programme.

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PHYSIOTHERAPY UPDATES

ABSTRACT

OPEN KINETIC CHAIN VERSUS CLOSED KINETIC CHAIN THERAPEUTIC EXERCISES AFTER ANTERIOR CRUCIATE LIGAMENT LIGAMENTOPLASTY: AN EVIDENCE-BASED APPROACH

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AIMS – INTRODUCTION

One of the treatment approaches after ACL (anterior cruciate ligament) ligamentoplasty focuses on the recovery of the muscle qualities necessary to carry out a professional activity. This muscle work has to respect the tissular and ligamentous cicatrisation process. This is done with a combination of CKC (closed kinetic chain) or OKC (open kinetic chain) proposals, which will be implemented within the clinical guidelines or pathways taking into account the different recovery stages of the tendoligamentous graft and respecting the ligamentization process.

The characteristics of using CKC over OKC are, among others: the control over the translation and rotation of the tibia on the femur allows the hamstring muscles and intermuscular coordination to work simultaneously thus there is an automatic co-contraction and a simultaneous and automatic recruitment of agonist and antagonist muscles.

MATERIAL AND METHODS

Bibliographical review of some databases (DB) from 1985 to 2015 using the terms "open and closed kinetic chain and anterior cruciate ligament reconstruction". The DB used are Scopus, Web of Science, Cochrane Plus, Pubmed, and PEDro.

RESULTS AND CONCLUSIONS

Regarding bone-tendon-bone grafts for ligamentoplasty, some authors claim that CKC exercises cause less laxity and pain in the anterior aspect of the knee. Other authors start OKC isokinetic exercises with articular ranges between 90° and 40° in the 6th week showing no differences in knee laxity but with improvement in terms of quadriceps recovery and returning to sport. In OKC, flexion over 60° and proximal resistance are insignificant regarding tensions on ACL plasty.

We can conclude that more research is therefore needed regarding the surgical procedure of hamstring tendon graft and CKC work should be prioritised during the first 6 weeks.

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PHYSIOTHERAPY UPDATES

BIBLIOGRAPHICAL CITATIONS AND BIBLIOGRAPHICAL REFERENCE MANAGERS

Dr. Josep Sánchez Aldeguer, MD [1,7,8], Dr. Jordi Esquirol Caussa, MD [2,7,9], Dr. Ishar Dalmau i Santamaria, MD [3,7,10], Ms Vanessa Bayo Tallón [4,5,6,7], Ms. Maider Sánchez Padilla[4,5,7]

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We would like to thank the Chartered Society of Physiotherapy of Catalonia for their collaboration and support in this project.

ABSTRACT

A bibliography is made up of bibliographical citations and references, which help us to specify the scientific sources on which the ideas expressed in the text are based and to allocate responsibility and authorship to avoid plagiarism. Bibliographical references must be given in an internationally accepted format, following the specific instructions for authors set by every publication. Bibliographical managers are computer resources and tools that allow us to manage documents and bibliographical references in an automatic and standardised way, to keep bibliographical citations in an orderly and coherent fashion, and to elaborate a bibliographical index of the written text in a correct and appropriate way. Thanks to these tools, we can correctly disseminate scientific knowledge conforming to the norms of intellectual property and maintaining the necessary coherence and precision of references in articles and other scientific publications.

KEY WORDS: Bibliography as issue. Reference works. Reference standards. Bibliographical databases.

Bibliographical citations and references are important in scientific texts, particularly in education and research. A *bibliography* is part of a text (it is not a single document) and it presents all the sources consulted in your work, article, research, etc., that you have used to prepare it. Normally a bibliography consists of a list at the end of the text or after a part of it with *bibliographical references* in a specific order. Its aim is to work as an indicator of the sources consulted to do a bibliographical review[1] or a scientific study,[2] and allocate responsibility and authorship by recognising other people's ideas and so avoid plagiarism. You must cite anything that is not your own and that is not in the public domain. Failing to credit a source or presenting ideas or fragments as if they were yours when they are not and, therefore, infringing the original author's intellectual property rights is *plagiarism*.

A **bibliography** consists of a series of bibliographical citations for each of the sources you have consulted and used for your work. A citation is a reference to a document from which an idea or literal text comes from. Ech bibliographical reference is made up of a series of items that allow us to describe, identify, and find any document. This reference tends to include the name of the author(s), the title of the work, the date when it was published, and where it was published.

All the data in the bibliography (each and every reference) must be correct, complete, and be presented in a specific format, following a given structure and system to help other researchers find the source. The aim of these pre-established is to offer the scientific community some homogeneous norms and guidelines to provide coherence to bibliographical references.

There are different styles of referencing. In the field of health sciences, the most commonly used style is **Vancouver**, used by the National Library of Medicine (NLM and its MedLine and PubMed resources and others) developed by the International Committee of Medical Journal Editors in 1978 (ICMJE. Quite likely this format will be substituted by a new one in the future but it is currently the most frequently used by health science journals). Regarding books, the style defined by the American Psychological Association (**APA**). is the most common. Although these criteria and recommendations are part of specialised style manuals, there are many summaries and compiled examples that facilitate the correct use of each style. We can choose a given bibliographical citation style depending on the specific criteria, norms or recommendations for authors of each publication. It is important to maintain coherence and we will use the same bibliographical style all through the text.

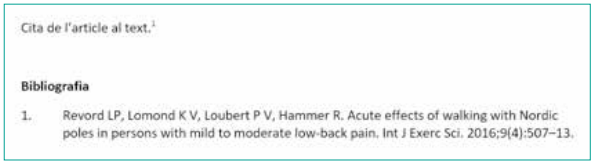
References can be ordered in an alphabetical order (taking the first letter of the author's surname or the first letter in the title if the name of the author is not provided), a thematic order, or using a numeric system (as they appear in the text). There are other systems that combine these three but they are less frequent. All the works that have been cited directly or indirectly in the text must have their corresponding complete and exact bibliographical reference at the end.

References must present, in an orderly and systematised fashion, the necessary information to find the referenced work, whether it is an article published in a journal, a book, a presentation in a conference, a web page, etc. Each citation format has slightly different characteristics.

For example, the bibliographical reference of an article published in a scientific journal in the Vancouver style must have a reference number in the text (in order of appearance). The reference must firstly start with the surname of the first author followed by the initial of his/her name, a comma, repeating the same up to a maximum of six authors, and finally a full stop (if there are more than six authors, we add "et al." before the full stop). Following that, there is the title of the article and a full stop at the end. Then, the official acronym of the name of the journal where the article was published and a full stop. Then, the year it was published, a semicolon, number of journal volume and number issue in brackets, colon and the initial and final pages separated by a hyphen indicating the pages in the journal where the article can be found (see example in Illustration 1). In the APA style, the layout is slightly different: in the text, instead of including a number in order of appearance, we write the surname of the first author and the year of publication in brackets and, in the bibliography, the referenced works are presented in an alphabetical order taking the first author's surname (if there is no first author, then we will use the first letter of the title) followed by the year it was published in brackets and a full stop. Then, the title of the article, a full stop, the acronym of the journal in italics, a comma, volume and number in brackets, comma, and the initial and final pa-

Illustration 1.

Article with a number reference in order of appearance in Vancouver format.


Cita de l'article al text.[1]

Bibliografia

1. Revord LP, Lomond K V, Loubert P V, Hammer R. Acute effects of walking with Nordic poles in persons with mild to moderate low-back pain. Int J Exerc Sci. 2016;9(4):507–13.

[1] For more information, see the article in this series entitled "A bibliographical review: the basis of our research" (see Revista Científica XIII).
[2] We will soon publish an article in this series about scientific studies.
[3] For more information on search engines, see the article in this series entitled "Search engines, key words (MeSH, DeCS), profiles and bibliographical search equations in physiotherapy" (see Revista Científica XIII).

Illustration 2.

same citation as in Illustration 1 in APA format.

Cita de l'article al text.(Revord, Lomond, Loubert, & Hammer, 2016)

Bibliografia

Revord, L. P., Lomond, K. V, Loubert, P. V, & Hammer, R. (2016). Acute effects of walking with Nordic poles in persons with mild to moderate low-back pain. *Int J Exerc Sci*, *9*(4), 507–513.

ges separated by a hyphen (see Illustration 2, same reference as in Illustration 1 but in APA style). When using other formats, other typographical styles like italics or bold type and other possibilities are required but the information provided is basically the same.

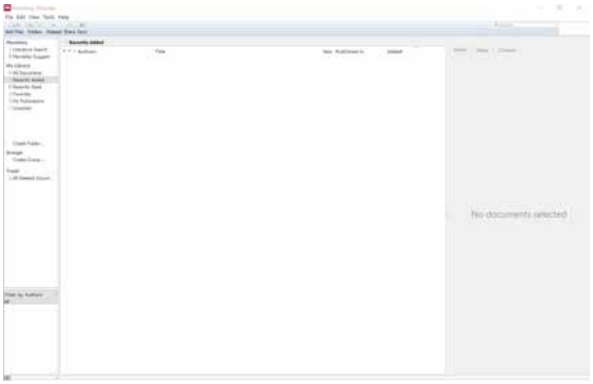
Organising a bibliography and documented resources when doing research may be a complex and tiring task. Before having our current modern resources, this used to be done with cards, which were manually ordered. This was often quite tedious. *Bibliographical management tools* help us to compile and update a bibliography during and after the process of writing an article or doing some work in an efficient manner.

Bibliographical management tools are computer resources that help us to create a personal database for our bibliographical references, to incorporate and manage any type of resource, to find documents (as if it was a database search engine), to gather and organise the items in a bibliography (often automatically), to organise the documents into files, to share a bibliography, to make notes on the works in the database, to organise and edit references, to insert citations in the main word-processing computer programmes in appropriate formats, and to elaborate a bibliography at the end of our work. Some of them even have social network capabilities and, applying complex analytical algorithms, they can suggest new sources related to the user's database (through links to other related articles), synchronise and share information among different computers or users, analyse the activity of co-authors or analyse the number of visits or consultations that your own articles have received, and inform the user how many researchers have searched for or cited them.

These **management** tools, through intuitive and user-friendly environments, simply require that you open a free personal account to start using them and so start your own database and enjoy all their resources. In some cases, it is advisable to download and install some application on your computer to take advantage of all its capacities (see Illustration 3). The documents on the hard disk can be easily incorporated to the database (individually or in groups). Most catalogues and bibliographical databases are provided with tools that can automatically import documents to the user's account or download files that can do this. Most management tools have a copy of the whole database stored in the cloud to secure your data and to allow you to get access to it from any computer with an internet connection.

Illustration 3.

Snapshot of Mendeley® Desktop, to be installed on the user's computer in order to enjoy all its capacities. .



While writing a scientific text, the bibliographical management tool will help you to include any citation or reference, automatically ordering them and modifying their format if necessary. The final list of bibliographical citations and references will be automatically incorporated to the document when the user likes.

In health sciences and in other scientific areas, the most commonly used management tool is Mendeley® but there are other tools with similar characteristics like EndNote®, Zotero®, CiteULike®, RefWorks®, etc. Many of them can synchronise your personal database on different computers and with an internet access and they are partially or completely free. Sometimes the user may need to change management tools, when this occurs you can find specific programmes that allow you to transfer your database to a new tool. Many universities in our field of knowledgement provide access to Mendeley®; the Spanish Foundation for Science and Technology provides access to EndNote® to the whole university community through the Institute for Scientific Information. Web of Science, Zotero® and CiteULike® are some other free management tools.

By using database management tools and elaborating correct bibliographical references, clinicians, researchers and teachers can produce high-quality scientific texts, which can help them disseminate their knowledge and conform to the norms of intellectual property.

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PHYSIOTHERAPY UPDATES

LEARN HOW TO DO RESEARCH

CRITICAL APPRAISAL OF SCIENTIFIC TEXTS

Ms Vanessa Bayo Tallón [1,2,3,7], Ms Maider Sánchez Padilla [1,2,7], Dr Josep Sánchez Aldeguer MD, PhD [4,7,8], Dr Jordi Esquirol Caussa, MD, PhD [5,7,9], Dr Ishar Dalmau i Santamaria, MD, PhD [5,7,10]

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We would like to thank the Chartered Society of Physiotherapy of Catalonia for their collaboration and support in this project.

ABSTRACT

Any claim made in a scientific text must be analysed in terms of its reliability and opportunity before it can be applied to clinical practice or research since it may not always have the supposed quality or it may not be applied to specific patients in clinical practice or used in other studies. The large body of evidence published in the scientific literature (clinical trials, reviews, clinical guidelines, etc.) make the reliability and applicability of each and every scientific study little homogeneous. With the use of a critical thinking process, we can safely and quickly identify those articles that are the most reliable and adequate for each individual case, either for clinical practice or for the design and undertaking of scientific studies or evidence syntheses.

Critical appraisal provides us with the necessary tools, mainly in the form of different closed questionnaires depending on the publication or type of study we would like to analyse. The clinical appraisal process done through formal and specific pre-established questionnaires allows researchers and clinicians to choose the most reliable and suitable articles or publications for each specific case, allowing evidence-based decision-making, the best approach and design of clinical trials, and the development of evidence syntheses in a rapid and reliable way.

KEY WORDS: Publication. Critical thinking. Critical appraisal. Decision-making. ISO 9000. Study.

"Thus the duty of the man who investigates the writings of scientists, if learning the truth is his goal, is to make himself an enemy of all that he reads, and, applying his mind to the core and margins of its content, attack it from every side." This was written more than a thousand years ago by the famous scientist Ibn al-Haytham (c. 965 – c. 1040, also known as Alhazen) but his words are still valid nowadays. They describe the need not to automatically believe anything published or that experts may claim without reflection or discussion, on the contrary, we must sceptically and critically analyse anything that is said and its justifications. This is true for any type of science in general but it is even more important when our priority is the patient's health and the necessary respect for our patients in a decision-sharing process (patient-centred care), in a highly qualified environment and with a wide variety of diagnostic tools and therapeutic options like the field of healthcare at present[1].

This idea, within the concept of **critical thinking**, consists of four key aspects:

1. **Wait and think:** before including a scientific study in the bibliography or before applying the conclusions of a study or the claims made by an expert, we must wait and think, we must not automatically accept the claim without any kind of previous reflection or analysis;

2. **Identify assumptions:** we must assess if the authors have accepted as true a fact that has not been verified or that is based on shaky or unproven ground (assuming that it is true just because this is what is commonly done or because we make an act of faith, without any kind of irrefutable evidence), which could weaken any conclusion since it is based on an unfounded claim (colloquially we can say that the claim has feet of clay or it is just a pie in the sky);

3. **Assess the information:** we must analyse if the aims were properly defined (falsibility), if we can explicitly follow the whole research process with the information provided (replicability)[2], and if the actions can be verified or replicated and the outcomes are the result of what has been presented, and

4. **Draw conclusions:** we must reach our own conclusions, we must not simply accept the other person's conclusion just because this is what we get. It is essential to analyse if, with the information provided, we can arrive at the same conclusion or maybe we can reach a different conclusion..

The amount of scientific literature published all over the world is constantly growing but the scientific quality of these published articles is often diverse. The process of "questioning and critically examining a text from all perspectives" (Ibn al-Haytam) is known **as critical appraisal** (en anglès, *critical appraisal*) and its aim is to certify the validity (being true or acceptable) and utility (applicability to a specific case) of the published outcomes. Through critical appraisal, the clinician and the researcher can decide whether they do or do not want to incorporate the published outcomes when treating a specific patient and when improving the healthcare service or whether to include them in a bibliographical review or a research project. Critical appraisal is therefore key both in research and in clinical practice.

Scientific publications in the field of health sciences are a milestone in our health and societies: many of the healthcare projects around the world are designed based on what is published and they affect the way healthcare is provided. Basing our interventions on incorrect or invalid scientific information can be worse than acting without any kind of information since this can alter our professional practice and harm our patients1. If we understand that not everything that has been published is strictly correct or useful for a given case, critical appraisal becomes crucial because it offers quick and reliable decision-making methods on the assessed outcomes. Critical appraisal is fundamental in order to distinguish valid scientific evidence from what it is not, making sure that any healthcare-related decision is the best according to our current knowledge.

Understanding the critical appraisal process allows us to acquire the necessary skills to rapidly rule out (often in a matter of minutes) any poor-quality article or any article that cannot be applied to our clinical or research reality and accept those that have the necessary quality to helps us in our clinical or research decision-making process.

In our clinical practice, before taking any diagnostic or therapeutic decision, we must assess all the evidence on which our decision is based, analysing first the reliability and trust of the source. We can analyse its reliability assessing the research question[3], checking that all the available literature is included in the comprehensive review, making sure the selected studies can be replicated, and analysing the possible usefulness of the outcomes. We can analyse its trust or evidence quality analysing the existence of any bias in the selection of participants or in the outcomes[4], the outcome precision and consistency, its direct applicability to specific patients (translationa-

[1] Further information in the first article in this series entitled "Evidence-based physiotherapy and translationality" (see Revista Científica XII). An article on patient-centred care will soon be published as part of this series.
[2] We will soon devote an article to the experimental scientific method and the different types of scientific studies.
[3] Further information in the article entitled "The clinical and research question in physiotherapy: the acronym PICO" (see Revista Científica XII).
[4] The next article in this series will be about bias and confusion factors.

lity), and analysing the assessment of the benefit-risk-economic cost relationships of each intervention.

Critical appraisal makes use of some established methods that allow us to reach our goals in the shortest possible time and with the highest level of reliability. We must start with a first approach that analyses, in an "informal" or subjective way: the interest of the title, the reliability of the publication (or publisher), the appearance of validity and applicability of the abstract, the authors' presumed reliability, the sources of financing, the type of publication, and the bibliography.

If we get around this "informal" filter, we can then continue with the critical appraisal process using a more formal and objective method, analysing the internal validity of the text (adapting the design to the aims) with specific tools or questionnaires for each individual type of study. The critical appraisal questionnaire is a "formal" tool based on scientific evidence. Each questionnaire has been designed to analyse one or more study types.

These "formal" questionnaires that are easily used are CASP (Critical Appraisal Skills Program) tools developed by the Institute of Health Sciences, Oxford. The questionnaires that have been translated into Spanish are known as CASPe (CASP-español). There are more precise and complex tools and questionnaires like STROBE for the assessment of observational studies, STARD for diagnostic tools, AMSTAR for systematic reviews, PRISMA and QUORUM for meta-analyses and systematic reviews, AGREE for clinical practice guidelines, CONSORT for controlled clinical trials, and EQUATOR for other kinds of studies. There is also a tool for qualitative studies and focus groups: COREQ[5]. These are the most commonly used critical appraisal tools although there are many others that can be appropriate for different cases but adopt the same philosophy.

Before sending a manuscript for publication, the norms for authors of scientific publications often ask authors to undertake the formal process of critical appraisal of their own article, using appropriate questionnaires (for example, the Spanish journal *Fisioterapia* published by Elsevier®, see illustration 1). This is a way for editors to make sure that the manuscripts sent for publication have the minimum, homogeneous standards of quality and they can therefore reduce the amount of rejected manuscripts.

In short, critical appraisal allows us to make evidence-based clinical decisions, set out and design clinical studies, and summarise the evidence in systematic reviews, evidence summaries, clinical practice guidelines, etc. in a more rapid, precise and reliable way.

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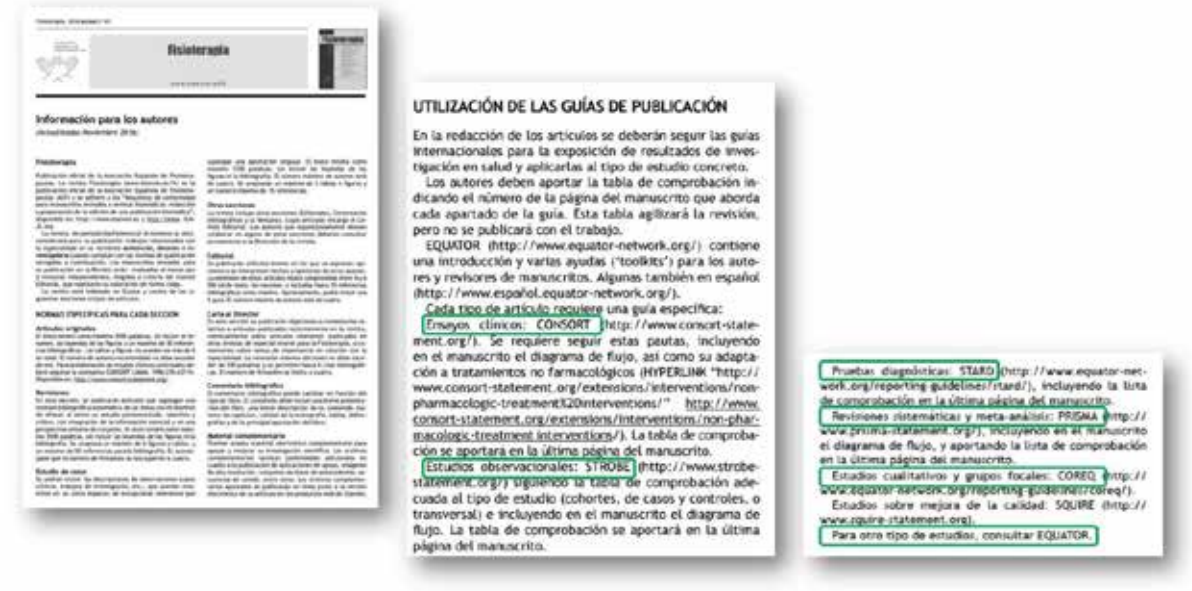
Illustration 1.

Norms for the authors of Fisioterapia (Elsevier®). We can see the requirements of critical appraisal of the articles that will be reviewed for publication.



[5] We will soon devote an article to the different types of scientific studies.

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PHYSIOTHERAPY UPDATES

POSTER

BIBLIOGRAPHICAL REVIEW OF ELECTRICAL STIMULATION IN SLEEP APNOEA-HYPOPNOEA SYNDROME

Anna Bagué Cruz

Physiotherapist. Private practice. Postgraduate degree in chest physiotherapy. Master's degree in scientific evidence.

AIM

Decide the best use of electrical stimulation to help maintain the permeability of the upper respiratory tract (URT) and treat sleep apnoea-hypopnoea (SAHS), considering the key role of the pharynx dilating muscles in this function.

METHODS

Different databases (Pubmed, PEDro, Cochrane, and Isi Web of Knowledge) were searched. The articles were assessed according to the Caspe criteria.

RESULTS

Some authors apply electrical stimulation to the genioglossus muscle (GG), based on Remmen's (1978) demonstration that there was a positive correlation between GG activity and URT reopening after an apnoea.

Some other authors disagree on the importance of the GG in the maintenance of URT. Berry (2003) observed that untreated patients with SAHS had greater GG activity in comparison to healthy individuals.

In order to decide whether the GG is or is not the main pharynx dilator muscle we revised its functional characteristics (fascial muscle) and found that they did not match the postural function required to maintain URT permeability.

CONCLUSION

The GG is a muscle that is activated through a paroxysmal increase in the orthosympathetic system that follows an apnoea. The GG activation helps reopen the URT. The weakness of the URT postural muscles is key in maintaining their diameter. Electrical stimulation that aims to improve URT permeability and, consequently, SAHS must aim to the type I fibres of the muscles in this area.

BIBLIOGRAPHICAL REVIEW OF ELECTRICAL STIMULATION IN SLEEP APNOEA-HYPOPNOEA SYNDROME

Author: Anna Bagué Cruz

Col·legi de Fisioterapeutes de Catalunya

Electrical stimulation (ES) helps maintain the permeability of the upper respiratory tract (URT) in sleep apnoea-hypopnoea syndrome (SAHS).

Electrical stimulation of the genioglossus muscle (GG)

Remmen's (1978) found a positive correlation between GG activity and URT reopening after an apnoea.

Several authors have examined the most efficient way of delivering ES to the GG: using invasive or non-invasive electrodes, applying ES during the day or during the night, applying ES directly to the muscle itself or through the hypoglossal nerve.

ES not applied to GG

Oliven (2003) found that applying ES to the GG and to its antagonist muscles was more effective than applying ES only to the GG.

Berry (2003) found that patients with untreated SAHS had greater GG neuromuscular activity than healthy subjects.

Is the GG in charge of maintaining the permeability of the URT?

	Postural muscles	GG
Type of fibre	Type I	Type II
Contraction	Slow	Fast
Strength	Low	High
Anaerobic capacity	Low	Medium
Resistance to fatigue	High	Medium
Pathological predisposition	Weakness	Contracture

Maintaining the permeability of the URT is a postural function.

Conclusions

The GG is activated by the orthosympathetic system to reopen the URT in case of apnoea. Weakness of URT postural muscles is a risk factor for URT obstruction.

XXII SEPAR JOINT WINTER MEETING

Inma Castillo Sánchez
Coordinator of the CFC Committee of Respiratory Physiotherapy

On 3rd and 4th February the 22nd winter meeting of the Spanish Society of Thoracic Pneumology and Surgery (SEPAR) was held in Valladolid.

The meeting started with an opening ceremony including all the sections of SEPAR and then there were parallel sessions for the lectures related to each section in different rooms.

The sessions on respiratory physiotherapy opened with a round table on "Upper respiratory tract management: from the otorhinolaryngologist to the physiotherapist". Dr Alba García, otorhinolaryngologist and respiratory allergologist at Hospital Clínic, explained the anatomy and physiology of the nasal cavity: the concept of nasal cycle and concepts such as hyposmia, anosmia, and nasal ventilation. Ms Marta San Miguel Pagola, physiotherapist, reviewed nasal irrigations, the latest Cochrane update in 2016, and secretion drainage techniques. She also talked about cough re-education and osteopathic manual techniques.

The second round table was devoted to the topic "artificial airway and deglutition disorders". Mr Dani Martí, physiotherapist at Hospital Clínic, explained the use of different tracheostomy tubes. Ms Sara De Santiago, speech therapist, talked about deglutition disorders of artificial airway and, lastly, Mr Roberto Martínez Alejos talked about deglutition screening, which needs to take into account any pathological antecedents and the examination of cranial nerves.

In the afternoon, there was a round table on "basic pharmacology for physiotherapists for the treatment of respiratory diseases". First, Dr Concepción Mestres Miralles, from Escola Universitària d'Infermeria Ramon LLull, dealt with basic pharmacology for the treatment of respiratory diseases. Dr Ebimar Arizmendi talked about pharmacological interactions in respiratory patients: upper and lower respiratory tract. The round table ended with the presentation given by Ms Victoria Alcaraz Serrano, physiotherapist, entitled "Drug delivery mechanical devices: aerosol therapy for the upper and lower respiratory tract".

The last presentation was a review, "Respiratory physiotherapy in the treatment of bronchiolitis: from evidence to practice".

The meeting continued on the following day with several workshops that extended the topics presented on the first day.

- Assessment of deglutition disorders: assessment of cranial nerves.
- Artificial airway: tracheostomy tubes, interest in choice in the weaning process.
- Upper respiratory tract management: how to perform an acoustic rhinometry to assess nasal obstruction.
- Drug delivery mechanical devices: upper and lower respiratory tract.

Col·legi de Fisioterapeutes de Catalunya

PHYSIOTHERAPY UPDATES

FINAL YEAR PROJECT

TREATMENT OF SPASTICITY IN CEREBRAL PALSY: A SYSTEMATIC REVIEW

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ABSTRACT

Introduction. Cerebral palsy (CP) is a group of conditions affecting motor development that cause impairment in posture, muscle tone and motor coordination. There are different treatment options to treat muscle tone problems. CP is characterised by spastic muscle tone, velocity-dependent hypertonia caused by exaggerated myotatic reflex.

Aim. To review the bibliography up to the point of scientific evidence in relation to the most efficient treatments in the reduction of spasticity in infantile spastic cerebral palsy.

Material and methods. The database search was done with the following key words: "cerebral palsy", "spasticity", "botulinum toxin", "physiotherapy", "physical therapy", "rehabilitation" and "orthosis". The search was limited to the year of publication (≥ 2011), language (English and Spanish) and type of study ("randomised controlled trials" (RCTs)). The trials on the effectiveness of therapy on spasticity with a score of ≥4 in PEDro or of ≥3 in Jadad were included.

Results. Thirteen RCTs were included in the systematic review. Most of them showed improvement in spasticity. This improvement was significant for botulin toxin and for physiotherapy (PT) interventions combined with neuromuscular electrical stimulation, whole body vibration, shock wave therapy, and extracorporeal shock wave therapy.

Discussion. Botulin toxin and PT have proven to have a significant level of effectiveness, alone and together, in the treatment of spasticity in CP. The application of technical aids (TA) is only shown to be a complementary therapy. The results are positive regarding PT with TA and botulin toxin and PT with TA but there are no significant differences regarding the superiority of one method over the other.

Conclusion. When examining the application of botulin toxin, PT, and TA as a whole, we cannot state which the best treatment for spasticity is. With all the currently available evidence, we should be able to claim that a treatment combining botulin toxin, PT, and TA is the most effective but we cannot since the only study that we found comparing these three treatments yields no significant differences. Further research along this line is therefore necessary.

THEORETICAL FRAMEWORK

Cerebral palsy (CP) or static encephalopathy is defined as a group of conditions affecting motor development that cause impairment in posture, muscle tone and motor coordination. This disorder is caused by a non-progressive but persistent injury to the brain before or after birth, in early childhood (1).

The disorder is frequently accompanied by sensory, cognitive, communication, perception, behavioural and/or epilepsy-related problems, which can affect the prognosis of affected children (2).

CP is currently the most frequent cause of motor disability (3). Its prevalence is around 2 and 2.5 per 1000 live births (LB) in developed countries, since in these countries perinatal asphyxia is more frequent. Perinatal asphyxia tends to affect more low-weight and preterm babies (2). In the last decades there has been in increase in its prevalence due to the better knowledge on neonatal care and management (3).

The origin of this syndrome is in the central nervous system (CNS). It is an upper motor neuron lesion, which can be congenital if it occurs in between the 3rd week of intrauterine life and before the end of the neonatal stage, or acquired if it occurs after the first 28 days after birth and before the age of five years (2).

CP is a multi-aetiological syndrome whose cause is very difficult to find due to the multiple risk factors associated with it. These risk factors are classified as prenatal, perinatal, and postnatal. Prenatal and perinatal risk factors account for 85% of all the causes of congenital CP whereas postnatal risk factors represent 15% of acquired CP (2).

In order to prevent, facilitate early detection, and do the follow-up treatment in children at risk of developing CP, the most common risk factors have been established. There are prenatal factors such as maternal factors, placenta alterations, and foetal factors (key in the case of multiple pregnancy); perinatal factors such as preterm births, low weight in new-born babies, infections in the CNS, asphyxia, intracranial haemorrhages, and hypoxic-ischemic encephalopathy, among others; and postnatal factors such as infections, traumatisms, convulsions, cardiorespiratory arrests, intoxications, and severe dehydration (1,2).

Neonatal asphyxia has been established as a possible factor triggering of the perinatal PC. This behaves hypoxia, hypo / hyperapnia and acidosis, which cause modifications in the cerebral circulation and, as a consequence, ischemia and cerebral hemorrhages (2).

The classification based on the predominant motor disorder and the extent of the condition is useful when deciding the type of treatment and the evolutionary prognosis. On the other hand, CP can be classified based on the level of severity: mild, moderate, severe o deep or based on the functional level of mobility: level I-V using the Gross Motor Function Classification System (GMFCS).

In terms of motor function, PC can be classified into spastic, dyskinetic (choreoathetotic, dystonic, or mixed), ataxic (diplegia, simple or disequilibrium syndrome), hypotonic and mixed (1). Depending on the extent of the condition, PC can be classified as unilateral (hemiparesis or monoparesis) and bilateral (diplegia, triparesis, tetraparesis). At an international level, the Gross Motor Function Classification System has become the standard system and it classifies functional abilities into 5 different levels, ranging from minimum to maximum level of severity, and it serves as a prognostic factor. Level I corresponds to an unrestricted gait with a slight limitation in fine motricity and, the last level describes a totally dependent person with a very restricted independent mobility (4).

The diagnosis of CP is mainly clinical, based on both the knowledge of normal motor development and any red flags regarding time (acquisition retardation, persistence of old motor patterns, etc.) and quality (stereotyped patterns that interfere with function). It is essential it can be diagnosed early (2,4).

Spastic CP is the most common type, around 70% of CP cases have a predominant spastic element (5). About the clinical characteristics, it is characterised by hypertonia and hyperreflexia with diminished voluntary movements, increased myotatic reflex, and predominance of some specific muscle groups that will determine the appearance of contractures and deformities (4).

When performing an examination, the main signs that suggest the existence of CP are: motor retardation, abnormal movement patterns, persistence of primitive reflexes, and altered muscle tone (1).

It is necessary to have a multidisciplinary team for the comprehensive assessment and care of the child with CP. He/she requires specialised, early, intensive care during the first years of life and a posterior maintenance treatment (1). The team must consist of a neuropaediatrician, a rehabilitation doctor, a physiotherapist, an orthopaedic physician, a psychologist, a speech therapist, a primary care paediatrician, and the collaboration of other specialists (1,6).

The treatment must be tailor-made, realistic and its goals must be jointly agreed by the patient and the team. In order to reach these goals, it is necessary to have physiotherapy, occupational therapy, pharmacological, surgical, orthotic, and technical help (6).

Physical and cognitive rehabilitation is key to maximise the child's capacities (7).

Spasticity is defined as velocity-dependent increased muscle tone, associated with an exaggerated myotatic reflex, and part of an upper motor neuron syndrome. It is a disorder that must be treated only when it interferes with the patient's function (6,8). The therapeutic options to treat spasticity are multiple, we can find, among others: drugs, physiotherapy, technical aids and surgery (6).

This review aims to find the best evidence-based option from the following alternatives: type-A botulinum toxin (BT), physiotherapy, technical aids (ferules and ortheses), the combinations of ABT + physiotherapy or ABT + physiotherapy + technical aids.

The treatment with A type botulinum toxin is a drug therapy that blocks the release of acetycholine at the neuromuscular junction and inhibits the peripheral release of nociceptive neurotransmitters. The effects known to date are analgesia and diminished focal spasticity (8).

The physiotherapy treatment consists of different methods that aim to reduce spasticity: cryotherapy, stretching exercises, work on antagonist muscles, kinesiotherapy, electrical stimulation, postural treatment, neuromuscular facilitation techniques, balance re-education, proprioception, gait, biofeedback techniques, and hydrotherapy (6,8).

Technical aids (ferules and ortheses) help to maintain posture and stretch spastic muscles for long periods of time (6).

SEARCH METHODOLOGY

The aim of this study is to review the existing literature up to the moment of maximum scientific evidence regarding the most efficient treatments in the reduction of spasticity in in infantile spastic cerebral palsy.

The following bibliographical databases were searched: PEDro, Elsevier, Pubmed, Scielo, ENFISPO, Scopus and ScienceDirect.

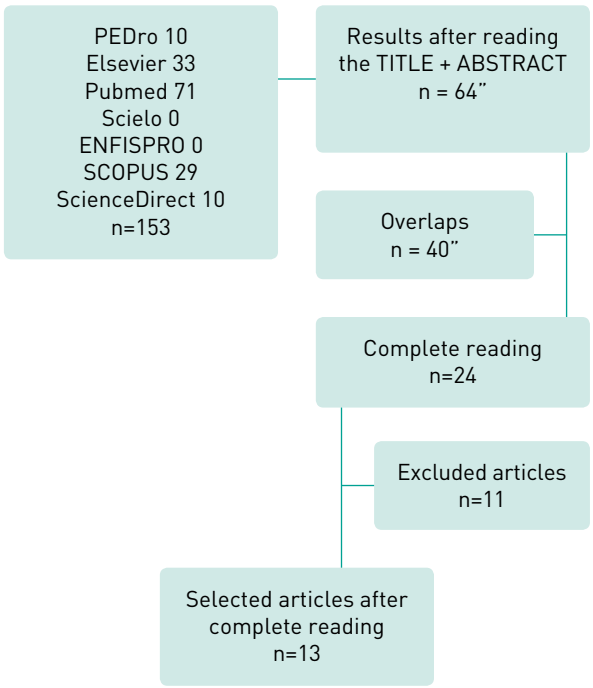
The criteria used for the search in order to obtain the best methodological quality are the presented below.

The search was done using the Boolean operator "AND" and the combination of the key words "cerebral palsy", "spasticity", "botulinum toxin", "physiotherapy", "physical therapy", "rehabilitation" and "orthosis". The search was limited to the year of publication (⩾ 2011), language (English and Spanish) and type of study ("randomised controlled trials" (RCTs)).

The review included those studies that fulfilled the following criteria: that one or several of the treatments examined in this reviewed were part of their intervention; that they examine the effectiveness of therapy on spasticity with a score of ⩾4 on the PEDro scale of methodological quality or of ⩾3 in the Oxford quality scoring system (Jadad scale).

Those trials that do not deal with infantile cerebral palsy, or those in which spasticity is not a consequence of this condition, or those articles to which we had no access or those randomised clinical trials that have not been carried out were not included in the review.

DIAGRAM 1.



The database search, done using the combination of key words, Boolean operator, and limiting it to year of publication, type of article, and language, resulted in a total of 153 articles.

After reading the title and abstract, 64 articles were selected, 40 of them were overlaps resulting from the different searches.

Finally, 24 articles were selected for complete reading. After that, 11 trials were excluded because they were not properly randomised, did not have a control group with which to compare the intervention group, were not randomised controlled trials, did not provide either results or conclusions on the variable of interest (spasticity) or obtained a score below 3 on the Jadad scale or below 4 on PEDro (see Diagram 1).

After the whole process, 13 articles fulfilled the criteria for the systematic review. Their outcomes are presented below.

The bibliography in this review has been done using Mendeley reference manager.

RESULTS

El-Shamy SM *et al.* examined the effects of shock wave therapy on gait patterns in children with hemiplegic CP. They assessed the level of spasticity of the ankle plantar flexors using the Modified Ashworth Scale (MAS). They

allocated the patients into two groups: the study group, in which patients received extracorporeal shock wave therapy and conventional physiotherapy (neuro-development techniques, stretching exercises, strengthening exercises, proprioception training, and gait and balance training); the control group only received conventional physiotherapy. After three months undergoing the corresponding treatment, the results showed significant improvement in spasticity and gait in both groups although they were more significant in the study group. Therefore, it seems that extracorporeal shock wave therapy combined with a conventional physiotherapy programme based on exercises can improve spasticity and gait patterns in children with hemiplegic CP.

In their study, Ibrahim M.M. *et al.* examined the effect of whole-body vibration on muscle strength, spasticity, gait speed, dynamic balance, and gross motor performance in spastic diplegic cerebral palsy children for 12 weeks. In the experimental group, as well as in the control group, patients had a one-hour physiotherapy session, three times a week. The session consisted of stretching and strengthening exercises, facilitation of postural reactions when standing and transferring body weight, facilitation of standing balance, and gait training. Apart from all this, the participants in the experimental group had whole-body vibration in 3 series of 3 minutes, followed by a 3-minute pause in between. Regarding spasticity, there were no significant changes in the control group unlike in the experimental group. It was concluded that spasticity can be reduced after a 12-week intervention programme using whole-body vibration combined with physiotherapy exercises.

In their 2014 study, Turgut Yildizgören M. *et al.* examined the effects of neuromuscular electrical stimulation on wrist amplitude, wrist and finger flexor spasticity, and hand functions in patients with unilateral cerebral palsy. The control group had conventional exercises (Bobath, active and passive articular balance, stretching exercises), occupational therapy, and wrist-hand ortheses for each patient 5 days a week for 6 weeks, in 20-30-minute sessions. The experimental group had the same type of intervention plus 30 more minutes of neuromuscular electrical stimulation of the wrist and finger extensor muscles. The level of spasticity was reduced in both groups but there was a significant improvement in the experimental group. Therefore we can conclude that neuromuscular electrical stimulation, together with ortheses and conventional exercises, have a positive effect on active range of motion, hand function, and spasticity.

Van Campenhout A. *et al.* analysed the reduction of spasticity in different parts of the gracilis muscle after injecting type-A botulinum toxin injections. The participants were distributed into two groups. The first group had a motor endplate-targeted botulinum toxin injection and the second group had the injection on the proximal aspect of the muscle. The results suggest that type-A botulinum toxin injections can reduce pathological electrophysiological activity more effectively if injected on the motor endplates rather than on the proximal aspect of the muscle.

In the study by Johnston T.E. *et al*, the authors compared the effects of a supported speed treadmill training exercise program (SSTTEP) with exercise on spasticity, strength, motor control, gait spatiotemporal parameters, gross motor skills, and physical function. The participants in the study were assigned to two groups. The first group had a 2-week intensive training programme using the treadmill and a paediatric suspension walker, with two 30-minute sessions a day and, in the following 10 weeks, they had it five days a week under the supervision of a physiotherapist. The second group had an exercise programme based on impairments and functional tasks, in sessions of 30 minutes. The results did not show any significant changes in terms of spasticity but they did for the analysed parameters.

Williams S.A. *et al.* investigated the effects of combining strength training and type-A botulinum toxin on muscle strength and morphology in children with CP. The participants were randomly allocated to two groups and both groups had an intervention and a control period. The turns of each intervention were randomly organised. In the first period, one of the groups had the intervention (muscular strength pre-training) and the other group continued with their usual care routine. After 12 weeks, they were injected type-A botulinum toxin. In the second period after the injection, the first group had their normal care routine and the second group had a strength training programme up to week 26. Previous to that, there was a control group that had their normal care routine and a toxin injection at week 12 and week 24. The results showed a significant reduction in spasticity and a significant improvement in muscle strength. The simultaneous use of type-A botulinum toxin injections and strength training has a greater effect in reducing spasticity, improving strength and achieving functional goals in comparison to the toxin treatment alone.

In their randomised clinical trial, Jianjun L. *et al.* aimed to determine the efficacy of type-A botulinum toxin nerve block, with and without rehabilitation, in the treatment of spastic CP. The patients were randomly assigned to two groups and were given the toxin. The experimental group had a ≥2 hour/day rehabilitation and the control group had <2 hour/day.

MAS was assessed before the intervention and weekly and the gross motor function measure (GMFM) was assessed before the intervention and one year post-intervention. There were significant improvements in MAS and GMFM when compared to the baseline. The experimental group showed significant changes in GMFM compared to the control group.

Liu J.J. *et al.* examined the effect of botulinum toxin for relieving spastic iliopsoas and to investigate the

improvement of motor function in children with CP. Before the intervention and after 8 weeks, MAS, range of hip joint, and GMFM were assessed. The experimental group had a treatment with toxin and conventional physical therapy whereas the control group had the conventional treatment alone. The control group showed no significant differences on the MAS scale before or after the treatment whereas the experimental group showed significant results. After 8 weeks the experimental group showed significant differences in spasticity relief.

Katusic A. *et al.* did a study whose aim was to assess the effects of sound wave vibration therapy on spasticity and motor function in children with cerebral palsy. The participants were allocated to two groups that were assessed at baseline and 1 year post-intervention. MAS and GMFM were the outcome measures. The intervention group had three 40-minute sessions a week combining physiotherapy and sound wave vibration therapy (twice a week) and the control group had physiotherapy alone. Significant differences between groups were detected with improved spasticity level and gross motor function in the intervention group compared to the control group. In conclusion, vibration therapy added to a physiotherapy programme significantly improves spasticity and motor performance in children with CP.

Cheng KHY *et al* evaluated the effect of whole body vibration (WBV) on lower extremity spasticity and ambulatory function in children with CP with a complete crossover design. The participants in the study were divided into two groups measuring range of motion, muscle tone, and ambulatory function before, immediately after, 1 day after, and 3 days after the intervention. The experimental group received a WBV for 8 weeks followed by a 4-week washout period and became the control group. The intervention lasted 10 minutes and was given 3 times a week. The results suggested that a WBV intervention normalized muscle tone, improved active joint range and enhanced ambulatory performance for at least 3 days after the intervention.

The study by Ferrari A. *et al.* investigated the efficacy of botulinum toxin combined with an individualized physiotherapy and orthoses treatment in improving upper limb activity and competence in daily activity in children with hemiplegia. MAS was used to assess spasticity at baseline, and after 1, 3, and 6 months. The intervention group received the toxin and an individualized physiotherapy and orthoses treatment whereas the control group had saline injections and the same programme. There were no significant differences in MAS scores between the two groups.

Bandholm T *et al.* compare the effects of physical rehabilitation with and without progressive resistance training following treatment of spastic plantar flexors with botulinum toxin in children with CP. Outcome measurements were performed at baseline pre-toxin, and 4 and 12 weeks post-toxin. They consisted of ankle muscle function (EMG), gait (3-dimensional gait analysis), balance function (sway analysis), GMFM, and spasticity (MAS). Spasticity of plantar flexors was equally reduced significantly in the two groups.

Chrysagis N *et al.* evaluated the effect of a treadmill program on gross motor function, walking speed, and spasticity of ambulatory adolescents with spastic CP. Measures were taken before the intervention and one year after it. Self-selected walking speed (10MW), gross motor function (GMFM), and spasticity (MAS) were measured. The intervention group received a 45-minute programme three times a week for 12 weeks. The programme consisted of 10-min warm-up, 30 minutes walking on the treadmill, and 5-min stretching. The control group had a conventional physiotherapy programme three times a week for 12 weeks, which consisted of: mat activities, balance, and gait training and functional gross motor activities. There were no significant changes regarding spasticity or differences between groups but the results suggest a reduction in spasticity.

DISCUSSION

The relief of spasticity by means of type-A botulinum toxin therapy has been widely proven by the consulted bibliography. Liu J.J. *et al* compare the effect of botulinum toxin combined with conventional physical therapy compared to conventional therapy alone and they obtain significant short-term and long-term results in favour of botulinum toxin combined with conventional therapy. Therefore, toxin injections seem to increase the effectiveness of the treatment when compared to just the therapy alone to reduce spasticity (9). This conclusion is also reached by Jianju L *et al.* in a study examining the difference between the application of the toxin with and without rehabilitation (10). A study by Bandholm T *et al.* demonstrates a significant reduction in spasticity in plantar flexors, regardless of the type of rehabilitation (with or without progressive resistance) given to patients after a toxin injection (11). Williams S A *et al.* show a significant reduction in spasticity when combining strength training and botulinum toxin (12). Once the effectiveness of botulinum toxin in improving spasticity has been evidenced, thanks to Van Campenhout A *et al.* we know now that we obtain greater improvement in pathological electrophysiological activity if the toxin is injected on the motor endplates rather than on the proximal aspect of the muscle (13). In any case, Ferrari A *et al.* did not obtain significant differences when comparing a physiotherapy treatment and technical aids combined with botulinum toxin and the same kind of programme with saline serum. We can therefore claim that, due to the lack of differences in between the two therapies, both are effective in reducing spasticity (14).

Physical rehabilitation has demonstrated its effectiveness in the improvement of spasticity. Several studies have examined this, Bandholm T *et al.* have analysed

the effectiveness of this therapy when combined with and without progressive resistance training, and they claim that spasticity of plantar flexors can be reduced in both ways (11).

Physical rehabilitation is also examined when combined with other physical therapies that involve vibration and electrotherapy. According to Ibrahim M.M. *et al.*, spasticity can be reduced with a whole body vibration (WBV) programme combined with physiotherapy exercises (15), This view is supported by Cheng KHY *et al.*, who suggest that WBV normalises muscle tone (16). In relation to the evidence found on electrotherapy, extracorporeal shock wave therapy and sound wave vibration combined with a conventional physiotherapy programme can improve spasticity (17,18). It has also been suggested that a physiotherapy, occupational therapy, and ortheses programme reduces spasticity but the results become significant when this programme is combined with neuromuscular electrical stimulation (19).

In the studies by Johnston T.E. *et al.* and Chrysagis N. *et al.* the effects of a rehabilitation programme including treadmill exercises are examined. Neither of the two articles shows significant improvement in terms of spasticity but they point to a reduction, which suggests more research on this therapy is needed (20,21). When doing this review, we could not find any study on the treatment of spasticity with only technical aids; these have always been complementary to other techniques.

In the studies that investigate the simultaneous use of botulinum toxin and physiotherapy, the results favour a combined therapy with the two treatments. This is supported by Williams S.A. *et al.*, Liu J.J. *et al.* and Jianju L. *et al.* whose studies analyse strength training, conventional physiotherapy, and longer rehabilitation time after treatment with botulinum toxin respectively (9,10,12).

According to Turgut Yildizgören M. *et al.* with physiotherapy exercises, occupational therapy, and ortheses, we can reduce spasticity, which can be even more reduced when combined with neuromuscular electrical stimulation (19). These are similar results to those obtained in the study by Ferrari A. *et al.*, which show no significant difference between the use or no use of botulinum toxin combined in a programme of physiotherapy and ortheses (14).

CONCLUSIONS

The currently available evidence-based bibliography supports the effectiveness of type-A botulinum toxin and physiotherapy as individual treatment therapies. In the outcomes of this review, technical aids have only been used as a complementary therapy thus, their validity as a therapy for the treatment of spasticity on their own cannot be evidenced.

Once the effectiveness of the two techniques has been proven separately, we proceeded to examine their combined use and there is evidence that their combined application leads to a greater reduction in spasticity in comparison to their individual use.

However, when examining the application of the three therapies together, it is difficult to know which the best treatment for spasticity is. Reviewing the current evidence we should be able to state that a treatment combining botulinum toxin, physiotherapy, and technical aids is the most effective treatment but this claim is challenged by the study by Ferrari A. *et al.* (14), in which no significant differences were found when comparing this intervention with physiotherapy and technical aids.

This argument takes us to the need of further higher-quality research along this line. That is why it is so important to do more research with bigger samples, longer follow-up periods, spasticity as the only aim in the study, tailor-made treatments for each individual patient, minimal bias, and a correct randomisation and blinding protocol.

The main limitation of this review is the reduced number of randomised clinical trials whose aim is to improve spasticity in CP. Another limitation has to do with the recommendations given for future studies and, besides, the techniques used in the studies should be described in detail so that they can be replicated.

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AGENDA

International Conference of Physiotherapy in Psychiatry and Mental Health

Date and city: From 10th to 12th April, Reykjavík, Iceland

Information: https://icelandtravel.artegis.com/event/ICPPMH-Conference2018

International Conference on Evidence Based Aquatic Therapy (ICEBAT)

Date and city: From 14th to 16th April 2018, Las Vegas, EUA

Information: www.icebat.us

World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases

Date and city: From 19th to 22nd April 2018, Krakow, Poland

Information: www.wco-iof-esceo.org

5th ER-WCPT Regional Congress

Date and city: From 26th to 28th April 2018, Dublin, Ireland

Information: www.wcpt.org/europe

CFC International Physiotherapy Congress – FTP18

Date and city: 4th and 5th May 2018, Barcelona

Information: www.ftp18.cat

WCPT Congress 2019

Date and city: From 10th to 13th May 2019, Geneva, Switzerland

Information: www.wcpt.org/news/2019-congress-venue-Dec15

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