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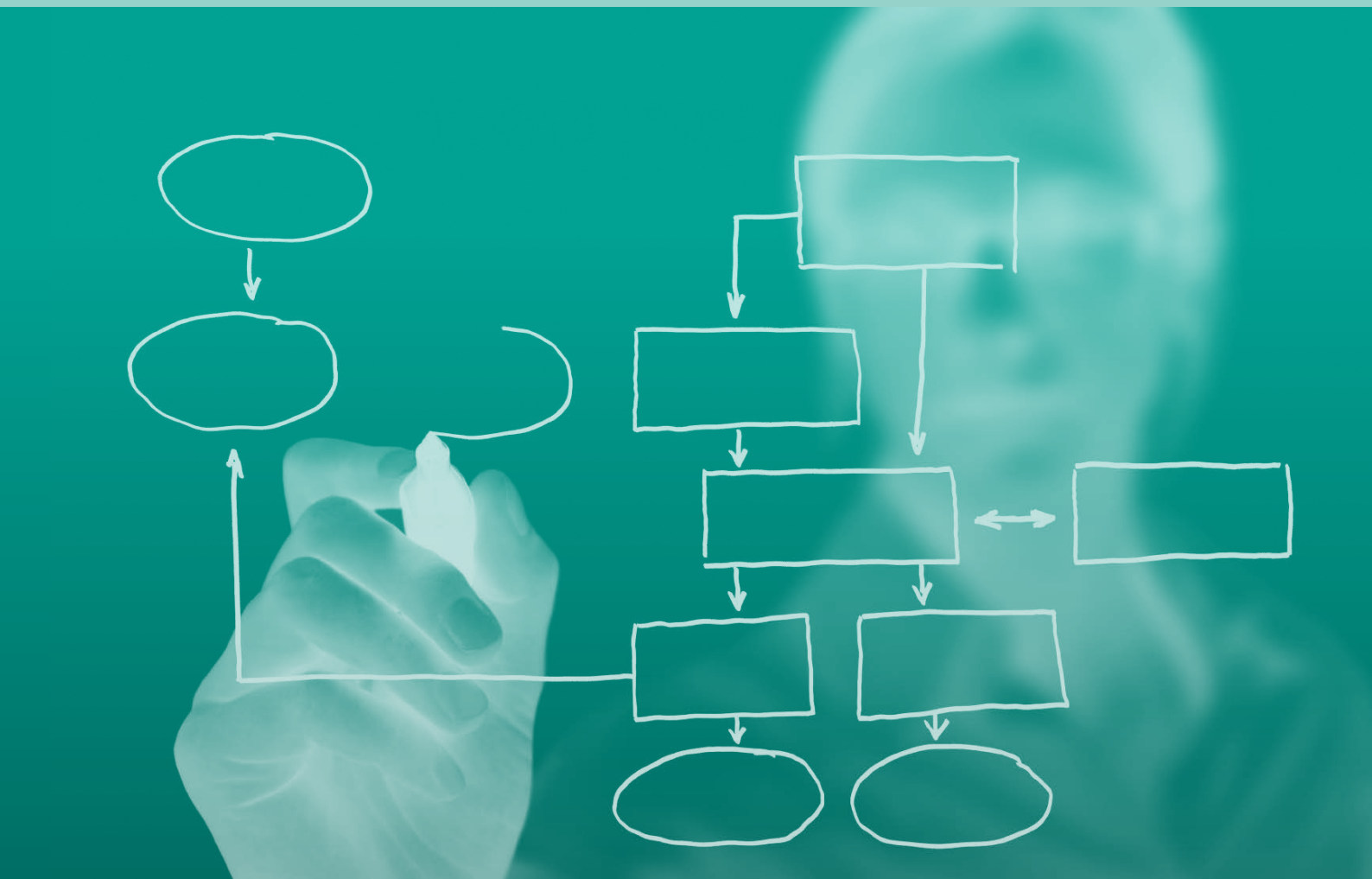
PHYSIOTHERAPY UPDATES



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PHYSIOTHERAPY UPDATES

EDITORIAL

TAKING SMALL STEPS IN THE RIGHT DIRECTION

Ramon Aiguadé
Treasury manager and responsible
for the Scientific Journal

This is issue 13 of our Scientific Journal. Some people will say number 13 brings bad luck. I have seen hotels with no 13th floor or planes with no 13 row. I am not superstitious and I am positive that after this issue, there will be many more ahead and they will be highly successful. That is why we need you. Yes, YOU who are reading these lines and, just by that, showing interest in our Scientific Journal. We need your articles, abstracts, posters... You can collaborate with us in different ways and we are looking forward to your contributions.

2017 is full of physiotherapy events. There is the National Congress on Physiotherapy in La Rioja, our CFC Conferences that, this year, include a poster session, and the WCPT World Congress in Cape Town, with cheaper registration fees until the end of February. Cape Town is quite far away and travelling and conference costs will be affordable just for a few physiotherapists in Europe. In 2019 there will be no excuse. The WCPT Congress will be held in Geneva, which is round the corner for us, Catalan physiotherapists, so we cannot miss this major physiotherapy event.

The Catalan Chartered Society of Physiotherapy (CFC) supports evidence-based physiotherapy. This is clearly shown in the new articles in the section called "Learn how to do research", little information capsules that can be very useful for those of you interested in research, or in the improved professional research management service we offer registered physiotherapists, with more resources and extended office hours.

In this current issue, you can find two original articles by Catalan registered physiotherapists who want to share their work with us and contribute to the development of physiotherapy. You will also find the translation of an article published in *Kinésithérapie la revue* about the usefulness of new technologies in the treatment of Parkinson's. We continue translating abstracts, which we try them to be as diverse as possible, covering different areas such as geriatrics, urogynecology, sports... as usual, we also have the Congress Highlights and Agenda sections with some very interesting suggestions.

But we want to go a bit further and incorporate new things. In this issue you will find, for the first time, a poster on the importance of pneumotoning to improve the treatment of patients with OSAHS presented at the *European Sleep Research Society Congress* and an end-of-degree paper reviewing the effectiveness of neuromuscular training in non-contact ACL injuries in female soccer players between 12 and 25 years of age.

As you can see, we want this journal to help you in your daily practice and we devote a great deal of effort into achieving this but if we want to succeed, we have to be prepared for a long journey in which we all play a part.

Col·legi de Fisioterapeutes de Catalunya

PHYSIOTHERAPY UPDATES

ORIGINAL ARTICLE

FUNCTIONAL STATE IN LONG-TERM CARE UNITS. CAN COGNITIVE DETERIORATION PLAY A PART?

Canelles Bergua, Marina Cristina[1]; Barrachina Martorell, Sílvia[2]

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[2]Physiotherapist in Centre SARquavitae Jaume Nadal

ABSTRACT

Design. The study was done in two healthcare centres.

Aims. Determine whether cognitive deterioration can affect the patient's functional state.

Methods. Using the data about patient admission in both centres in 2014 and checking the differences in terms of functionality (measured with Barthel's index) and cognitive state (measured with Lobo's Mini Mental State Examination (MMSE) screening test).

Results. Functional dependence on admission is higher at the SARquavitae Jaume Nadal centre. Cognitive deterioration is worse at SARquavitae Terraferma.

The correlation between these two variables is different when taking the two centres independently. In the centre where cognitive deterioration is more severe, the relationship between MMSE and Barthel index is positive (sig. 0.01), whereas in the other centre no such relationship is found. Taking the two centres together, the relationship is positive (sig. 0.03).

Conclusions. The results indicate that cognitive deterioration seems to affect the relationship with the improvement or deterioration of functionality. Further studies are needed to establish appropriate protocols for these cases.

KEY WORDS: Barthel's index, MMSE, Functional improvement.

INTRODUCTION

The main objective of long-term care units is to achieve the patient's maximum autonomy. This includes patients with advanced dementia or any other chronic cognitive condition (1).

Barthel ADL index is a scale used to measure performance in activities of daily living and thus objectively measure the patient's degree of dependence and its evolution in time (2). This scale is used in healthcare centres and is systematically administered on admission and every four months. In long-term care units, if the patient shows no significant changes, it is administered as often as needed.

Another scale that is commonly used is the Mini Mental State Examination (MMSE) test, adapted and validated by Lobo *et al.*, as a screening test for cognitive deterioration (3).

In 2013, in a retrospective four-year study carried out in a geriatric post-acute rehabilitation centre in Laussane, Seematter-Bagnoud *et al.* (4) concluded that, apart from some sociodemographic characteristics, cognitive deterioration was the predominant negative factor for functional improvement. Muir *et al.* (5), on the other hand, concluded that, after hip fracture repair surgery, patients improved similarly in physical function regardless of their cognitive state.

Taking into account that we work as physiotherapists in two different healthcare centres with different levels of prevalence, our aim is to find out whether there is any relationship between functional improvement and the MMSE test in our patients.

AIMS

- Know the functional state, using Barthel ADL index, of the patients admitted to Centre SARquavitae Jaume Nadal and Centre SARquavitae Terraferma in 2014 and monitor their evolution in a period of four months.
- Analyse any existing differences in terms of functional level in the two centres on admission and after four months.
- Determine whether cognitive deterioration, measured with the MMSE, can affect the patients' functional improvement.
- Quantify the prevalence of cognitive deterioration in the two centres.

MATERIALS AND METHODS

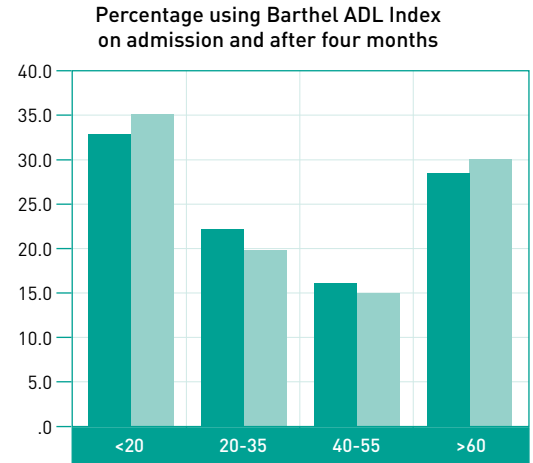
The SARquavitae centres have a computerised medical register with each individual patient's medical history (GCR), we got the data regarding admissions in both centres in 2014 focusing on the assessment on admission and after four months. We wanted to see if there are any statistical differences between these two periods. In order to find these significant differences, we used a confidence level of 95%.

RESULTS

As shown in Table 1, the patient's functional state on admission, using Barthel's index jointly for the two centres, yields a mean score of 38.26 points (typical deviation 30.79), which is associated with severe dependence. Graph 1 shows that 33% of these patients scored below 20 and 28.6% of them, over 60. If we consider the data taken after four months, the mean value is 39.04 (typ. dev. 32.57). Table 2 shows that, with a confidence level of 95%, there are no statistically significant differences between the value on admission and the value after four months (significance 0.843). We can also see (Graph 1) how the most extreme values increase, both maximum and minimum dependence. Those patients with a total level of dependence are go from 33% to 35%. Moderate/mild dependence goes from 28.6% to 30%.

Graph 1

Functional state of patients in both centres.



	<20	20-35	40-55	>60
Admission	33.0	22.3	16.2	28.6
4 months	35.0	19.9	15.0	30.1

If we classify the data according to centre, Terraferma has a mean in Barthel's index of 46.02 (typ. dev. 30.51) and Jaume Nadal, 33.57 (typ. dev. 30.07). In the second centre, the level of physical dependence is almost 12.5 points above that of the first centre (the lower the value, the higher the level of dependence).

Table 1

Statistical data using Barthel ADL Index in both centres.

Descriptive statistics

	N	Minimum	Maximum	Mean	Typ. dev.
Barthel on admission	364	0	100	38.26	30.794
Barthel after 4 months	286	0	100	39.04	32.569
Difference Barthel (post - pre)	286	-70.00	75.00	.1923	16.44389
Valid n (according to list)	286				

Table 2

Significance of the differences using Barthel ADL Index.

Related samples test

		Related differences					t	gl	Sig. (bilateral)
		Mean	Typical dev.	Typical mean error	95% confidence interval for the difference				
					Inferior	Superior			
Pair 1	Result post – Result pre	.192	16.444	.972	-1.722	2.106	.198	285	.843

Regarding the Mini-Mental, there are no significant differences between the values on admission and after four months (sig. 0.289). Tables 3 and 4.

Table 3

Statistical data using MMSE in both centres.

Descriptive statistics

	N	Minimum	Maximum	Mean	Typ. dev.
MMSE on admission	358	.00	30.00	14.4721	8.98165
MMSE after 4 months	258	.00	30.00	14.3798	8.91350
Difference MMSE (post - pre)	258	-16.00	30.00	.2481	3.74692
Valid n (according to list)	258				

Table 4

Significance of the differences using MMSE.

Related samples test

		Related differences					t	gl	Sig. (bilateral)
		Mean	Typical dev.	Typical mean error	95% confidence interval for the difference				
					Inferior	Superior			
Pair 1	Result post – Result pre	.24806	3.74692	.23327	-.21131	.70743	1.063	257	.289

In the SARquavitae Terraferma centre, the percentage of patients with severe cognitive deterioration on admission is 56.5 and the percentage of patients with no cognitive deterioration admitted to the centre is 2.3%, as shown in Table 5. The mean MMSE value on admission is 11.80 (typ. dev. 6.89) (Table 6).

Table 5

Cognitive state on admission to Terraferma.

MMSE on admission

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Severe deterioration	74	56.5	56.5	56.5
	Mild deterioration	10	7.6	7.6	64.1
	Moderate deterioration	42	32.1	32.1	96.2
	Normal	3	2.3	2.3	98.5
	Pathological suspicion	2	1.5	1.5	100.0
	Total	131	100.0	100.0	

Table 6

Mean MMSE values in Terraferma.

Descriptive statistics

	N	Minimum	Maximum	Mean	Typ. dev.
MMSE on admission	131	.00	30.00	11.8015	6.89417
MMSE after 4 months	105	.00	30.00	11.8286	6.99513
Difference MMSE (post - pre)	105	-14.00	6.00	-.2190	1.90637
Valid n (according to list)	105				

In the SARquavitae Jaume Nadal centre, 32.2% of patients have severe deterioration and 13.7% are within normal values, that is to say, with no cognitive deterioration (Table 7). The mean MMSE value on admission is 16.01 (typ.dev. 9.67) (Table 8).

Table 7

Cognitive state on admission to Jaume Nadal.

MMSE on admission

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Severe deterioration	73	32.2	32.2	32.2
	Mild deterioration	33	14.5	14.5	46.7
	Moderate deterioration	65	28.6	28.6	75.3
	Normal	31	13.7	13.7	89.0
	Pathological suspicion	25	11.0	11.0	100.0
	Total	227	100.0	100.0	

Table 8

Mean MMSE values in Jaume Nadal.

Descriptive statistics

	N	Minimum	Maximum	Mean	Typ. dev.
Barthel on admission	227	.00	30.00	16.0132	9.67319
Barthel after 4 months	153	.00	30.00	16.1307	9.65776
Difference Barthel (post - pre)	153	-16.00	30.00	.5686	4.58224
Valid n (according to list)	153				

This difference of 4.3 points in the MMSE means affects them when the means are related to the values in the Barthel's index.

If we relate the two variables taking both centres together, the relationship between Barthel and Mini-Mental is positive, that is to say, if a variable improves, so does the other one, and the other way round. An improvement in the patient's cognitive state affects his/her functional state, or conversely, a higher level of functional dependence is determined by the patient's cognitive state (Table 9 and Graph 2).

However, this relationship does not work in the same way when we take the two centres separately. In the Terraferma centre, where the level of cognitive deterioration is higher and there is less functional dependence, the relationship is indeed positive (Table 10, Graph 3) whereas in the Jaume Nadal centre the relationship is not statistically significant (Table 11, Graph 4).

Table 9

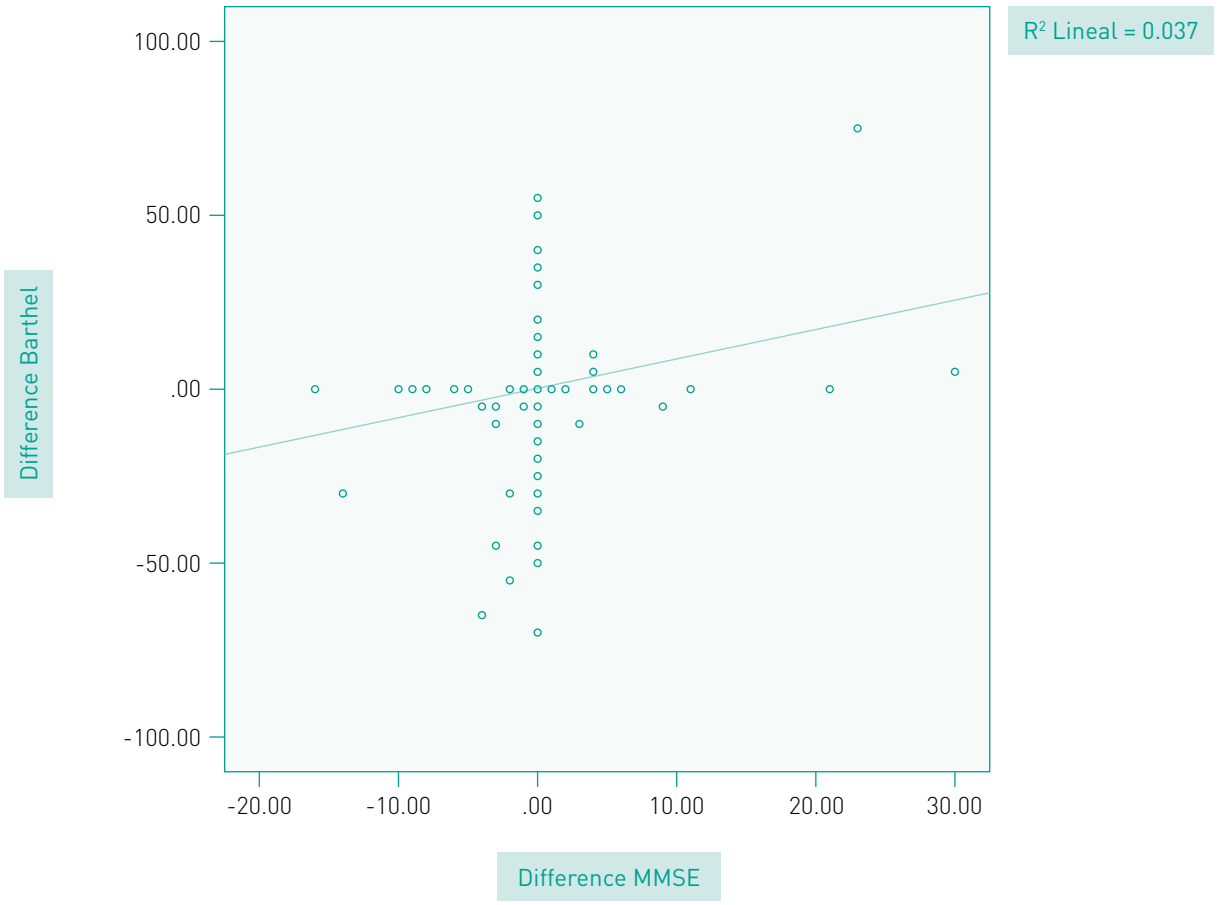
Correlation between Barthel's index and MMSE in both centres.

Correlations

		Difference MMSE	Difference Barthel
Difference MMSE (post - pre)	Pearson's correlation	1	.192
	Sig. (bilateral)		.003
	N	258	231
Difference Barthel (post - pre)	Pearson's correlation	.192	1
	Sig. (bilateral)	.003	
	N	231	286

Graph 2

Correlations between Barthel and MMSE variables in both centres.



TERRAFERMA CENTRE

Table 10

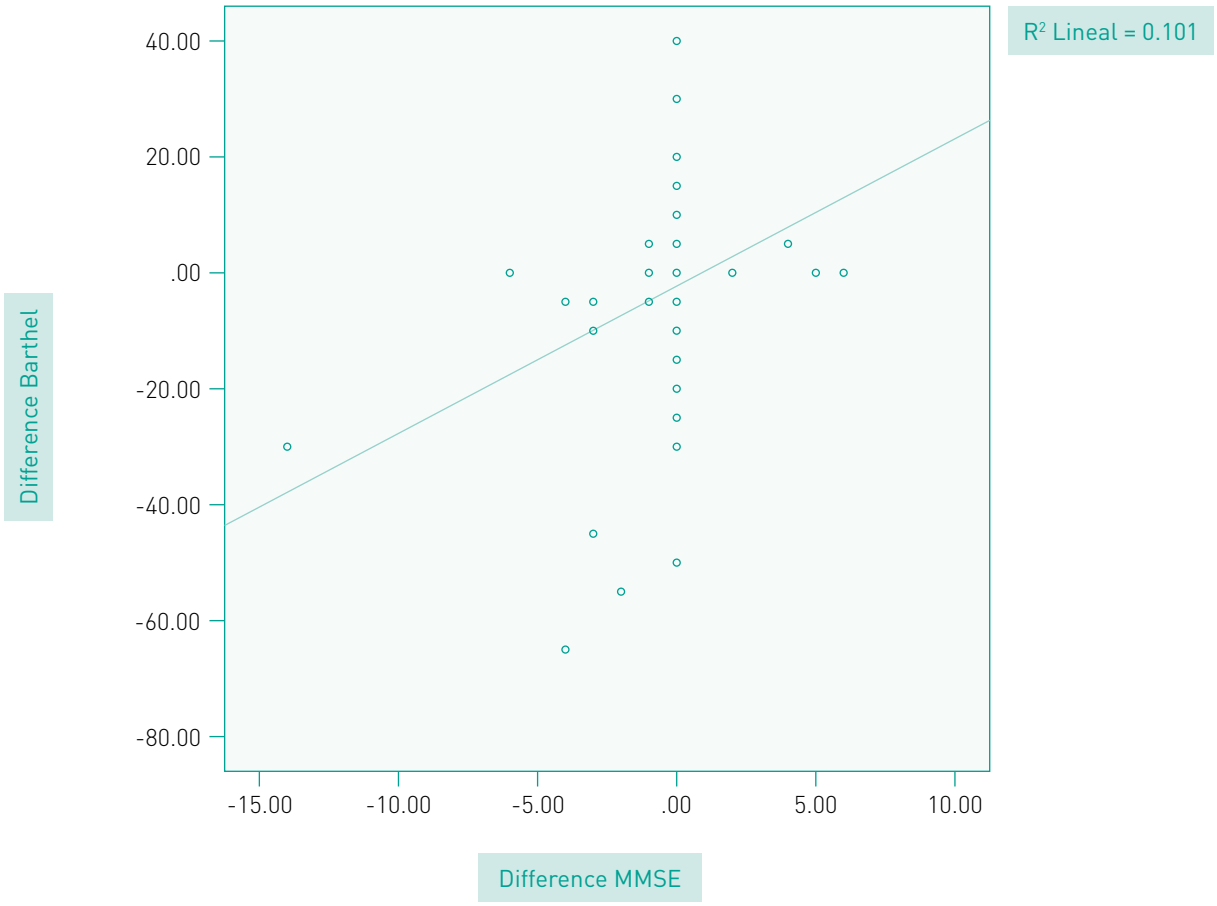
Correlations between Barthel's index and MMSE in Terraferma.

Correlations

		Difference MMSE	Difference Barthel
Difference MMSE	Pearson's correlation	1	.318
	Sig. (bilateral)		.001
	N	105	105
Difference Barthel	Pearson's correlation	.318	1
	Sig. (bilateral)	.001	118
	N	105	

Graph 3

Correlations between Barthel's index and MMSE in Terraferma.



JAUME NADAL CENTRE

Table 11

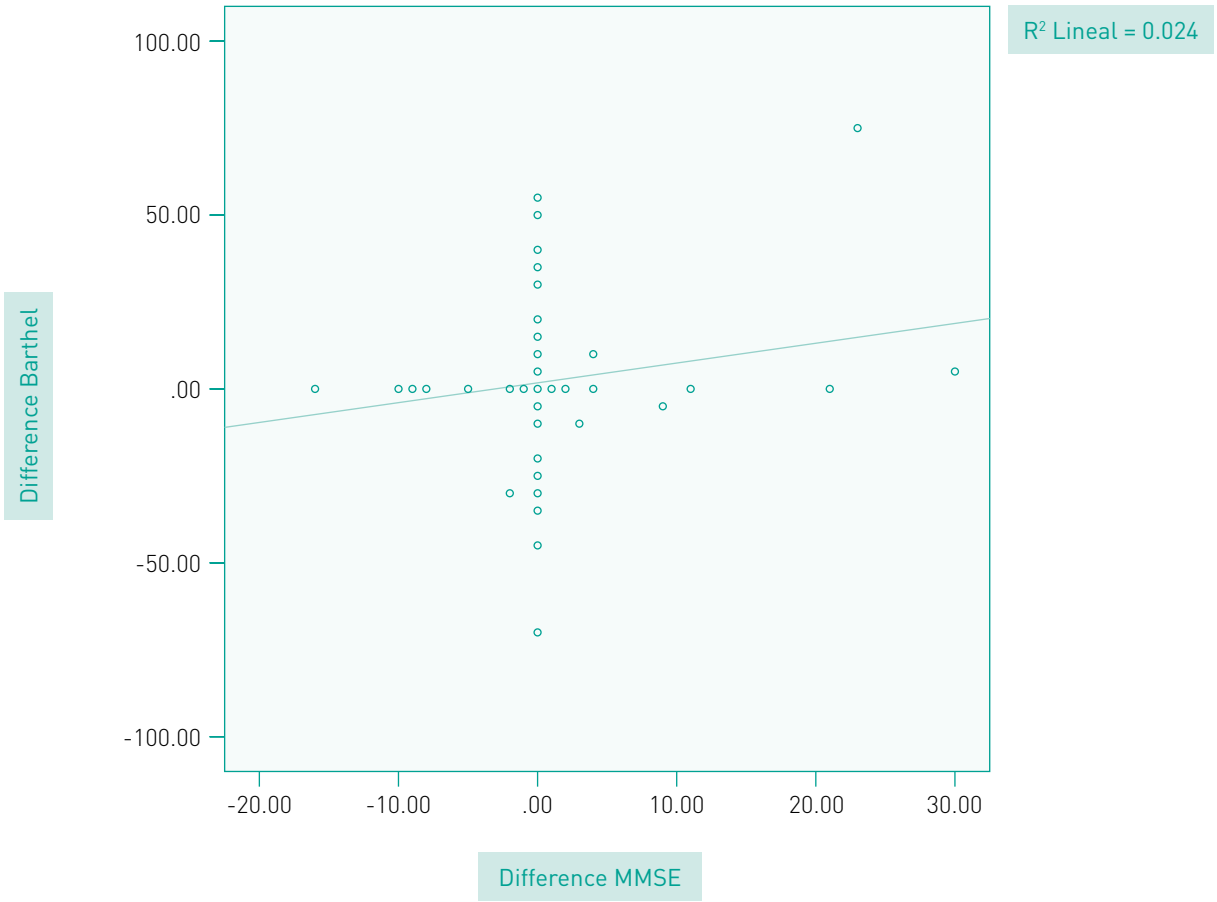
Correlations between Barthel's index and MMSE variables in Jaume Nadal.

Correlations

		Difference MMSE	Difference Barthel
Difference MMSE	Pearson's correlation	1	.156
	Sig. (bilateral)		.081
	N	153	126
Difference Barthel	Pearson's correlation	.156	1
	Sig. (bilateral)	.081	
	N	126	168

Graph 4

Correlations between Barthel's index and MMSE variables in Jaume Nadal.



CONCLUSIONS

No significant differences have been found between Barthel's index on admission and after four months, neither when taking the two centres jointly nor separately (sig. 0.843).

There is a difference in terms of the level of functional dependence in each centre. In the Jaume Nadal centre, Barthel mean value on admission is 33.57 (typ. dev. 30.07) and in the other centre, it is 46.02 (typ. dev. 30.51). There is a difference of 12.45 points.

In the SARquavitaeTerraferma centre, cognitive deterioration is higher, only 2.3% of patients have no deterioration whereas this percentage in the Jaume Nadal centre is 13.7. As with the Barthel's index, there are no differences between the MMSE values on admission and after four months (sig. 0.289).

When correlating the variables, some differences were found. In the terraferma centre, where cognitive deterioration is more severe, there is a positive relationship between the Barthel's index and MMSE values. If there is some improvement in one of the values, the other one improves too, and the other way round, if a value gets worse, so does the other (sig. 0.001). The same does not occur in the Jaume Nadal centre, where cognitive deterioration is less severe and there is no relationship (sig. 0.081).

The relationship is also positive when considering the two centres together (sig. 0.003).

The results seem to suggest that the greater the cognitive deterioration is, the more it affects the level of functional dependence. Further studies are needed to confirm the current results.

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Col·legi de Fisioterapeutes de Catalunya

PHYSIOTHERAPY UPDATES

ORIGINAL ARTICLE

INTRODUCTION TO FASCIAL TISSUE

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For quite a long time the term 'fascial tissue' was rather vague, used in anatomy to refer to the undifferentiated tissue that covered different structures and that was dissected without relating it to any adjacent structures. However, the scientific advances in the last decade (which have led to 4 editions of the *International Fascia Research Congress*) have demonstrated the importance of fasciae, both in normal and pathological functioning, in the different structures of the human body. This new, more detailed knowledge has allowed the development of new physiotherapy techniques like myofascial induction, fascial manipulation or the *Scar Modelling Technique*, and has helped to back up the effectiveness of existing techniques.

The aim of this article is to provide a brief introduction to fascial tissue based on some of the most relevant and recent publications on this topic so that the therapist can better understand the nature of this tissue and its importance in manual treatments, which are commonly used in everyday practice.

FASCIAE AND THEIR ORIGIN

The term fascia comes from Latin and etymologically it means "long, narrow strip or band". The Roman encyclopaedist Celsus, in his work *De re medica*, used the term to refer to the therapeutic action of bandaging or dressing injuries (1). Later on, Galenus was one of the first to relate this term to what we know understand as subcutaneous cellular tissue. But it was not until Vesalius that the term was connected with a structure close to muscle tissue (1). Although nowadays there are still discrepancies regarding its definition (2,3), the term *fascia* can be defined as a "viscoelastic, functional, and three-dimensional network of connective tissue, made up basically of collagen fibres (4,5), which surrounds and interpenetrates all the structures of the human body in all directions, and which is difficult to isolate as a whole" (6).

Not many studies exist on the ontogeny of fasciae in general, but the importance and functions of mesenchymal tissue of mesodermal origin (as a key and indispensable element of the morphogenesis of the musculoskeletal system) have been widely studied in animals (7-9). Recently it has been demonstrated how this transition from an undifferentiated and poorly organised tissue into a more mature tissue with variable morphotypes (according to region and their distribution), occurs within weeks 22-39 of human foetal development (10). Thus, initially it is fascial undifferentiated fibroblasts which indicate myoblasts about their precise distribution depending on the specific muscle they will make, whereas the continuous dialogue between these two elements will continue into their maturity, that of the muscular tissue and that of the fascial tissue (10).

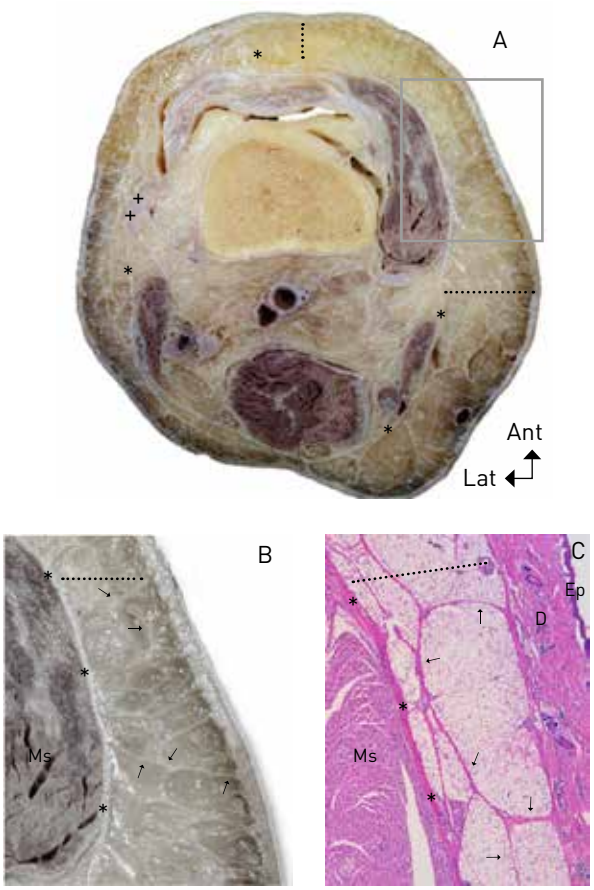
CLASSIFICATION OF FASCIAE

The concept of fascia is quite generic, so different classification systems have been proposed. Some of them are based on the structure or the tissue with which fasciae interact and we can then distinguish between neurofascia (covering nervous tissue), visceral fascia (surrounding viscera) and myofascial (covering and related to muscles). Other more integrative classifications take into account both anatomical and histological and functional characteristics (11). However, the classification system which is the most commonly used and

accepted by the International Nomina Anatomica categorises fasciae based on their location in the human body into superficial and deep fasciae (Fig. 1).

Figure 1

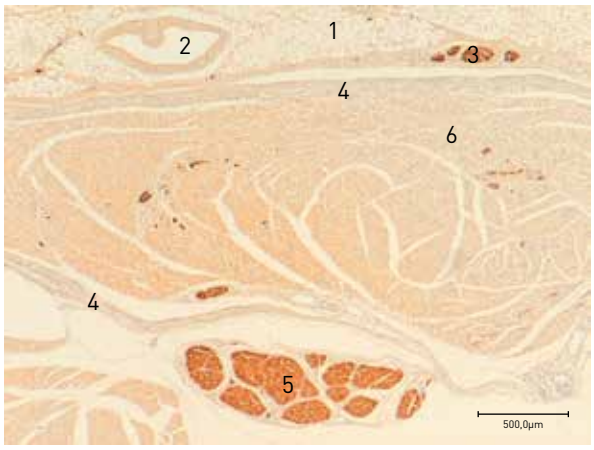
A. Transversal cut of the distal third of the thigh, phenol sample. The thickness of the superficial fascia (dotted line) and deep fascia (*) are marked. The thickening of the deep fascia (++) in the ilioitibial part is shown. Anatomical (B) and histological (C) enlargement of Figure A. The variable thickness of the superficial fascia (dotted line) and how the adipose tissue it is made up of is compartmentalized (arrows), forming the cutaneous retinaculum, are indicated. The relationship of the fascial tissue with the epidermis (Ep), dermis (D), hypoderma (or superficial fascia, marked with a dotted line) and deep fascia (*), as well as muscular tissue (Ms), are marked. The image (C) shows an embryo sample, dyed with hematoxylin-eosin.



Superficial fascia consists of adipose and connective tissue and is found immediately underneath the skin (12) (Fig. 1). This structure, apart from being a storage medium of adipose tissue, also contains nerves and vessels (13) (Fig. 2). It is made up of networks of dense and/or lax connective tissue that goes from the subcutaneous layer to the deep fascia and forms different walls in all directions comprising a three-dimensional network typically known as cutaneous retinaculum (Fig. 1.B and 1.C). These walls connect the superficial fascia with the dermis and store superficial fat in small compartments, they also determine the fascia's capacity of sliding and defining both body form and shape (14).

Figure 2

Embryo image of the flexor carpi ulnaris, dyed with s100. In the superficial fascia (1) there is a variable deposit of fat, with veins (2) and cutaneous nerves (3). At a deeper level, the close relationship of the deep fascia (4) with muscular tissue (6) and nervous tissue (5) is shown (this latter connection is very important in adults when using peripheral nerve mobilization).



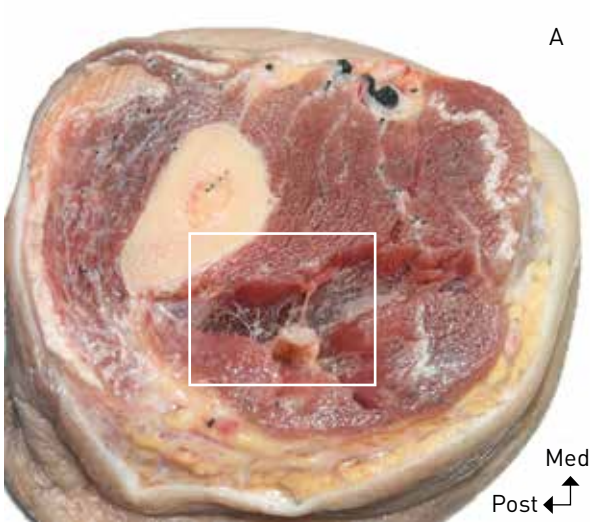
Deep fascia is made up of dense, regular connective tissue (Fig. 1) that is histologically distributed in a maximum of three layers with small quantities of lax connective tissue in between them (15, 16). Its thickness and direction varies (Fig. 3), and they could increase if undergoing excessive mechanical demand (17). This fascia covers and surrounds the muscles, viscera, vessels and nerves. It forms retinacula and compartments or septa, which group muscles according to their main functions (for example, flexors and extensors).

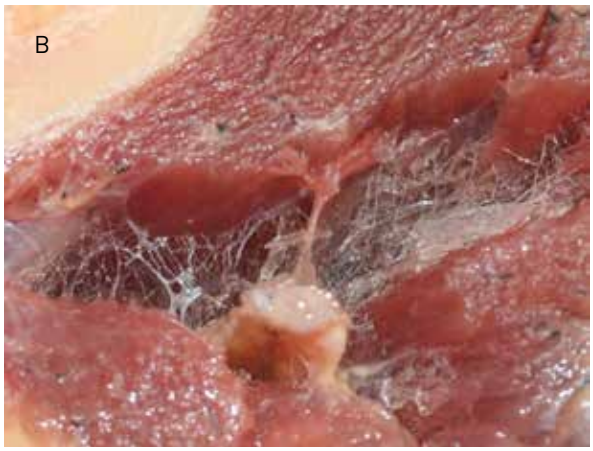
It also allows continuity between separated regions or anatomical structures, such as the fascial continuity between the pectoral and brachial areas (18) or the thoracolumbar fascia and the long head of the femoral biceps through the sacrotuberous ligament (19,20-22); relations that, depending on the bibliography, are described as myofascial meridians, channels or chains. This type of fascia is also responsible for the subdivision and compartmentalization of the different tissues, through epi-, peri-, and endostructures (Fig. 4).

The continuity and subdivisions of the deep fascia allow 30% of the power generated by a contraction in the muscular tissue to be transmitted through the

Figure 3

A. Transversal cut of cryopreserved arm. The image shows how the fascial tissue covers and connects all the anatomical structures. B. Enlargement of the image, the multidirectionality of the fascial tissue, its relationship with surrounding structures and the compartmentalization of the different types of tissue are shown.





fascia and not through the muscular tissue and this to be done with synergic and antagonists muscles alike (23-26).

COMPOSITION OF FASCIA

Although fascial composition is similar to the rest of structures that form connective tissue, fasciae present a higher degree of irregularity in the distribution of their fibres (particularly when comparing fasciae to ligaments or tendons) and a variable composition of lax connective tissue (greater in deep fascia) or denser tissue (when analysing intermuscular fascia or septa) (27). Therefore, the histological composition of connective tissue (and consequently of all its components, including fasciae) is:

Figure 4

Relationship of fascial tissue with tendinous tissue. The epitendon (EpT) surrounds the whole tendon. The peritendon (PeT) covers tendinous bundles and the endotendon (EnT) surrounds each and every tendinous cell.

Extracellular matrix: it is all the extracellular components that are part of fascial tissue. We can find:

- **Elastin fibres**. It is a protein whose network distribution gives fascial tissue elasticity and, at the same time, resilience (28).
- **Collagen fibres** (mainly type I). Their distribution provides resistance and helps fascial tissue to adhere (17,28).
- **Reticular fibres**. These fibres predominate in the embrionary phase of fascial tissue and are eventually substituted by collagen fibres. Their presence, together with collagen fibres, contributes to the sliding of fasciae (29).

Cells:

- **Fibroblasts**. They are spindle-shaped cells with extensions whose main function is to secrete the components of the extracellular matrix, among which essential proteins for fasciae (elastin and collagen). They can easily adapt and remodel themselves in response to the different mechanical stimuli they receive (30-32).
- **Myofibroblasts**. They allow fascial tissue to contract to a certain extent (33-35), but their presence is not that clear in human fasciae since they have only been found in animal or pathological fasciae.
- **Adipose cells**. They accompany fibroblasts and their main function is to store lipids.
- **Macrophages**. They eliminate cellular and tissular debris and prepare fascial tissue for cicatrisation (36).

Ground substance: It occupies all the space in between cells and fibres of connective tissue. It is a viscous substance formed by long molecules of proteoglycans and glycosaminoglycans with hydrophilic properties, which allow nutrients and waste matter to circulate. Hyaluronic acid is one of the molecules most commonly found in ground substance and it enhances the sliding between fascial and muscular tissue (37,38). Lately, some studies suggest that the molecules of hyaluronic acid in fascial tissue may be connected with myofascial pain syndrome (39,40).

MAIN PROPERTIES AND FUNCTIONS OF FASCIA

The anatomical and histological composition of fascia gives it three key properties for its behaviour and treatment. These are: tensegrity, thixotropy, and piezoelectricity. Tensegrity of fascial tissue is one of the main characteristics of fascia, which allows us to understand how the increase in tension in a tissue can be stabilised or compensated by increasing tension in some of its parts (41) and so transfer this tension to all the elements in the tissue (42). This property can help the therapist to understand the concept of globalness and unity of the human being and account for the response of the human body to excessive tension or compression that can either be felt at the same site or somewhere else in the body. Thixotropy in fascia is made possible by the ground substance and it refers to the thinning property of this tissue when mechanical or thermic energy is applied, which then returns to its original state when this energy stops (43). This might explain why some fascial therapies are applied in a slow and continuous way like the *Scar Modelling Technique* (44). Piezoelectricity is given by the collagen in the fascia and is the capacity of generating some response resulting from mechanical pressure (45). All these properties make fascia one of the few tissues able to modify their consistency when it undergoes manipulation or tension (46,47), thus having an effect at cellular level.

The histological characteristics of fascia also account for its main functions (25,48), and some of the most important ones are:

- Compartmentalisation, support, and fixation (10,49).
- Transmission of forces (23,26).
- Absorption and dissemination of tensions (50).
- Coordination of movements (19).
- Facilitation of circulatory return and haemodynamics (51).
- Connection between different systems of the human body.
- Contribution to diffusion of nutrients and other elements, since fascial tissue has blood vessels that nourish surrounding tissues.

In short, fasciae form an exoskeleton that turns the body into a whole and that relates, interconnects and coordinates all the regions of the body (12).

CLINICAL IMPLICATIONS OF FASCIA

The importance of fascia for the therapist lies in the implication of this tissue in pathological processes. Frozen shoulder, plantar fasciitis, trigger points, or, more generally, fascial or myofascial restrictions (that can lead to articular and muscular movement restrictions) are some examples of fascial dysfunctions that therapists often have to treat. Thus, in patients with chronic lumbago, it's been observed how the fascia in that area was 25% thicker compared to healthy patients, with collagen fibre degradation, and microcalcifications (52). This tissue is also involved in scar formation and connective tissue fibrosis (53), which can lead to some limitation in sliding not only between different anatomical planes but also between different viscera (54) or nerves (principle of neurodynamics or peripheral nerve manipulation (55)). The latter case may cause neuropathies and nerve compressions close to the restriction site (56-58).

As if the properties and functions of fascia were not important enough for the clinical practice, it must be underlined that this tissue is the base of many medical, rehabilitation, and physiotherapy techniques. The fascial compartments and interfascial space are used for different anaesthetic routes and for blocking pain in different parts of the body (59,60). The principles of acupuncture and dry puncture are also based on fascial tissue. Some of the acupuncture points are distributed along the exit or perforation route of a cutaneous nerve of the deep fascia (61). Different studies have demonstrated that when inserting and rotating acupuncture needles, a small bundle of collage forms around the needle, which causes a mechanical stimulus and helps in the restoration of the extracellular matrix of connective tissue (62-65), which explains part of the effectiveness of acupuncture and dry puncture. In the same way, most of the beneficial effects of massage are based on the principle of tensegrity of fasciae (66), which accounts for the fact that, when massaging some parts of the body, motion range and flexibility increase and pain decreases (67,68). The effectiveness of some manual methods on meningeal or visceral structures can also be accounted for by the fascial bridges between suboccipital muscles and the dura mater (69) or the links and connections between fasciae and viscera (70).

CONCLUSION

Taking into account everything aforementioned, fascia is demonstrated to be an important tissue that works as an integrative structure of human anatomy, particularly of the musculoskeletal system. Because of that, the general term of pathology or muscular tear should be revised and the type of fascia involved in the lesion, determined. We should concentrate our therapeutic efforts not only on the contractile part of the musculoskeletal system but also on its fascial components.

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Col·legi de Fisioterapeutes de Catalunya

PHYSIOTHERAPY UPDATES

TRANSLATED ARTICLES

"WII-HABILITATION" IN PARKINSON'S DISEASE AND MULTIPLE SCLEROSIS

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This article has been translated from the Catalan translation of the original text in French. Original publication:
"Oui à la Wii™ pour la rééducation dans la maladie de Parkinson et la sclérose en plaques". Kinesither Rev 2015;15(162):63-9.

ABSTRACT

Objectives. To inventory the use of video games in balance rehabilitation for patients with Parkinson's disease and multiple sclerosis.

Method. PubMed search between September and October 2013.

Results. Nine English-language studies were selected.

Discussion. Video games are promising for static and dynamic rehabilitation of balance disorder, although less effective than work with a physiotherapist. They are a good complement to conventional rehabilitation and can be used at home by patients with a good functional level.

Level of evidence. Not applicable.

KEYWORDS: Balance. Parkinson's disease. Rehabilitation. Multiple sclerosis. Wii Fit.

INTRODUCTION

Parkinson's disease (PD) and multiple sclerosis (MS) are two chronic diseases of the central nervous system. PD affects between 70,000 and 80,000 people in France and every year around 4,000 more people are diagnosed with it according to the Fondation pour l'Aide à la Recherche sur la Sclérose En Plaques (ARSEP). It is the first non-traumatic cause of severe disability among young people. MS affects approximately 150,000 people in France and 14,000 new cases are diagnosed every year according to France Parkinson. It is the second most severe cause of motor disability among the elderly after strokes.

Re-education for these pathologies is a priority so that patients can optimise their capacities and combat social isolation. Balance or deep sensitivity disorders are important and falls are their main complication, affecting 55.8% of patients with MS between 2 and 6.5 on the Expanded Disability Status Scale (EDSS) [1] and 68.3% of patients with PD between 1 and 4 on the Hoehn and Yahr scale [2].

For the treatment of these disorders, virtual reality has already proven to be effecti [3, 4, 5]. But these devices are so expensive for the moment that they cannot be democratised. However, nowadays we can find quite interesting video games at affordable prices. Sony Playstation EyeToy®, Nintendo Wii® and the peripheral Kinect d'Xbox® were launched on the market in 2003, 2007 and 2010 respectively and they are promising tools for the rehabilitation of balance problems. In just a year, the number of publications on this topic has doubled (In PubMed, using the key words EyeToy, Wii, Kinect and Rehabilitation: 104 studies between 2012 and the present date, and 52 before 2012). But only post-CVA rehabilitation has been specifically studied. Regarding PD and MS, there are less publications and, up to now and to our knowledge, there is no single review of the literature in French or English.

The aim of this study is to describe the effectiveness of video games in the rehabilitation of static and dynamic balance in PD and MS.

METHOD

We searched for studies on balance re-education of patients with PD and MS by means of videogames (Nintendo Wii®, Xbox Kinect® and Sony Playstation EyeToy®) in the PubMed search engine using the following key words: Wii, Kinect, EyeToy, *Video games*, Parkinson's disease and Multiple sclerosis. The final search was done on 10th October 2013.

Eleven results for PD and eight for MS were obtained. Those studies that were not on balance re-education (only upper limb rehabilitation), qualitative studies and those on the assessment of motor and balance capacities not including re-education were excluded. Another study was excluded due to lack of financial resources to obtain it (Table I).

Table I

Results of the bibliographical search and exclusion criteria.

	Parkinson's disease	Multiple sclerosis
Results before exclusion	11	8
Upper limb re-education	-3	
Qualitative studies	-1	-1
No re-education	-3	
Comment of article		-1
Financial resources		-1
Total after exclusion	4	5

RESULTS

There were a total of nine studies in English, in all of them Nintendo Wii® was used, and in 8 of them, Wii Fit Plus. None of these studies included other videogame systems available to the general public like Xbox Kinect® and Sony Playstation EyeToy®.

The Wii Fit Plus games are played with the Wii Balance Board (WBB), a platform with a pressure sensor in each corner. WBB calculates the player's weight distribution and determines the centre of pressure (COP), the projection of the centre of gravity on the ground (Fig. 1).

Figure 1

Centre of pressure.

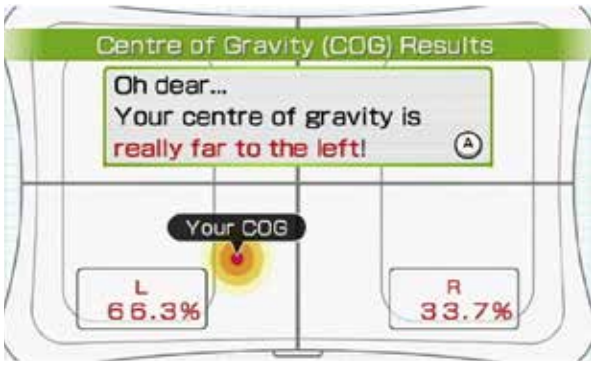

Figure 2

Balance training games (from left to right and from top to bottom: Fishing under the sea, Tightrope Walking, Hula-hoop, Jogging, Snowboard, Skiing, Table Tilt, Down the river, Soccer Heading).

The Wii Fit games are played displacing the player's own COP by doing flexibility exercises, physical training exercises and balance training games (Fig. 2). They all use a kind of visual and auditory feedback that helps correct the player's position and orientation.

Multiple sclerosis

Five studies on MS were selected (Table II).

The participants' age ranges from 25 to 65 years and they were diagnosed with MS more than 3 years ago. They

Table II

Selected studies (MS).

Author	Population	Protocol	Results
Nilsagård *et al.* (2013) (3)	84 participants randomly assigned to 2 groups (MSIS 72,9, MS for 12,3 years)	Experimental group: Wii Fit Control group: no reeducation. The patients physical activity is not limited outside study	↑ FSST Timed Chair Stands, DGI, ABC, MSWS-12. No significant difference between grous.
Prosperini *et al.* (2013) (4)	36 participants randomly assigned to 2 groups (EDSS between 1,5 and 5, MS for 1,7 years)	Wii Fit at home (alternating groups A and B)	↑ stabilometry, FSST, 5-FWT, MSIS-29. Effectiveness for both groups. Reduction in number of falls
Brichetto *et al.* (2013) (5)	36 participants randomly assigned to 2 groups (EDSS < 6, MS for 11,7 years)	Experimental group: Wii Fit Control group: static and dynamic balance exercises	↑ BBS, MFIS and stabilometry favourable to experimental group
Guidi *et al.* (2013) (6)	17 participants randomly assigned to 2 groups (EDSS between 0 and 3,5, MS > 3 years)	Experimental group: Wii Fit Control group: advice to prevent falls	↑ BBS and stabilometry in experimental group. No improvement in control group
Plow *et al.* (2011) (7)	30 participants (EDSS between 1 and 6, MS for 9 years)	Wii Fit at home	↑ MFIS, TUG and unipedal balance

MS: Multiple sclerosis; MSIS: Multiple Sclerosis Impact Scale; EDSS: Expanded Disability Status Scale; BBS: Berg Balance Scale; TUG: Timed Up and Go; FSST: Four Step Square Test; 25-FWT: 25 Foot Walk Test; DGI: Dynamic Gait Index; ABC: Activities-specific Balance Confidence Scale; MFIS: Modified Fatigue Impact Scale; MSWS: Multiple Sclerosis Walking Scale.

have balance problems but do not need help to walk or only a walking stick in one hand. Their disability goes from mild to moderate, from 1 to 6 on the EDSS scale.

The Wii Fit games used in the studies are: Fishing under the sea, Skiing, Score a ten, Soccer Heading, Table Tilt, Tightrope Walking, Down the river, Snowboard, Skateboard, and Zazen (3, 4, 5, 7). These games require players to transfer their weight in all directions, except Zazen, where players have to stay as still as possible on the WBB. The patients are also advised to do some exercises from the muscular training and yoga programmes (7). Only one study does not use Wii Fit games but programmed games to be done on the WBB: a progressive sequence of 6 static and dynamic balance exercises, on one leg and increasing difficulty (6).

Parkinson's disease

Four studies on PD were selected (Table III).

The participants' age ranges from 50 to 85 years and were diagnosed with PD more than 4 years ago. The evolution of the disease is classified between 1 (unilateral, mild disability) and 3 (bilateral, postural instability) on the Hoehn and Yahr scale.

The Wii Fit Plus games used in the study are: Tilt City, Rhythm Parade, Obstacle Course, Soccer Heading, Steps, Jogging, Skiing, Ski Jump, Down the river, and Hula-Hoop (8, 9, 10, 11). Some of the exercises from the tone up and yoga exercises were included: Torsions, Stretching (8) and Deep Breathing (10). These games require the player to displace the centre of gravity in different directions and also to take alternative steps or keep his/her centre of gravity.

DISCUSSION

Multiple sclerosis

All the studies show the effectiveness of a rehabilitation programme using Wii Balance Board (WBB).

In their studies, Guidi *et al.* (6) and Brichetto *et al.* (5) observe a greater improvement in the results for the experimental group in comparison to the control group, particularly regarding the measures on the stabilometry platform with a reduction in the displacement of the centre of pressure (COP) (–36,3 mm^2 ± 11,8 versus –1,2 mm^2 ± 15 with eyes open, –117,4 mm^2 ± 46,1 versus +10,9 mm^2 ± 39,7 with eyes closed) which demonstrates the effectiveness of static balance exercises with visual feedback. Plow *et al.* (7) also show an improvement in static balance with unipedal balance (+4.7 s ± 13.4 with eyes open and +6.6 s ± 5.5 with eyes closed).

Table III

Selected studies (PD).

Author	Population	Protocol	Results
Pompeu *et al.* (2012) (8)	32 participants (from 1 to 2 on the Hoehn and Yahr scale, PD for 5 years) randomly assigned to 2 groups	30 min warm up Experimental group: Wii Fit Control group: 30 min balance exercises with Ph	↑ UPDRS-II, BBS, UST. No significant difference between the two groups
Dos Santos Mendes *et al.* (2012) (9)	30 participants (from 1 to 2 on the Hoehn and Yahr scale, PD for 4,7 years, 11 healthy, aging participants	30 min warm up and 30 min Wii Fit, twice a week (7 weeks)	Same learning capacities for participants with Parkinson's and healthy participants: ↑ Functionnal Reach Test and scores in games
Esculier *et al.* (2012) (10)	11 participants with Parkinson's (18,4 in the UPDRS, PD for 8,5 years)	9 healthy, aging participants, Wii Fit at home, 30 min, 3 times a week (6 weeks)	Participants with Parkinson's: ↑ TUG, STST, unipedal balance, 10-m Walk Test, CBM, Tinetti and stabilometry Healthy participants: ↑ TUG, STST, unipedal balance and CBM
Mhatre *et al.* (2013) (11)	10 participants with Parkinson's (from 2,5 to 3 on the Hoehn and Yahr scale)	10 participants with Parkinson's (from 2,5 to 3 on the Hoehn and Yahr scale)	↑ BBS, DGI, SRT, GDS and stabilometry. No improvement in balance confidence

PD: Parkinson's disease; UPDRS: Unified Parkinson's Disease Rating Scale; BBS: Berg Balance Scale; UST: Unipedal Stance Test; STST: Sit To Stand Test; SRT: Sharpened Romberg Test; TUG: Timed Up and Go; DGI: Dynamic Gait Index; GDS: Geriatric Depression Scale; CBM: Community Balance and Mobility Scale; Ph: physiotherapist

For Brichetto *et al.* (5) rehabilitation with WBB seems to be more effective than a standard type of rehabilitation for balance disorders in patients with MS. But the rehabilitation protocol for the control group was not well defined and, even more significantly, the measures only refer to static balance. Although these results show there is a real interest in the experimental group, they must be explained. Prosperini *et al.* (4) i Nilsagård *et al.* (3), who are interested in dynamic balance, express reservations and question these observations.

Nilsagård *et al.*'s study (3) shows no significant difference between the two groups after training. Only the experimental group benefits from the Wii rehabilitation programme for balance disorders but the groups are clearly distinguished by the frequency of exercise performed outside the protocol: on average, 13.6 sessions per person for the experimental group and 22, for the control group during the study. This exercise, which can be considered a kind of self-re-education, had then positive effects and the results at the end of the study are equivalent for both groups. However, in the experimental group the improvement is statistically significant for all the measures except for 25-FWT, whereas in the control group, the improvement is significant only for FSST and DGI, which shows an advantage of re-education for the experimental group.

In the study by Prosperini *et al.* (13), ethe authors show that a 12-week Wii training programme improves static and dynamic balance and reduces the impact of MS on quality of life (–10.5 ± 7.6 points on MSIS-29, where a change of 8 points is clinically significant (12)). This is verified by the measures taken on the stabilometry platform (–130 mm ± 96.3 versus +32 mm ± 84.8), which seems to be better adjusted than a clinical test such as BBS in the prediction of accidental falls in a period of 3 months. But according to some previous studies done by the same authors, training with a WBB seems to have more limited effectiveness than balance training with a physiotherapist (Ph) (14, 15, 16).

Nevertheless, an interesting aspect must be emphasised: training with a WBB, particularly used when re-educating static balance, shows an improvement in gait and dynamic balance performance (FSST [second]: –2.95 s ± 3.5 versus +0.2 s ± 3.2). The same result found by Nilsagård *et al.* (3) and Plow *et al.* (7), with an improvement on the TUG-DT (dual task) (–1.9 s ± 4.2 and –2.6 s ± 2.4 respectively). Greater performance on dynamic balance can be accounted for by better postural control and muscular reinforcement provided by the weight transfers required by the games. But after 12 weeks without training, only the performance on static balance (measures with a stabilometry platform (–2 mm ± 108.1) are maintained, which brings more benefits of Wii Fit games for static balance training than for dynamic balance, gait speed, and long-term quality of life (4). There is a tendency towards the scores obtained before the training. So, the training should continue in order to maintain the gained benefits. On the other hand, standard deviation is important in both groups, which shows that the improvement of the measured parameters varies considerably in each patient. In fact the WBB cannot be considered an alternative to standard re-education but an interesting complement.

This type of training may also reduce the risk of falls in patients with MS.

After gathering all the data for the study by Nilsagård *et al.* (3), the experimental group amounts to a total of 10 falls during the study compared to the 14 falls in the control group (outside the intervention). In the study by Prosperini *et al.* (4), the proportion of falls decreased: 50% of participants were non-fallers at the end of the study versus 35% at the beginning.

Parkinson's disease

All the authors demonstrate an improvement in balance of the patients in the studies.

Pompeu *et al.* (8) show a greater improvement in static balance in the experimental group, measured for unipedal balance (+9.5 s ± 10.5 versus +4.1 s ± 15.5 on the UST with eyes open and +1.3 s ± 3 versus +1.2 s ± 2.1 on the UST with eyes closed). However, in comparison to asymptomatic, aging patients, Esculier *et al.* (10) show that this improvement is significantly produced later on and is less remarkable in patients with Parkinson's (+15.2 s in patients with Parkinson's versus +18.1 s in asymptomatic, aging patients). It is worth mentioning that Esculier et al. get better results for unipedal balance than Pompeu *et al*. This difference may be accounted for by the difference in the protocols used, since the one used by Esculier *et al.* is more intense (three sessions per week compared to two sessions per week by Pompeu *et al.*). What is more, the increase in the number of repetitions for the STST shows an improvement in lower limb strength (10). In fact, the proposed games often require to have the knees flexed so that lower limb resistance is also worked.

In the study by Dos Santos Mendes *et al.* (9), there is a significant improvement in the Functional Reach Test after training and the scores are the same two months later. Pompeu *et al.* claim the same and the results of static balance are basically identical 60 days after the study.

Postural balance is assessed by Mhatre *et al.* (11) using the WBB. There is a 31% reduction in the movements of the centre of pressure (COP) in static stance (bipedal, eyes open) and the dynamic stance assessment (tracking tasks) shows a 7% reduction in tracking tasks. These results are repeated when assessing gait: according to Esculier *et al.* (10) the 10m Walk Test improved for the participants with Parkinson's (-0.7 s) and the Dynamic Gait Index (DGI) shows an increase of 17%. The result is clinically significant for a change

above 13% (17). These results reveal an improvement of voluntary control of COP, which is important for any gait direction changes.

The Berg Balance Scale (BBS) reveals in the study by Mhatre *et al.* (11) a significant improvement of 3.3 points, that is to say, a 16.2% reduction in the risk of falls.

According to these studies, dynamic balance also improves throughout the training sessions.

Pompeu *et al.* (8) consider these progresses to be transferable to daily living activities (–0.7 ± 2.8 on the UPDRS-II). But there is little improvement in dual task activities (+2.2 s ± 9.4 in the UST with eyes open with dual task). According to the authors, a larger test repetition would be needed so that this could lead to automatization, and so divert attention to other tasks.

Some authors are interested in the participants' feelings regarding the use of Wii. The ABC scale does not yield a significant result (10,11), which demonstrates there is no improvement in the patients' confidence in their own balance.

A personalised questionnaire allowed to assess the participant's level of satisfaction: 50% liked it a lot, 33% liked it, 17% were neutral and no one disliked it. The participants reported having rehabilitation with their spouses, children or grandchildren at home as something positive (10). Wii can then be used as a complement in order to increase the patient's motivation and implication in their long-term rehabilitation, which would contribute to a functional improvement and would prevent the negative consequences of immobility (8).

According to Esculier *et al.* (10), the visual and auditory feedback provided by these games activates the reward circuitry, which is beneficial for patients with Parkinson's (18,19). But this reward circuitry could fail if the results stop improving and demotivate the patient. The learning and memorization ability of Parkinson's sufferers depends on exercise. In the study by Dos Santos Mendes *et al.* (9), from the 10 proposed games, three do not show any kind of evolution in the performance of patients with Parkinson's in comparison to healthy aging patients (Obstacle Course, Footing Plus, Soccer Heading). It is therefore important to choose the most appropriate game for each patient.

Limitations

The main limitation of this literature review is the small number of publications on this topic. We have focused on a single database for our search, MEDLINE (PubMed search engine), since it is the most relevant database in the field of biomedical research. But there is no doubt that the number of published studies that examine the use of videogames as part of re-education will continue to increase and it would be interesting to do a systematic review or even a meta-analysis in the next few years.

CONCLUSIONS

These results suggest that the use of WBB balance training programmes is promising if we want to improve the dynamic and static balance of patients with PD and MS. These exercises also require the activation of other parameters like resistance, strength or proprioception with positive effects on gait quality and on the impact of the disease on everyday life. These repercussions persist in time if exercise is done regularly but the tendency is to go back to the initial state after 12 weeks with no exercise (4). On the other hand, 3 sessions per week are more effective than two, each session lasting 30 minutes on average (8,10). A combination of domiciliary Wii exercises with a Ph may offer a new perspective to be taken into account from the very early stages of the disease. The games that have proven to be effective for MS are: : Fishing under the sea, Skiing, Score a ten, Soccer Heading, Table Tilt, Tightrope Walking, Down the river, Snowboard, Skateboard, and Zazen and for PD: Tilt City, Rhythm Parade, Steps, Skiing, Ski Jump, Down the river, and Hula-Hoop. Soccer heading, Jogging and Obstacle Course have proven to be ineffective for improvement factors in patients with Parkinson's.

Nevertheless, we must be cautious when using these videogames because they need to be used together with the patient at the beginning of the treatment. In a qualitative study based on interviews, 30 patients with MS, after spending 14 weeks doing a domiciliary training programme using Wii Fit, reported having greater self-confidence in their capacities. But some patients also felt somehow intimidated when using the Wii exercise programme or they were afraid of falling. The comments of the results the game itself makes made the patients even more aware of their disabilities. The Wii Fit game, which can be personalised up to a certain extent, cannot be adapted to all functional levels and this can discourage patients with severe forms of the disease (20).

Taking into account the evolution of these pathologies, it would be advisable to do further studies to assess the possibilities of these technologies when treating patients with a more severe disability level to check if the results are also promising and if this type of re-education programmes can be included in the rehabilitation with a Ph in all the stages of the disease.

Highlights

- Balance disorders are a severe complication in Parkinson's disease and multiple sclerosis.
- Using the Wii Balance Board® is motivating and gives good results in static and dynamic balance.
- A combination of domiciliary Wii exercises with a Ph may offer a new perspective to be taken into account.

- The proposed Wii Fit Plus® games cannot be adapted to all levels and patients may need to be monitored at the beginning of their treatment.

Declaration of interests

The authors declare no conflict of interest in relation to this article.

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PHYSIOTHERAPY UPDATES

ASSESSMENT OF A PROGRAMME OF NEURAL MOBILIZATIONS IN ASYMPTOMATIC YOUNG HIGH-PERFORMING SPORTSPEOPLE

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ABSTRACT

One of the main properties of the nervous system is its mechanosensitivity, which can be affected by the practice of sport. The aim of this study is to assess whether neural mobilizations performed on healthy adolescent high-performing sportspeople after training can improve the mechanosensitivity of the nervous system.

A randomised clinical trial was conducted. The participants were 67 high-performing basketball, handball, and volleyball players between 14 and 17 years of age. The participants were divided into two groups, one of the groups had a programme of passive static stretches after training and the other one had the same programme but this time including a neural mobilization exercise. The Slump test was used to assess the mechanosensitivity of the nervous system. The knee extension angle was measured in cervical flexion and extension before and after the training, on days 1, 30, and 60. The whole programme was completed by 48 participants.

For the statistical analysis, a two-way repeated measures ANOVA was used to see the differences in knee extension angle with cervical flexion and extension in the two groups throughout the three assessments.

The mean neurodynamic results of the Slump test obtained in the initial assessment of this population are 20.25°± 7° for males and 16.34°± 5° for females.

The two groups in the study developed differently with time. The intergroup study shows statistical equality in basal assessment and a statistically significant difference on day 30, which persists on day 60. Regarding the intragroup study, the experimental group presents some statistically significant differences from the very beginning to the end of the study whereas the control group does not.

In short, it seems that a two-month post-effort programme of neural mobilizations improves the mechanosensitivity of the nervous system in young elite sportspeople.

KEYWORDS: Slump Test. Mechanosensitivity. Neural Mobilization. Sports Practice. Young Athletes.

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PHYSIOTHERAPY UPDATES

TWO-YEAR EFFECTS AND COST-EFFECTIVENESS OF PELVIC FLOOR MUSCLE TRAINING IN MILD PELVIC ORGAN PROLAPSE: A RANDOMISED CONTROLLED TRIAL IN PRIMARY CARE

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ABSTRACT

Objective: Comparar els efectes i la rendibilitat econòmica de la rehabilitació del sòl pelvià (RSP) i la conducta expectant en dones amb prolapses dels òrgans pelvians.

Design: Randomised controlled trial..

Setting: Dutch general practice.

Population: Women (≥55 years) with symptomatic mild prolapse, identified by screening.

Methods: Linear multilevel analysis.

Main outcome measures: Primary outcome was change of pelvic floor symptoms (Pelvic-Floor-Distress-Inventory-20 [PFDI-20]) during 24 months. Secondary outcomes were condition-specific and general quality of life, costs, sexual functioning, prolapse stage, pelvic floor muscle function and women's perceived improvement of symptom.

Results: PFMT (n = 145) resulted in a 12.2-point (95% IC 7,2-17,2, P < 0,001) greater improvement in PFDI-20 score during 24 months compared with watchful waiting (n = 142). Participants randomised to PFMT more often reported improved symptoms (43% versus 14% for watchful waiting). Direct medical costs per person were €330 for PFMT and €91 for watchful waiting but costs for absorbent pads were lower in the PFMT group (€40 versus €77). Other secondary outcomes did not differ between groups. Post-hoc subgroup analysis demonstrated that PFMT was more effective in women experiencing higher pelvic floor symptom distress at baseline.

Conclusion: PFMT resulted in greater pelvic floor symptom improvement compared with watchful waiting. The difference was statistically significant, but below the presumed level of clinical relevance (15 points). PFMT more often led to women's perceived improvement of symptoms, lower absorbent pads costs, and was more effective in women experiencing higher pelvic floor symptom distress. Therefore, PFMT could be advised in women with bothersome symptoms of mild prolapse.

Tweetable abstract: Pelvic floor muscle training can be effective in women with bothersome symptoms of mild prolapse.

KEYWORDS: Cost-effectiveness; long-term effectiveness; pelvic floor muscle training; pelvic organ prolapse; primary care; watchful waiting.

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PHYSIOTHERAPY UPDATES

BIBLIOGRAPHICAL REVIEW OF THE EFFECTIVENESS OF ELECTRICAL STIMULATION OF THE GENIOGLOSSUS MUSCLE IN THE TREATMENT OF OBSTRUCTIVE SLEEP APNOEA HYPOPNEA SYNDROME (OSAHS)

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ABSTRACT

Antecedents

In 1978 Remmens concluded that the genioglossus (GG) muscle was the main dilator of the pharynx. His study demonstrated an increase in neuromuscular activity of the GG in the process of overcoming obstruction of the upper respiratory tract (URT). Thus electrical stimulation (ES) seemed to be an ideal treatment since the GG is a phasic muscle that is more hypertonic in patients with OSAHS than in healthy patients.

Aim

To review the treatment of the GG with ES in patients with OSAHS in articles found in Medline, Embase, and Cochrane Library.

Methods

In favour: a study by Oliven showed a reduction of intrapharyngeal critical pressure after applying ES in patients with OSAHS. There were no differences between having the electrodes implanted on the hypoglossal nerve and into the GG muscle. Later on, a study by Ludwing demonstrated that transcutaneous ES is also effective for toning the GG muscle. His study obtained an increase in the volume of the GG (3D sonographic measurement). There was no difference between placing a large electrode on the mouth's floor and having multi-point electrodes. Against: The fibre composition analysis of the pharyngeal muscles performed by Wouldson showed that the GG is a phasic muscle. Since maintaining the permeability of the URT is a typical function of type I fibres, we cannot conclude that ES of the GG is an appropriate treatment. A study by Berry found that the neuromuscular activity of the GG muscle in untreated OSAHS patients was higher than in healthy subjects.

Conclusions

Weakness of the GG muscle does not seem to be the cause of URT obstruction. Further studies are needed to conclude whether the GG acts to compensate an obstruction in the URT. More studies would also be needed to check if weakness of the tonic muscles in the URT, such as the tensor muscle of the soft palate, can cause URT obstruction.

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PHYSIOTHERAPY UPDATES

RECOMMENDATIONS ON PHYSICAL ACTIVITY AND EXERCISE FOR OLDER ADULTS LIVING IN LONG-TERM CARE FACILITIES: A TASKFORCE REPORT

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ABSTRACT

A taskforce, under the auspices of The International Association of Gerontology and Geriatrics-Global Aging Research Network (IAGG-GARN) and the IAGG European Region Clinical Section, composed of experts from the fields of exercise science and geriatrics, met in Toulouse, in December 2015, with the aim of establishing recommendations of physical activity and exercise for older adults living in long-term care facilities (LTCFs). Due to the high heterogeneity in terms of functional ability and cognitive function that characterizes older adults living in LTCFs, taskforce members established 2 sets of recommendations: recommendations for reducing sedentary behaviors for all LTCF residents and recommendations for defining specific, evidence-based guidelines for exercise training for subgroups of LTCF residents. To promote a successful implementation of recommendations, taskforce experts highlighted the importance of promoting residents' motivation and pleasure, the key factors that can be increased when taking into account residents' desires, preferences, beliefs, and attitudes toward physical activity and exercise. The importance of organizational factors related to LTCFs and health care systems were recognized by the experts. In conclusion, this taskforce report proposes standards for the elaboration of strategies to increase physical activity as well as to prescribe exercise programs for older adults living in LTCFs. This report should be used as a guide for professionals working in LTCF settings

KEYWORDS: Physical activity; elderly; exercise; functional ability; long-term care; nursing home.

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IS THERE AN ECONOMICAL RUNNING TECHNIQUE? A REVIEW OF MODIFIABLE BIOMECHANICAL FACTORS AFFECTING RUNNING ECONOMY

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ABSTRACT

Running economy (RE) has a strong relationship with running performance, and modifiable running biomechanics are a determining factor of RE. The purposes of this review were to (1) examine the intrinsic and extrinsic modifiable biomechanical factors affecting RE; (2) assess training-induced changes in RE and running biomechanics; (3) evaluate whether an economical running technique can be recommended and; (4) discuss potential areas for future research. Based on current evidence, the intrinsic factors that appeared beneficial for RE were using a preferred stride length range, which allows for stride length deviations up to 3 % shorter than preferred stride length; lower vertical oscillation; greater leg stiffness; low lower limb moment of inertia; less leg extension at toe-off; larger stride angles; alignment of the ground reaction force and leg axis during propulsion; maintaining arm swing; low thigh antagonist-agonist muscular coactivation; and low activation of lower limb muscles during propulsion. Extrinsic factors associated with a better RE were a firm, compliant shoe-surface interaction and being barefoot or wearing lightweight shoes. Several other modifiable biomechanical factors presented inconsistent relationships with RE. Running biomechanics during ground contact appeared to play an important role, specifically those during propulsion. Therefore, this phase has the strongest direct links with RE. Recurring methodological problems exist within the literature, such as cross-comparisons, assessing variables in isolation, and acute to short-term interventions. Therefore, recommending a general economical running technique should be approached with caution. Future work should focus on interdisciplinary longitudinal investigations combining RE, kinematics, kinetics, and neuromuscular and anatomical aspects, as well as applying a synergistic approach to understanding the role of kinetics

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PHYSIOTHERAPY UPDATES

LEARN HOW TO DO RESEARCH

A BIBLIOGRAPHICAL REVIEW: THE BASIS OF OUR RESEARCH

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ABSTRACT

Scientific knowledge is accumulative. Each individual research project is based on the prior knowledge gained thanks to other researchers. A bibliographical review must take into account all the previous scientific knowledge of a given topic so that the objectives of a research project or clinical intervention can be defined.

In order to undertake a proper bibliographical review, we must first clearly and correctly define the topic with a well-built PICO research question. Then we must do an exhaustive search and collect all the relevant information sources, followed by a critical selection and reading of all the gathered documents. At this stage we should do a systematic writing of the review including all the appropriate information and finally the conclusions that summarise all the knowledge gained by science in that area, as well as any open research line and gaps in the knowledge of that topic. The review must be systematic, synthetic, complete, critical, with a logical and consistent structure, updated and unbiased. A bibliographical review is a review article in itself, which can be published as such in scientific journals.

Only starting with an exhaustive bibliographical review, can we eventually plan an evidence-based research project or a clinical intervention adapted to the population we have in mind for our research.

KEY WORDS: Review. Review literature as topic. Scientific integrity review. Protocols. Research projects. Research.

Science is a great tradition, it is accumulative: each researcher, each thinker takes the path of his/her research following the steps of his/her predecessors. Science is made up of a series of little steps based on previous achievements that together allow scientific progress. Once, in a letter to Robert Hooke (February 1675), Isaac Newton wrote about his optical discoveries: "If I have seen further, it is by standing on the shoulders of giants". Any piece of research is based on previous achievements and they are all little (or not that little) steps forward in any area of scientific knowledge: physiotherapy, health sciences, or any other. That is why it is so important to know the status of the issue at hand really well; not only as a solid basis for our knowledge but also to be able to identify and pursue any potential new line. It is essential to know everything about our research topic, what aspects have been taken into account, what debates have sparked, and what are the analytical and systematic aspects of that specific topic.

In order to design a research project, we must first provide a short justification of the reasons why our research can be considered an improvement in the knowledge of that specific topic and we must also state the objectives of our research clearly. The justification part presents the state of the art in a very brief way and the contributions that our research can make to that.

After a short justification, we must start with a comprehensive bibliographical review (theoretical framework), which will be the base, the foundations of our research. This bibliographical review involves the analysis and explanation of all the concepts, definitions, hypotheses, theoretical approaches, studies and antecedents about the chosen topic. If the bibliographical review is exhaustive, we will have a solid basis for our research project.

In order to establish a good theoretical framework, we must do a complete bibliographical review: firstly, we have to find all the relevant bibliography about our research topic; secondly, we have to do a critical reading and review of the selected bibliography to evaluate all the scientific information of interest and include this knowledge providing the highest level of certainty and scientific evidence; finally, based on the selected information, we have to develop a theoretical framework including all the theories that refer to our research topic (If there is more than one).

Before elaborating our research questions we must take into account all the previous scientific knowledge on the topic. Having all the relevant scientific knowledge as the basis of our research is the easiest way to define the appropriate objectives for the practical framework of our study.

If we have a complete bibliographical review, we will be able to, based on the specific objectives of our research:

- Elaborate the most appropriate research protocol or
- Obtain the most relevant information to decide what is the best diagnostic and therapeutic approach for a specific patient. A good scientific literature review allows us to integrate the best scientific evidence with clinical expertise and the patient's values to provide the best quality healthcare.[1]

A good bibliographical review will provide us with the best evidence to answer our clinical questions with the least time possible, to ask appropriate questions during the research process, to identify the best evidence and examine its quality, reliability, exactness, and relevance.

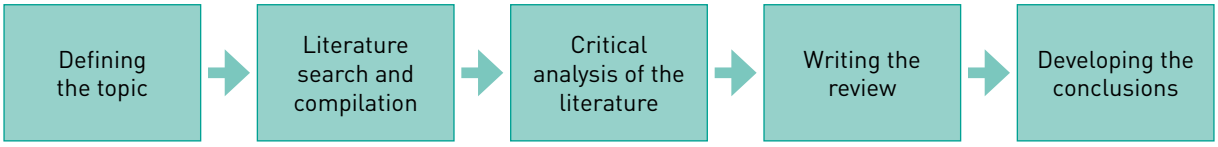
To do a bibliographical review, the following steps will be followed (Figure 1):

1. Defining the topic: formulate a specific answerable question, using the PICO format (Patient or Population, Intervention, Comparison or Control and Outcome).[2]
2. Heuristic stage: data search and collection. Develop a search profile:[3]
    a. Choosing the most relevant information about the topic from the most appropriate databases.
    b. Choosing the right key words, translating them into the language of the databases we are going to use, adapting them to the codified language of the databases (MeSH and DeCS terms).
    c. Formulating the application using search equations with Boolean operators and appropriate filters.
    d. Finding the articles, analysing and selecting the most appropriate for our research topic based on titles and abstracts, and getting the whole text of the finally chosen articles.

[1] For further information, consult the first article in this series entitled "Evidence-based physiotherapy and translational research" (Scientific Journal XII).
[2] For further information, consult the previous article in this series on PICO questions.
[3] These issues will be the focus of the next article in this series, which will be about databases, search engines and key words (Scientific Journal XII).

Figure 1

The bibliographical review process.



3. Hermeneutic stage: reading, interpretation, evaluation, and classification of each individual information source. At this stage, all the redundant articles or those that do not provide knowledge applicable to our review (excluded by title, abstract or text) must be ruled out. The selected articles must be critically read, taking into account their objectives, design, sample, methods, validity and applicability of results.[4]
4. Systematic development of the theoretical framework (reference framework): writing the final text for the review including all the bibliographical references[5], formulating theories applicable to the topic, conceptual systems and scientific knowledge in that particular area. In general, the structure of these reviews includes a short introduction, an epigraph with the methods used to do the review, a body with detailed information about the reviewed topic, and conclusions.
5. Developing final conclusions: determining the most appropriate theoretical models, identifying the possible gaps in the current available knowledge, and defining the conceptual framework and most suitable model to define our future research project (or answer a clinical question).

A good review must:

- Be concise and have well-defined, specific objectives that are not diluted in the text. It must take into account the audience it is for.
- Underline the most illustrative documents; only those that are relevant and have been personally consulted.
- Have a logical structure, be critical when presenting the knowledge and consistent with the methods, specifying any possible methodological limitations and weak points.
- Be updated: including recent articles (5 – 10 years old) but also old ones if they are important.
- Include the authors' own research in an honest way.
- Be unbiased: the most important aspect is that it presents current knowledge without just presenting evidence in favour of a specific tendency, theory or perspective. The most important thing is scientific knowledge per se and, in the case of healthcare sciences like physiotherapy, the health of the population. Literature reviews do not intend to convince anybody that a prejudged position or a given perspective is the right one. The aim of science is to extend our knowledge not give an opinion.

An adequate bibliographical review is a solid basis for our research, keeping in mind the current state of knowledge and being conscious of all the different theories and their scientific bases. Only this can produce useful results for scientific knowledge with direct application in our daily practice, which is the main objective of physiotherapists as healthcare providers.

A bibliographical review is a scientific study in itself, although it is basically a theoretical one (it does not include fieldwork but it can be the basis of a clinical study). It is a scientific study that, in spite of not being original, can be published in scientific journals because it offers a compilation of the most relevant information about a specific topic. Review articles can be:

- *Systematic reviews (evaluative or exhaustive)* that include all that has been published to date and are done by panels of experts who often use meta-analyses, or
- *Clinical or narrative reviews,* which give updated information about constantly evolving concepts, answer questions about specific topics (aetiological, diagnostic, clinical or therapeutic) or present clinical cases combined with a bibliographical review.

[4] Soon we will publish an article on the process of critical reading.
[5] Soon we will publish an article on bibliographical references and database management systems.

Only with a good bibliographical review modulated by our professional experience can we design a high-quality and reliable scientific study or an evidence-based clinical intervention plan to assist our patients with the best quality and highly personalised care, taking their opinions and values into account.

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Col·legi de Fisioterapeutes de Catalunya

PHYSIOTHERAPY UPDATES

SEARCH ENGINES, KEY WORDS (MESH, DECS), PROFILES AND BIBLIOGRAPHICAL SEARCH EQUATIONS IN PHYSIOTHERAPY

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ABSTRACT

The huge amount of published scientific evidence has made necessary the use of databases and search engines to help researchers or clinicians find what they may need at a given time. Databases include publications with a set of quality standards founded on evidence-based science. The main search engines for any topic related to physiotherapy are *PubMed* which is more general, and *PEDro,* which is more specific.

In order to find data of interest, we must enter the appropriate search term, there are different filters and operators that help us to narrow down the results to what can really be useful for our current research or clinical practice. Taking the search term, filters and operators, the search engine will generate a search equation that, when applied, will give the search related results. These will be presented as list of titles and other specific characteristics of each item that can help us find where it is deposited.

With these search results we can retrieve evidence-based scientific information for clinical practice guidelines, systematic reviews, new research, and evidence-based clinical practice.

KEY WORDS: Database. Search engine. Expert review.

The enormous amount of scientific literature existing nowadays has led to the creation of databases where any quality publication is indexed so that it is available for researchers and professionals. The correct use of search engines and databases, although not difficult, require a minimum theoretical knowledge to make the most of them.

Search engines: in the field of healthcare sciences the most widely known and more comprehensive search engine is *PubMed*, a search system developed by the *National Center for Biotechnology Information (NCBI)*, at the *National Library of Medicine (NLM)* in Washington, which gives access to databases like MEDLINE (covering all healthcare sciences with over 26 million biomedical citations) and others. Other search engines are more specific and focus on a particular disciple or initiative like the *Cochrane Plus* library of evidence-based medicine, *PEDro* (physiotherapy evidence database), CINAHL (nursing), *Osteopathic Research* (osteopathy), etc. All the search engines have help pages with advice on how to use them efficiently. The publications in the different engines must comply with some quality requirements to be accepted and indexed. These requirements include from going through an expert review process of the materials included in each publication to a long list of requirements that will guarantee the quality of these works. Therefore, the publications included in different indexes and search engines are the ones that provide a body of knowledge of scientific evidence.

Key words: all these search engines work in a similar way and usually have a basic search system that requires entering one or more terms into a text field (search box) and pressing the search button: in a matter of a few seconds the engine will retrieve the title and basic data of the scientific publications that contain the term we entered. At this stage, it is important to enter specific terms and pay attention to terminology (not syntax). It is advisable to use key words included in the MeSH (*Medical Subject Headings*), list of scientific terms, which is the terminology used to index scientific articles. To know the equivalent MeSH terms in Spanish or Portuguese, we must consult DeCS (*descriptors en les Ciències de la Salut*). For this initial basic search, it is advisable not to use punctuation marks, operators or labels in the search field.

The search engine will use a process called ATM (*Automatic Term Mapping*), which distinguishes the type of term entered as scientific term, title of journal, and name of authors. If we are looking for a specific cite, we must enter all the information we have in the search box.

Operators: operators are signs we enter as part of the search equation that help us to refine the results to what the researcher is interested in. Operators must be entered in capital letters in the query. There exist different types of operators:

- **Exact phrase operators:** by using ("...")the engine will produce hits that contain the exact text in between quotations. If we want to search the word "pain", the search will return a list of all the publications on pain; if we enter "back pain", the results will contain textually this word combination.
- **Logical or Boolean operators** are those operators that we use in a basic search. The main ones are AND, OR, NOT and if we enter them together with the key words, the results will include the publications that have both words (inclusion, AND), some of the words (disjunction, OR) or the first but not the word after the operator (exclusion, NOT). If we use two terms without quotations, the search engine will automatically select an AND operator in between them. We can include multiple operators in a single search and combine them, the engine will interpret them from left to right. Thus, the equation "low AND back AND pain" will produce publications on lumbar pain; "low AND pain AND back OR lumbago" will include the term "lumbago" in the hits.
- **Phrase operators** (nesting): placing brackets around search terms makes the engine to first process those terms in brackets. Thus, '"low back pain" NOT (infection OR cancer)' will produce a list of publications on lumbar pain of no infectious or neoplastic origin; '("low back pain" AND infection) NOT cancer)' will give a list of lumbar pain in relation to infections but not to cancer.
- **Term separation operators:** The search operator AROUND(n) will search the keywords that appear within the proximity of 'n' words. Thus, 'back AROUND(2) pain' will return results where the two words are separated by maximum two words.
- **Truncation operators (asterisk,*):** if we use an asterisk at the beginning or the end of a string of letters, the search engine will return words that end or begin with that string of letters, regardless of their beginning or end. Thus, '*therapy' will return any word that ends with the string (physiotherapy, chemotherapy, etc.) and 'physio*' will return results like physiotherapy, physiopathology, etc.

Filters: to fine tune our search and get more appropriate results, we can use filters that reduce the number of hits. The main filter categories are: type of article (clinical trial, systematic review, etc.), available text (full article, free full article, abstract), language of publication, publication years/period, animal species (article about humans, other animals, etc.), sex, age of participants in study or others (type of file, type of web, etc.). We can use different filters at the same time to obtain only the most relevant results: if we use several filters of different categories, we must use the Boolean operator "AND" in between them, and if we use different filters in the same category, we must use the Boolean operator "OR" in between them. In general, we must keep in mind that if a filter prevents yielding results, it will automati-

cally be cancelled and will not be applied and that filters are automatically applied throughout a search session if they are not cleared.

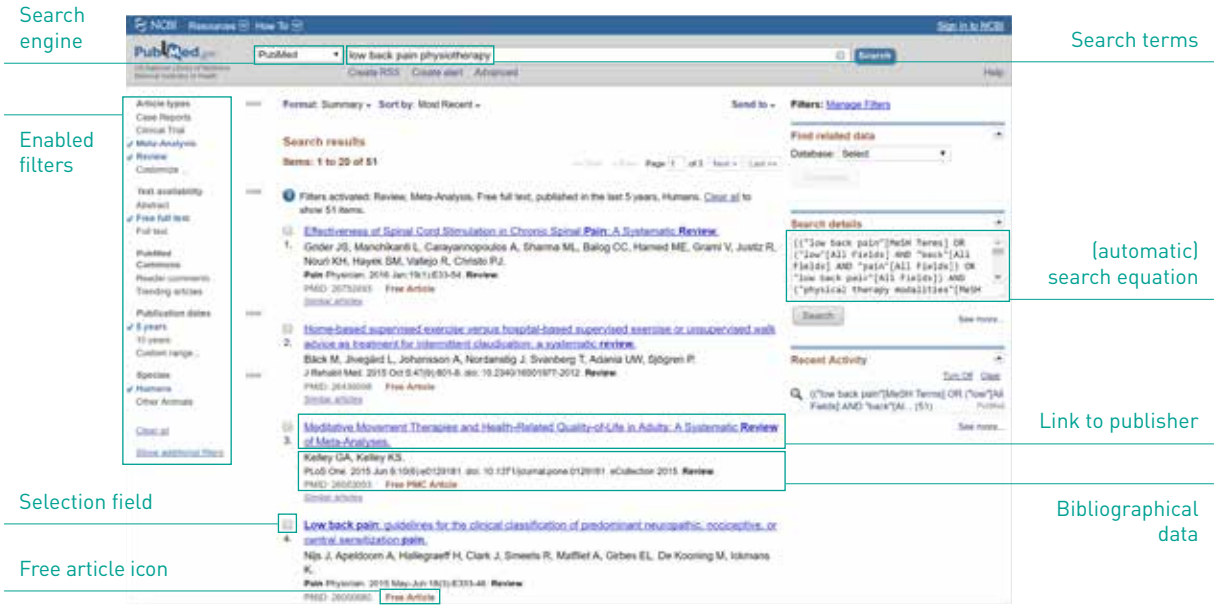
Make a search, search equations: in an advanced search, we can combine different search words and connect them with operators and filters, writing search equations to fine tune the search results to what we consider to be more interesting for us. Apart from using the PICO format, it is advisable to follow a search strategy to get only the most relevant results for our research. Writing keywords combined with filters and operators will automatically give us a search equation that can be stored and reused in the future. Search equations can also be manually written but some experience in this field is needed. For example, the automatically generated equation ((“low back pain”[MeSH Terms] OR (“low”[All Fields] AND “back”[All Fields] AND “pain”[All Fields]) OR “low back pain”[All Fields]) AND (“physical therapy modalities”[MeSH Terms] OR (“physical”[All Fields] AND “therapy”[All Fields] AND “modalities”[All Fields]) OR “physical therapy modalities”[All Fields] OR “physiotherapy”[All Fields])) AND ((Review[ptyp] OR Meta-Analysis[ptyp]) AND “loattrfree full text”[sb] AND “2011/09/22”[PDat] : “2016/09/19”[PDat] AND “humans”[MeSH Terms]) will return reviews or meta analyses about physiotherapy for lumbar pain in humans, published in the last 5 years with free texts. This equation can be stored to be reused or modified (see illustration 1).

Manage the results: the hits returned include the title and basic bibliographical data (author, publication reference, free text available, etc.) and can be selected to only see the most important one for our research. By clicking on each reference, we can access a new window showing that specific publication, so we can obtain the selected article (illustration 1 shows an example of a search in *PubMed* iand illustration 2, in *PEDro*).

Based on the results obtained in our bibliographical search, we will be able to compile this material to do a good bibliographical review[2], which will be the basis to develop clinical practice guidelines, systematic reviews, undertake new research and for evidence-based clinical practice[3].

Illustration 1

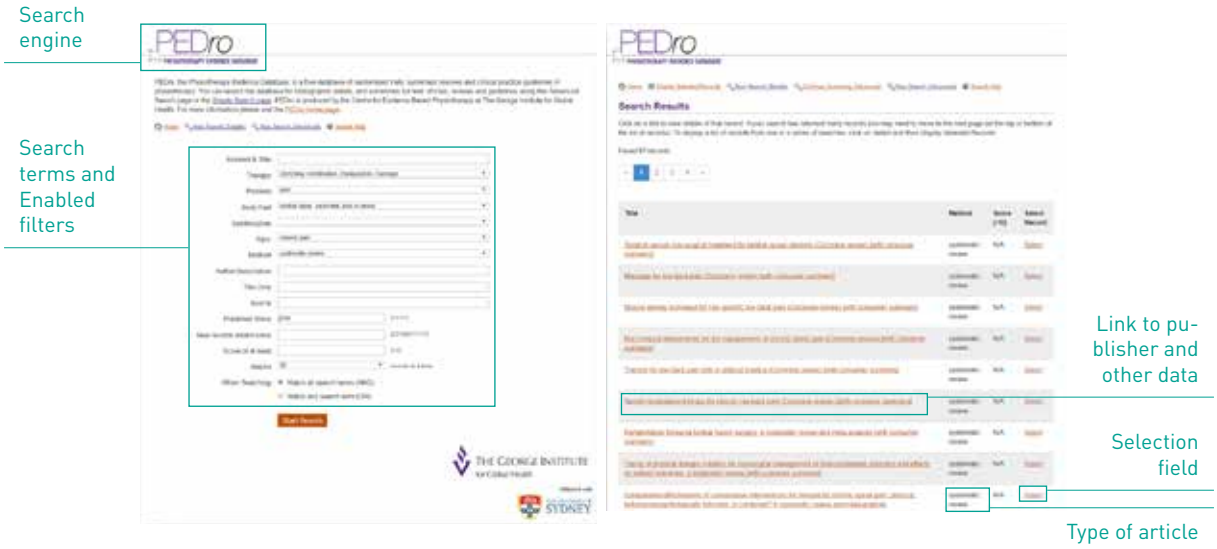
Search results in PubMed and the different fields of basic information of the result page.



[1] For further information, consult the article on PICO questions in this series.
[2] For further information, consult the previous article in this series on bibliographical reviews.
[3] For further information, consult the first article in this series entitled “Evidence-based physiotherapy and translational research”.

Illustration 2

Search results in PEDro and the different fields of basic information of the result page.



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Col·legi de Fisioterapeutes de Catalunya

PHYSIOTHERAPY UPDATES

PNEUMOTONING (OROPHARYNGEAL AND RESPIRATORY EXERCISES AND MANUAL THERAPY) TO IMPROVE THE COMPLIANCE OF CPAP IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA HYPOPNEA SYNDROME (OSAHS). PILOT STUDY

Bagué Cruz, Anna

Physiotherapist. Private practice. Postgraduate degree in chest physiotherapy. MSc in scientific evidence.

ABSTRACT

The most appropriate treatment for Obstructive Sleep Apnoea Hypopnea Syndrome (OSAHS) is *Continuous Positive Airway Pressure* (CPAP). The problem is that 30% of patients do not complete the CPAP treatment. The more obstructed the upper respiratory tract (URT) is, the higher the CPAP pressure must be but when the CPAP pressure increases, so does the patient's intolerance.

Aim. Increase the effects of CPAP through pneumotoning (PNT), which improves URT permeability by means of: oropharyngeal and respiratory exercises as well as manual therapy.

Methods. Patients (n=34), randomly assigned to two groups with sealed opaque envelopes. The intervention group had CPAP + PNT whereas the control group had CPAP. The results are compared using *U Mann Whitney* for continuous variables and a chi-squared test for nominal variables.

The initial data for the two groups were homogenous in terms of gender, age, body mass index, snoring, apne-hypopnea index, SaO^2 < 90%, smoking habits, Sleep Apnoea Quality of Life Index (SAQLI), and CPAP pressure.

Results. There is a statistically significant difference in compliance (100% in the intervention group vs 65% in the control group, p=0.01); in reduction of CPAP pressure (p= 0.04), improvement in daytime sleepiness measured with Epworth Sleepiness Scale (p= 0.01), improvement in SAQLI (p= 0.05), and in subjective intolerance to CPAP measured with the Analogic Visual Scale (p= 0.02).

Conclusion. PNT can be an additional treatment to CPAP to improve its tolerance and compliance.

PNEUMOTONING (OROPHARYNGEAL AND RESPIRATORY EXERCISES AND MANUAL THERAPY) TO IMPROVE THE COMPLIANCE OF CPAP IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA HYPOPNEA SYNDROME (OSAHS). PILOT STUDY

Author: Anna Bagué

Col·legi de Fisioterapeutes de Catalunya

Aim: To increase CPAP compliance using pneumotoning therapy (PNT) in patients with Obstructive Sleep Apnoea Hypopnea Syndrome (OSAHS). PNT includes different techniques that help improve the permeability of the upper respiratory tract (URT)

Normalization of muscle tone


diaphragm


suprahyoid muscles


masseter


temporalis


cervical muscles


infrahyoid muscles

Oropharyngeal exercises

Nasal permeability:
- open nostrils
- lingual position
- head position

Toning of URT dilator muscles:
- nasal PEP
- elevation of soft palate
- elevation of larynx
- mobilization of jaw and tongue

Respiratory exercises

Exercises to increase lung volume (help maintain lateral diameter of URT).

Prolonged expiration exercises for draining.

Use of kinesiotape at night to:

- open nostrils
- close mouth
- keep the base of tongue
- keep the muscle tone of the masseter

Results

N = 34

	Control group (CPAP)	Experimental group (CPAP + PNT)	p value
CPAP compliance	65%	100%	0.01
Δ CPAP pressure	0.6 ±1.9	3.4 ±2.4	0.04
Δ Epworth	0.6 ±0.9	7 ±1.3	0.01

Conclusions: PNT may be used as a good coadjuvant therapy to improve CPAP compliance and tolerance.

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PHYSIOTHERAPY UPDATES

28TH ANNUAL MEETING OF THE EUROPEAN ACADEMY OF CHILDHOOD DISABILITY (EACD)

Dra. Lourdes Macias
Coordinator of the CFC's Paediatric Committee

The 28th Meeting of the European Academy of Childhood Disability, together with the International Alliance of Academies of Childhood Disability (IAACD), and the 5th International Conference of Cerebral Palsy (ICPC) were held in Stockholm from 1st to 4th June 2016.

This scientific event brought together 1,500 professionals from 66 countries working in the field of disability: physiotherapists, neuropaediatricians, rehabilitation doctors, occupational therapists, speech therapists, developmental doctors, traumatologists, etc. The meeting covered a wide variety of topics and presentation modalities (courses, mini symposiums, keynote speakers, free papers on recent studies) all of them presented by internationally renowned experts.

This year 24 Spanish professionals took part in the meeting. Twelve of them were physiotherapists, of which, 6 are part of the Comissió de Pediatria del Col•legi (CFC's Paediatric Committee) and 5 presented the following posters:

- Evolution of functional capacity, assessed with the Egen Klassifikation Scale, in the Spanish population with spinal muscular atrophy or Duchenne muscular dystrophy. A three-year longitudinal study (Mr Joaquim Fagoaga)
- Effects of the Standing Program with Hip abduction on Hip Acetabular Development in Children with Spastic Diplegia Cerebral Palsy (Ms Lourdes Macias)
- Study of the prevalence and assistance of the obstetric brachial plexus palsy in Catalonia (Ms Ascensión Martín and Ms Alicia Manzanas)
- The effects in upper extremities function using a Headpod in a child cerebral palsy (Mr Sergi Nogués)

The opening session was in charge of the president, Dr Ann-Christin Eliasson, occupational therapist at the Karolinska Institute and well known for her important research and publications. She greeted us all at Stockholm City Hall, where the Nobel Prize ceremony takes place.

During the three days of the meeting, starting at 7 in the morning and finishing at 7 in the evening, we had six lecture halls offering presentations, workshops, mini symposiums, free papers, posters, etc. on different topics simultaneously.

Some presentations were on the latest developments in neuroscience on neuronal plasticity in early childhood. It was clear that the stimulation of mirror neurons and grasping hand movements through imitation can be effective interventions for our daily practice, particularly when treating developmentally retarded children. These developments also seem to state that, depending on the type of therapy used neuronal plasticity may be different, like with restrictive therapy in the treatment of children with hemiplegia in comparison to bimanual therapy.

Research on restrictive therapy is becoming more noticeable and the presentation of the Baby-CITM manual or restrictive therapy for babies was quite interesting. The application of this therapy in children younger than 12 months diagnosed with hemiplegia has proven to be key in the neuronal reorganization of contralateral and bilateral corticospinal motor circuits after a lesion in the central nervous system.

Prematurity was another interesting topic and, once again, its great incidence in developed countries was stressed. Based on this, some international guidelines have been drawn up for the early detection of babies that may have a brain lesion due to prematurity. One of the latest non-invasive tools for its detection is the assessment of spontaneous general movements (SGM), which are neither reflexes nor voluntary movements that babies make spontaneously in the uterus and persist after birth until the fourth month of age. These mo-

vements have been comprehensively studied and are defined as writhing, fidgety movements. Scientific evidence and the studies presented at the meeting show that the absence of these movements before the fourth month of age is an indicator of a brain lesion.

Quite a few presentations were about cerebral palsy (CP) and its consequences, as well as the consensus on evidence-based therapeutic interventions. For example, exercising in a leisure, therapeutic, and participative context is considered a priority for any child with CP or a similar condition, taking always into account the patient's capacities, level of affection, and individual motivation. The type of mobility physical exercise involves is a way of counteracting the negative effects of spasticity, which makes muscles weak and stiff. In this regard, the physiotherapist has a key role in informing about the type, amount, and frequency of exercise required. It is also advisable that exercise can be done in environments involving other children. That is why there are more and more technical aids that, with specific adaptations, can help these children to take exercise. For example, a new type of adapted bicycles for patients of all ages was presented (see image).

Another innovative idea had to do with the importance and new research on the early introduction of electric wheelchairs and other power mobility systems. Evidence shows that children who are severely affected and with severe walking problems benefit from independent mobility to enhance overall development. The inactivity that many children present due to their degree of motor affection makes them eventually passive. This passivity does not only affect them cognitively but also emotionally. Ongoing research suggests that a child with a significant degree of retardation in his/her psychomotor development should use and benefit from power mobility from month 8 or 9. These mobility aids can be cheaply produced (see image below) like "Go Baby, Go" presented at the meeting or the ones that are already on the market.

http://www.oregonstate.edu/ua/ncs/archives/2014/nov/%E2%80%98go-baby-go%E2%80%99-mobility-program-children-disabilities-expands-osu

The use of virtual reality as a therapy for disabled children was another topic presented in different talks, mini symposiums, and presentations. New technology, together with adapted games and the physiotherapist's imagination to reach certain therapeutic goals, are an attractive and playful way of improving the patient's physical condition.

Another current topic discussed at the meeting was that of pain in disabled teenagers. Since life expectancy for disabled people has increased so have the side effects of some pathologies with the passing of time, which means the physiotherapist now faces a field that requires specialised training. This is the reason why it is so important to have pain assessment tools that include specific tools for children who cannot communicate. Physiotherapy in this field will be more and more necessary, which requires an interdisciplinary management and assessment combining medicine, psychology, rehabilitation, and additional services.

It was clear from the meeting that there are more and more national registers of disabling pathologies. These registers provide researchers with valuable sources of information for their studies. Scandinavian countries like Sweden are the pioneers and their example is a beacon for other countries like ours. We could start with a register of children with CP since the protocol for this register is already available and its completion could be a realistic goal. Thanks to this type of registers, Swedish researchers have been able to demonstrate the significant reduction of musculoskeletal sequelae in children with CP in the last four years.

Another novelty was the classification system for visual function in children with CP. To date, we have some international recognised systems for other functions in children with CP like the Gross Motor Function Classification System (GMFCS), the Manual Ability Classification System (MACS), the Communication Function Classification System (CFCS), and the Eating and Drinking Ability Classification System (EDACS), which will soon be translated into Spanish. The Visual Function Classification System will allow us to better understand this function and how the visual impairments affecting this population can affect their autonomy. At the same time, the Visual Function Classification System can help identify the required adaptations to improve visual function. These classification systems are really valuable in terms of establishing the same criteria for a given system for different professionals and they are essential when setting therapeutic goals.

Another point that was underlined at the meeting had to do with the obsolescence of therapeutic models devised in the last century, which claimed that neuronal changes could be achieved with manual techniques like Bobath or NDT. The role of the paediatric physiotherapist has changed from a healthcare professional who basically used manual techniques to a professional who must teach and educate the parents about their child's needs and help them to see their child as an active person undergoing a learning process to develop physical autonomy, with or without postural and mobility aids. This learning process must take place in the child's environment, at home, school, etc. Scientific evidence is pointing towards this direction and must encourage deep reflection about new types of treatment (hand off) focusing on helping families to make the most appropriate decisions and helping children to decide about their future as soon as this is possible; this is what we call participation-centred models or interventions.

Just as technology develops and makes our lives easier, it also improves in the field of disabilities. This involves working with renewed technology. Therefore, we must provide our patients with those technological aids that they need and whose use is supported by scientific evidence.

The future of many disabled children was also discussed at the meeting, more specifically through the story told by a parent whose child with CP had enrolled at university and was sharing a flat with other people. Thanks to the help of his parents but also to technology, he could have an easier access to education, mobility, and participation.

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PHYSIOTHERAPY UPDATES

EUROPEAN STROKE ORGANISATION CONFERENCE

Carina Salgueiro
Member of the CFC's Neurological Physiotherapy Board

From 10th to 12th May, the second European Stroke Organisation Conference was held at the Barcelona International Convention Centre. I took part in it as a representative of the Neurological Physiotherapy Board of the Chartered Society of Physiotherapists of Catalonia (CFC).

We spent three busy days discussing about stroke from all possible perspectives: prevention, early intervention, assessment, rehabilitation, and associated disorders and sequelae. The participants were professionals of all fields, mainly neurologists and rehabilitation physicians, and a lower percentage of physiotherapists, speech therapists, nurses, and psychologists.

One of the main issues dealt with during these days was stroke affecting the young, whose incidence has increased, the same as stroke affecting women.

From the point of view of rehabilitation, considerable scientific evidence was presented about early rehabilitation treatment after a stroke and how this shorter waiting time changes the patient's prognosis. Thus, in general terms, this is some useful advice for all stroke units: their internal organisation should be changed so that, whenever it is possible, physiotherapists can start giving treatment within the first 24 hours after a stroke. These units can manage these changes and adapt their clinical approach to the condition of each individual patient.

Another topic that was widely covered during the days of the conference was cerebrovascular diseases or small vessel diseases and the need to treat these cases, which have so far had low priority in neurology services.

In the conference there were also some posters about research being carried out by minority professions, which marks the beginning of quality research evidence. New trends in rehabilitation were presented, such as virtual reality, exoskeletons, and other robotic products.

The conference proved to be an enriching experience, not only because it facilitated professional contacts and cooperation but also because of the available updated information on scientific evidence in the area of neurology and neurorehabilitation of stroke patients.

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PHYSIOTHERAPY UPDATES

9TH INTERNATIONAL SYMPOSIUM ON VETERINARY REHABILITATION AND PHYSICAL THERAPY. UPPSALA (SWEDEN)

Marta Subirats Laguarda
Member of the CFC's Committee of Veterinary Physiotherapy

From 8th to 12th August, the 9th International Symposium on Veterinary Rehabilitation and Physical Therapy was held at the Faculty of Veterinary Medicine and Animal Science at the Swedish University of Agricultural Sciences in Uppsala (Sweden).

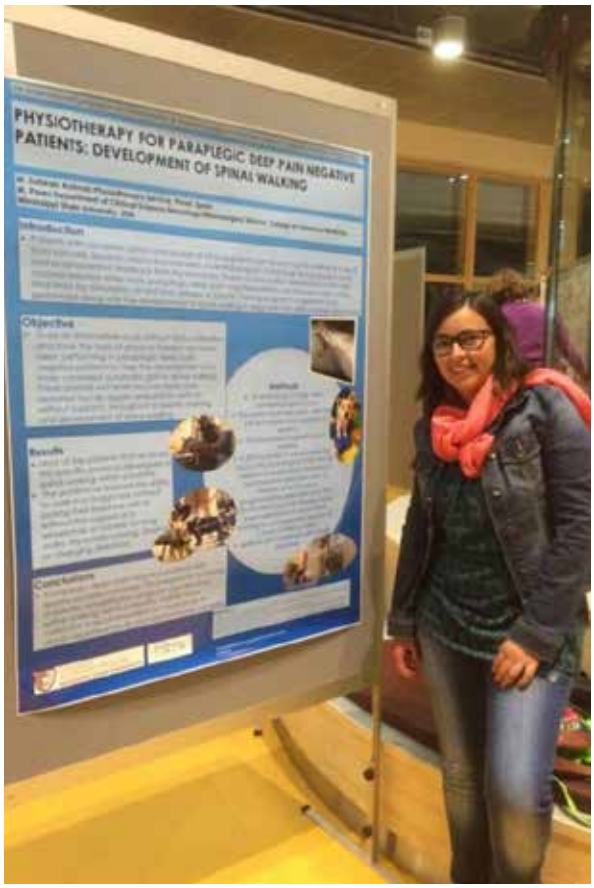
Over 270 participants, including physiotherapists, veterinaries, and aides from all over the world, met in order to discuss the new advances in the field of veterinary rehabilitation. It was the first time there were participants from the six continents.

During all the intense days of the symposium, twenty-six speakers offered forty-eight presentations. We also had eleven practice labs with twenty-four dogs, three cats, and eighteen horses that were our patients. There were a total of six discussion panels, twelve presentations, and thirty-two scientific posters, all of them with the aim to broaden our knowledge and help us understand all the physiotherapy approaches and techniques that, more and more often, are extrapolated from humans to animals. The theme of the symposium was *Functionality is the key*, including topics such as *movement with respect to bones, muscles and joints; movement with respect to nerves and neuromuscular System; movement with respect to pain and critical care, and movement in relation to overall function*.

Some of the talks and labs were about regenerative therapies, myofascial techniques, neurodynamics, pain, *neurotaping*, vestibular techniques, protocols on animals in sport, etc.

In the poster session I could present mine: *Physiotherapy for paraplegic deep pain negative patients: development of spinal walking*, which is the first poster I present at a symposium of this category with excellent professors and professionals in the area of veterinary physiotherapy. This poster would not have been possible without the help of Dr Maria Pérez Hernández, from the Department of Surgery at the University of Mississippi, and the patience of my patients and their owners.

I am very proud of being part of this professional body and of my experience. I really feel like learning more and more. I feel excited and positive when I see that, in other countries, veterinary physiotherapists are well-recognised, we are all equal, we all learn from each other, and we all work for the same objective: the well-being of animals.



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PHYSIOTHERAPY UPDATES

FINAL YEAR PROJECT

EFFECTIVENESS OF NEUROMUSCULAR TRAINING IN THE PREVENTION OF NON-CONTACT INJURIES OF THE ACL IN FEMALE FOOTBALL PLAYERS AGED BETWEEN 12 AND 25. BIBLIOGRAPHICAL REVIEW

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ABSTRACT

State of the art. Female football players have a higher risk of having an ACL injury, particularly at adolescence, due to intrinsic risk factors like anatomic, genetic or hormonal factors, and extrinsic risk factors like environmental (equipment and playing field) and subjective neuromuscular and biomechanical factors. The literature only describes extrinsic factors as modifiable, which, physiotherapy, as a movement-based science, tries to control and modify in order to reduce their incidence by means of preventive neuromuscular training programmes.

Aims. To determine the effectiveness of neuromuscular training in the prevention of non-contact ACL injuries in female football players between 12 and 25 years.

Methods. Bibliographical review of clinical trials in evidence-based healthcare reference databases like PEDro, PUBMED and Cochrane.

Results. 85 clinical trials were identified. Taking into account their randomization level, sample size, population, assessment and application of neuromuscular training, only 9 met the inclusion criteria and were finally included in the bibliographical review. Almost all of them produced significant results in the improvement of functional variables (balance, coordination, and strength) coexisting with a non-contact ACL injury (relative knee extension, greater knee abduction moment, greater trunk lateral flexion, and a backwards position of the mass centre), measured with video-analysis when performing jumping series (DVJ, SLHH, Tuck Jump, Side Hop) or balance tests on one leg (SEBT, YBT) and with dynamometry when assessing lower-limb strength.

Conclusions. The results obtained in this review support the claim that neuromuscular training is an effective therapy to improve the clinical and functional variables in the prevention of non-contact ACL injuries in teenage female football players. In spite of the evidence of their effectiveness, more studies are needed that can help establish consensus neuromuscular training programmes for this risk population.

KEYWORDS: Anterior cruciate ligament injuries / Knee injuries. Prevention. Female. Football. Exercise therapy / neuromuscular training. Feedback.

INTRODUCTION

Anterior cruciate ligament (ACL) injuries represent 50% of all knee ligament injuries, 75% of which occur while exercising. The data available suggests a prevalence between 3 and 8 times higher in female young athletes than in male young athletes (1). The results obtained in studies done in different countries report a high incidence, particularly in teenage girls. This type of injuries are described as important injuries that have both short-term and long-term negative consequences for the athlete, with high direct and indirect rehabilitation costs (2,3).

In the last few years there has been a considerable increase in the practice of female sports all over the world and, more specifically, in the practice of football, which, according to the *National Collegiate Athletic Association* (NCAA), has seen an increase of 210% only in the United States in the last ten years. FIFA estimates there are around 40 million female football players in all their federations and the outlook is that the number will continue increasing, which might therefore increase the risk of injuries like ACL injuries and highlight the importance of prevention programmes (4).

A study by Kobayashi *et al*. (2010) concludes that, based on a sample of 1700 athletes over a period of 20 years, almost 70% of ACL injuries are due to an indirect injury mechanism (non-contact) and 60% of them affect women (5).

Shultz *et al*. (2015) claim that the ACL injury mechanism is multifactorial, including neuromuscular, biomechanical, anatomical, genetic and hormonal factors. When the injury occurs, there is relative knee extension, greater knee abduction moment, greater trunk lateral flexion, and a backwards position of the centre of mass. They also conclude that, by reviewing studies analysing jump tasks using videotape feedback, females have greater knee abduction moment and abduction angles at jump-landing after Drop Vertical Jump, which the literature considers a risk factor in ACL injuries (6,7).

The risk factors increasing the likelihood of an ACL injury can be divided into extrinsic/environmental and intrinsic. The former include those extrinsic factors such as type of sport, sports field, weather characteristics, type of shoe and shoe-surface interaction (8). Intrinsic factors can be divided into:

- Anatomical: body mass index, intercondylar notch size and ACL geometry, Q angle, articular laxity.
- Genetic: genes associated with ligamentous laxity or genu recurvatum phenotype, among others.
- Hormonal: the incidence of ACL injuries increases during the menstrual cycle (preovulatory phase), being higher in pubescent girls.
- Neuromuscular: relative strength and recruitment and relative articular rigidity and stability by means of a good coactivation pattern of the hamstrings and quadriceps muscles, muscular fatigue.
- Biomechanical: in the different planes during sports play, like decreased hip anterior flexion, hip adduction, hip internal rotations, knee valgus and extension, all of them included in the literature as conditions that influence the occurrence of ACL injuries.

This group of factors determines the importance of gender (female) in the higher risk of ACL injuries (6-8).

The role of the physiotherapist is essential in ACL injury prevention programmes that include neuromuscular training with the aim of influencing modifiable risk factors described in the literature, like neuromuscular and biomechanical factors (6-8). This can be done by means of balance training, plyometric exercises, technique training and /or by means of feedback on coordination and muscular strengthening exercises to train force in order to modify the functional and clinical variables like knee abduction moment, balance for postural control, and feedback coordination (9).

For prevention to be effective it is important to establish possible risk factors before taking any preventive measure. Erroneous or abnormal movement strategies may be modified and help us in the design of a prevention programme so the developments related to clinical screening tools used to identify those athletes than can benefit from a prevention programme have to be necessarily taken into account. The literature on this issue is extensive and there is no existing consensus on which of them is the most effective, although it seems that, in order to obtain the necessary information to know if an individual athlete is in a situation of risk and act accordingly, choosing the right prevention programme, the most commonly used tests are the Star Excursion Balance Test (SEBT), the Drop Vertical Jump (DVJ) and the Single Leg Hop and Hold (SLHH) (10).

METHOD

A bibliographical review of randomised clinical trials was done using evidence-based healthcare reference databases such as PEDro, PUBMED, and Cochrane.

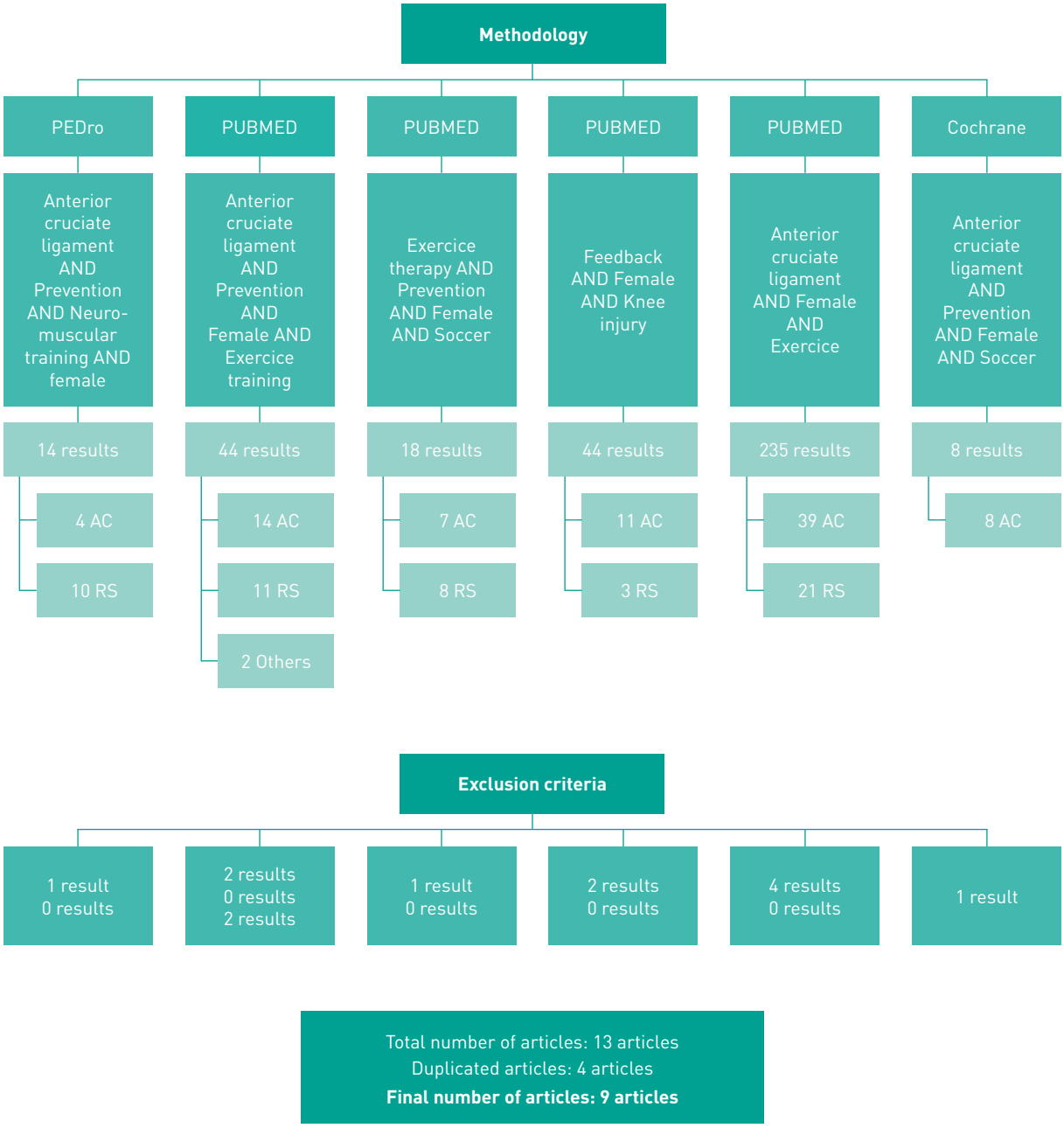
Inclusion criteria

- Clinical trials (4/10 PEDro scale)
- Studies from 2010 to 2016
- Population - female football players between 12 and 25 years
- Use of neuromuscular training

Exclusion criteria

- Lack of clinical assessment tools in the analysis of results
- Sample size less than 10 and over 150
- Studies with mixed samples
- Other sports apart from football included

The flow diagram below shows the methodology and the results obtained after applying the different filters and in the different databases. The results of the search are quantified as well as the number of definitive results, excluding the duplicated article (found in more than one of the databases), in order to obtain the final number of articles.



Total number of articles: 13 articles
Duplicated articles: 4 articles
Final number of articles: 9 articles

RESULTS

The results include clinical trials, arranged in a table with information about year, author(s), level of evidence, and results obtained explained in a descriptive way and ordered chronologically from newest to oldest.

Table 1

Common characteristics of the reviewed studies.

Year	Authors	Level of evidence (PEDro)	Results
2014	Celebrini R. *et al.* (11)	6/10	Improved peak knee flexion angles in "side-cut" and "side-hop" manoeuvres, with no alteration in knee abduction moments after applying a 6-week Core-PAC training programme. The study suggests that the Core-PAC may be one method of modifying high-risk factors for ACL injuries.
2013	Stroube B. *et al.* (12)	5/10	Reduced neuromuscular deficits measured during a tuck-jump assessment by 23.6% after applying visual and verbal feedback. The study indicates that task-Specific feedback is effective for reducing risk factors.
2013	Noyes F. *et al.* (13)	4/10	Significant improvement in lower limb alignment on a drop vertical jump test and the other tests used (T-Test, 37-minute sprint test, and in VO_2max) after using the Sportsmetric training programme.
2013	Myer G. *et al.* (14)	4/10	Frontal plane knee angle reduction by 37.9% during a drop vertical jump upon implementing augmented feedback of some deficits formerly identified by a Tuck-jump assessment.
2013	Etnoyer J. *et al.* (15)	4/10	The use of oral and visual feedback during a drop vertical jump manoeuvre improves lower extremity kinematics, particularly knee flexion. The study suggests that feedback can be used in ACL injury prevention programmes.
2012	Lindblom H. *et al.* (16)	7/10	A neuromuscular warm-up programme does not improve performance in the tests used (SEBT, etc.), probably due to insufficient stimulus, a low player attendance at training sessions, and low exercise specificity.
2012	Greska E. *et al.* (17)	4/10	A resistance neuromuscular training programme complemented with feedback improves hip isometric strength, hip abduction and knee valgus.
2011	Tsang K. *et al.* (18)	5/10	The plyometric training program used increases hamstring strength while maintaining quadriceps strength, thereby improving the quadriceps: hamstrings strength ratio, which helps knee stability.
2012	Filipa A. *et al.* (19)	4/10	A neuromuscular training program improved the SEBT score in the posteromedial and posterolateral directions (Y-balance test) with no significant changes in the anterior direction.

Dominances

The dominances of the results of the final studies included in the bibliographical review are shown jointly below.

Sample characteristics

Age: the age range in the 9 articles varies from 12 to 25 years, with a mean of approximately 15 years in 66.7% of the articles, whereas it is 20 years in the remaining 33.3%.

Body mass index (BMI) and anthropometric data: both, BMI and anthropometric data, are included in all the reviewed articles, although it is not specified if they have been taken into account and/or if they have any effect on therapy application, or if they affected the final results. The approximate mean BMI value is 21.1.

Competitive level: 55.6% of studies are about training for amateur female football players, 22.2% for professional football players, and the remaining 22.2% for occasional football players.

Characteristics of the study

Sample size: sample range goes from a minimum of 12 to a maximum of 124 girls (excluding withdrawal rates), with a total mean of 43.8 subjects and a mean withdrawal rate of 2.3 subjects to obtain a relationship between a larger withdrawal rate in study cases and a larger sample size.

Control group: in 77.8% of all the studies there is a control group whereas in the remaining 22.2%, there is no control group.

Transversal or longitudinal studies: 88.9% of all the studies are longitudinal whereas the rest, 11.1%, are transversal studies.

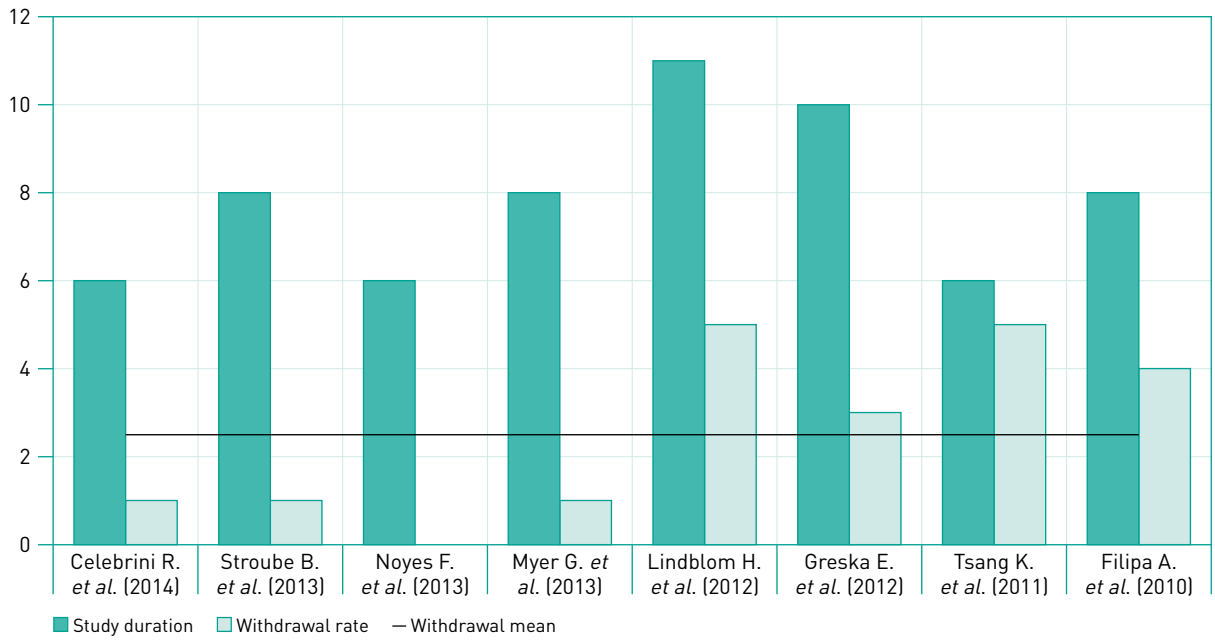
Study duration and withdrawal range: study duration is equivalent to training duration, including withdrawal rate, to establish a possible relationship between longer training duration and larger withdrawal rate. Taking into account that one of the studies was transversal, this analysis is excluded, thus getting a final outcome of 8 articles. Graph 1 shows the relationship between study duration, withdrawal rate, and total withdrawal mean in these 8 articles.

Training session duration: the mean time (minutes) of the therapy applied during the training session is 62 minutes. In order to establish the relationship between training session duration and competitive level, graph 2 was produced, which shows that a longer training session duration does not relate to a higher competitive level in athletes.

Randomization level: in 66.6% of the reviewed articles there is sample randomization whereas in the remaining 33.3%, there is not.

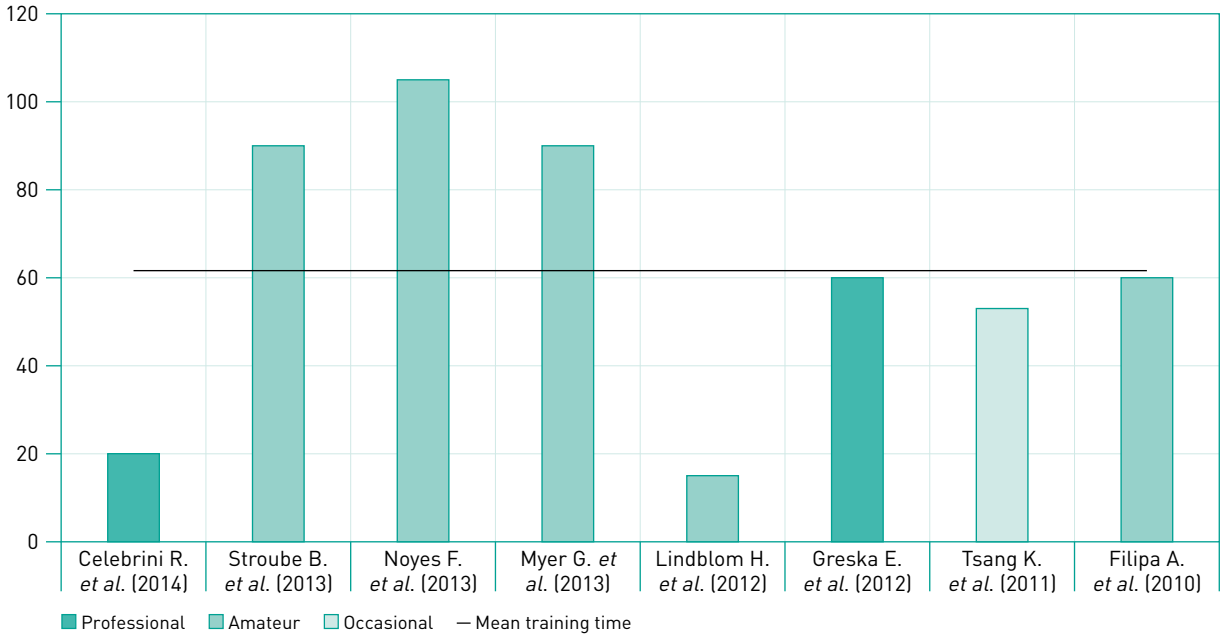
Graph 1

Study duration, withdrawal rate and mean.



Graph 2

Training session duration (min.), mean training time and competitive level of athletes.



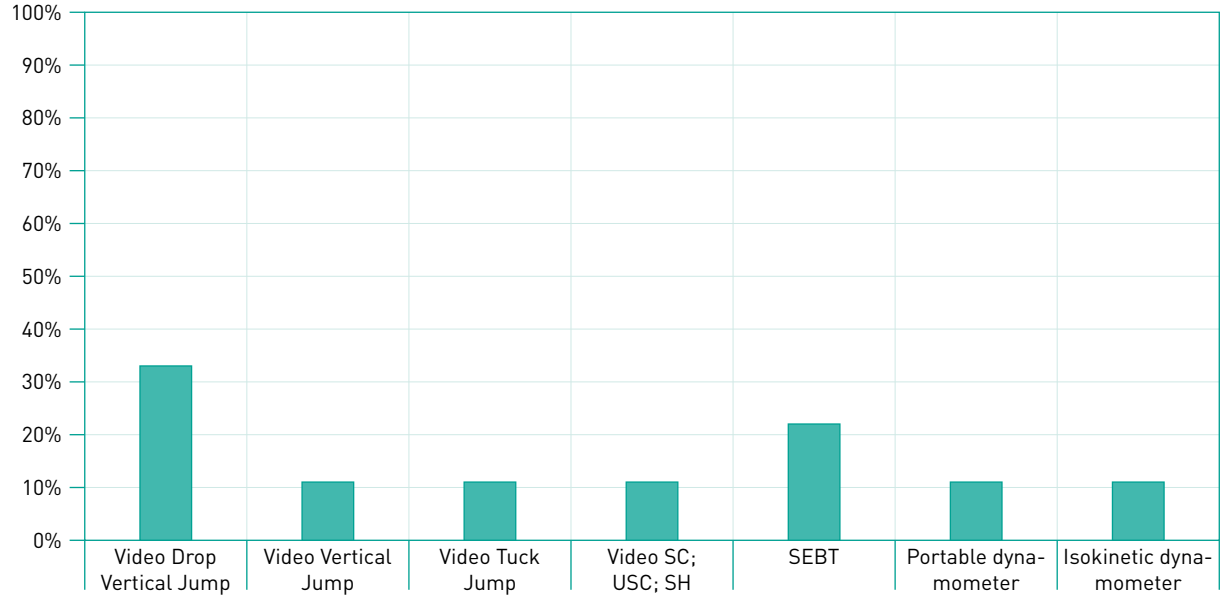
Global dominances within each clinical variable:

Assessment tools: in all the reviewed articles, a wide variety of clinical assessment tools are used with the aim of assessing and quantifying the improvements in the different functional variables after applying the preventive therapy.

The most widely used, in 33.3% of cases, is video analysis of the drop jump manoeuvre, followed by analysis of the scores obtained from the SEBT, in 22.2% of cases. The other 44.5% use other tools whose percentage is shown below (graph 3).

Graph 3

Percentage of use of the different clinical assessment tools.



Relationship between studied variable, assessment tool and percentage of improvement:

Table 2

Relationship between studied variable, assessment tool and % of improvement.

Variable	Assessment tool	% Improvement
Abduction moment	Video Tuck-Jump	>35.7% reception; >71.4% GRF; >80% symmetric contact with the feet → Celebrini R. *et al.* (11)
Abduction moment	Video Drop Vertical Jump	Deficit reduction from 38% to 4% → Stroube B. *et al.* (12) 37.9% deficit reduction →Myer G. *et al.* (14) Improvement not specified in percentage → Etnoyer J. *et al.* (15)
Force (Q:H)	Isokinetic dynamo-meter	3.07% power improvement 3.51% improved strength moment Greater hamstring strength
Stability	SEBT	6.5% improvement in left lower limb and 8.2% in right lower limb → Filipa A. *et al.* (19) No improvement → Lindblom H. *et al.* (16)

DISCUSSION

With this bibliographical review we have seen that preventive neuromuscular training is effective in improving clinical and functional variables (balance, coordination, and strength) that are considered to be risk factors for female football players and in reducing the risk of having a non-contact ACL injury. This claim refers to a group of factors that must be properly analysed and assessed for the claim to be supported.

The analysis of the population in the studies shows that there is homogeneity in the sample descriptive data of all the analysed articles. Regarding the age variable, ranging from 12 to 25 years, the approximate mean is 15 years. According to the literature, puberty is the stage when preventive therapy should start to be used in order to prevent ACL injuries in females since this is when the risk of having this type of injury is the greatest (6). This claim is supported by a study by DiStefano L. *et al.* (2009) in which puberty is said to be the stage when the results of modifying risk factors after a therapeutic intervention with neuromuscular training are the most significant (20).

The average age of the population in the studies is an important piece of information that must be considered when applying this therapy since the closure of epiphyseal growth plates in girls occurs between the ages of 13 and 16 years (21), which stresses the need to determine the maximum physical load in these preventive programmes based on the target population. In the reviewed studies, it is not stated whether there was any modification in the application of the different therapies or in the length of the training sessions, frequency, etc., failing to deal with the fact that the closure of epiphyseal growth plates is more prone to injury after experiencing physical load considered high or above resistance level (22). Uncontrolled or excessive physical loading in teenagers whose closure of epiphyseal growth plates is still incomplete presents a higher incidence of overuse injuries, which makes it a factor that needs controlling when training this population group. The load must then be moderate and never high due to the fragility of their skeletal system (7,23). Taking this factor into account and the fact that neuromuscular training programmes include strength exercises to modify clinical and functional variables, like knee abduction moment (7), it is advisable to review this concept in order to decide whether it is necessary to encourage strength training at those ages when bone is more prone to injury. It is then necessary to determine the correct physical loading in order to prevent ACL injuries and any negative effects affecting this stage of life.

All the reviewed articles take account of anthropometric data as well as body mass index (BMI). BMI has proven to be relevant in any process of physical loading and, therefore, the results can be considered even more significant (23). A high BMI can be a risk factor in ACL injuries, particularly in female football players, and this seems to suggest that a high BMI is related to a greater knee abduction moment, increasing the risk of injury, which highlights the need of considering it when having a training intervention (7).

The athletes' competitive level is variable, with more amateur sportswomen. The literature shows that this therapy is already used in the professional field, and the reviewed studies containing this type of population

only apply complementary techniques like *feedback* with the aim to improve their use, whereas the studies with amateur or occasional athletes use complete training therapies in order to improve clinical and functional variables. Professional female athletes would be in a situation of "less risk" compared to amateur or occasional athletes due to their better physical condition and higher resource availability (24).

In the study of global dominances, it has been proven that the use of clinical assessment tools is diverse within each functional variable and this is so depending on each specific variable studied:

For the functional variable "strength", the most commonly used tool is video analysis of jump manoeuvres for knee abduction moment by means of a system validated in 2010 by Myer, G.D. *et al.* that propose analysing kinetic and kinematic data with "MATLAB and analysing knee abduction moment from the deceleration phase of DVJ to the lowest position of the body centre of mass", using a motion analysis system ("*Panasonic DV camcorder PV-DV601D and PV-GS250, Panasonic, Secaucus, New Jersey,*") for the different stages of a DVJ and to determine the optimum location of retroreflective markers. The authors also suggest the use of isokinetic dynamometers (Biodex Inc. Shirley, NY, USA) for the cocontraction of the hamstrings and quadriceps muscles (25).

PFor the functional variable "balance", SEBT (YBT) together with postural control analysis are used, and for the analysis of the variable "coordination" (*feedback*), video systems together with oral instructions are used (10,25).

La reducció del moment abductor del genoll així com l'entrenament de la força sobre la musculatura isquiotibial per disminuir la diferència entre la contracció del quàdriceps i els isquiotibials, s'ha observat que són fets clau en la prevenció de lesions del LEA. Es considera que proporcionen una major estabilitat del genoll i, per tant, situen l'atleta en una situació de menor risc de lesió (26,27).

On the other hand, better postural control implies a reduction of ground reaction forces during jump landing manoeuvres, as well as greater hip flexion, which helps reduce ground reaction forces on the knee. These elements reduce the risk of injuries, such as ACL injuries, in athletes (28).

Each clinical and functional variable is assessed with a different assessment tool and, indirectly, this might mean that the percentage of improvement could be related to the tool employed, which leads to the need of establishing a general consensus over their use. For example, taking the use of video analysis for DVJ, the use of a different recording system, with different devices and different recording software and a different location of retroreflective markers may bias the data gathering process and the interpretation of results. This stresses the need of establishing a validated and accessible system to obtain more precise data that can produce comparable and significant results.

The same claim can also be made in relation to SEBT and YBT as static balance tests used in the assessment of postural control. Both are reliable measuring tools to assess balance (29). But when assessing coordination, we must take into account that a non-contact ACL injury involves jumping. Because SEBT and YBT are performed statically, they can't be used when assessing this functional variable. This raises a reasonable doubt that is not mentioned and that can pave the way for a new approach in future studies.

ACL injuries are multifactorial and gender plays a key role. It has been demonstrated that the association of normal physiological variations in the concentration of sexual hormones during the menstrual cycle do imply substantial changes in collagen metabolism markers and their production, in knee laxity and also in musculo-tendinous rigidity and the myotatic reflex. These biological changes during the menstrual cycle can have neuromechanical consequences increasing the risk of ACL injuries. Its peak occurs at the preovulatory phase, when joint laxity is at its maximum. In spite of this result, no clear consensus exists over this issue (6,30-32). In this regard, it must be emphasised that it is not clear that contraceptive pills act as a protection factor in these situations, although they stabilise the menstrual cycle.

CONCLUSIONS

Neuromuscular training programmes for the prevention of non-contact ACL injuries in female football players are effective regarding the modification of clinical and functional variables, which are considered to be potential risk factors for this injury. Nevertheless, the results according to different authors may be interpretable as there can be other causes that account for the positive results or some variables that can determine the validity of those results are not really controlled.

Further studies are needed so that existing knowledge gaps can be filled in, the importance of intrinsic factors in ACL injury risk in women is underlined, and significant results in relation to safety values of the functional variables studied are produced. Consensus diagnostic assessment tests are necessary to validate preventive neuromuscular protocols or programmes that aim to reduce the current injury rate.

LIMITATIONS

The most important limitation of this bibliographical review is the moderate/low level of evidence of the studies. There are no published research articles that include all the inclusion criteria set by available scientific evidence. The studies with larger samples present statistical data about injury or no-injury in sports clubs or organi-

zations but they do not include individual analyses for each sportsperson before and after neuromuscular training of risk factors, considered as essential variables to be studied, with the aim of obtaining comparative elements of the possible improvement in their results.

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AGENDA

7th CFC Conference on Geriatric Physiotherapy
Date and city: 1st April 2017, Barcelona
Information: www.fisioterapeutes.cat

15th World Congress on Public Health
Date and city: From 3rd to 7th April 2017, Melbourne
Information: www.wcph2017.com

6th Francophone Conference on Physiotherapy
Date and city: From 27th to 29th April 2017, Disneyland Paris (Hotel New York Convention Centre), Marne-la-Vallé
Information: www.congres-jfk.fr

7th CFC Conference on Musculoskeletal Physiotherapy
Date and city: 20th May 2017, Barcelona
Information: www.fisioterapeutes.cat

World Confederation for Physical Therapy (WCPT) 2017
Date and city: From 2nd to 4th July 2017, Cape Town
Information: www.wcpt.org/congress

6th CFC Conference on Physiotherapy, ICT and 2.0
Date and city: 30th September 2017, Tarragona
Information: www.fisioterapeutes.cat

1st Sports Conference
Date and city: 21th October 2017, Barcelona
Information: www.fisioterapeutes.cat

National Congress on Physiotherapy
Date and city: 10th and 11th November 2017, Logroño
Information: www.aefi.net

18th SCBF Congress
Date and city: 25th November 2017, Barcelona
Information: www.scfisioterapia.cat

World Congress on Osteoporosis, Osteoarthritis, and Musculoskeletal Diseases
Date and city: From 19th to 22th April 2018, Krakow
Information: www.wco-iof-esceo.org

5th European Congress of the European Region of the World Confederation for Physical Therapy (ER-WCPT)
Date and city: From 26th to 28th April 2018, Dublín
Information: www.wcpt.org/europe

PHYSIOTHERAPY UPDATES

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