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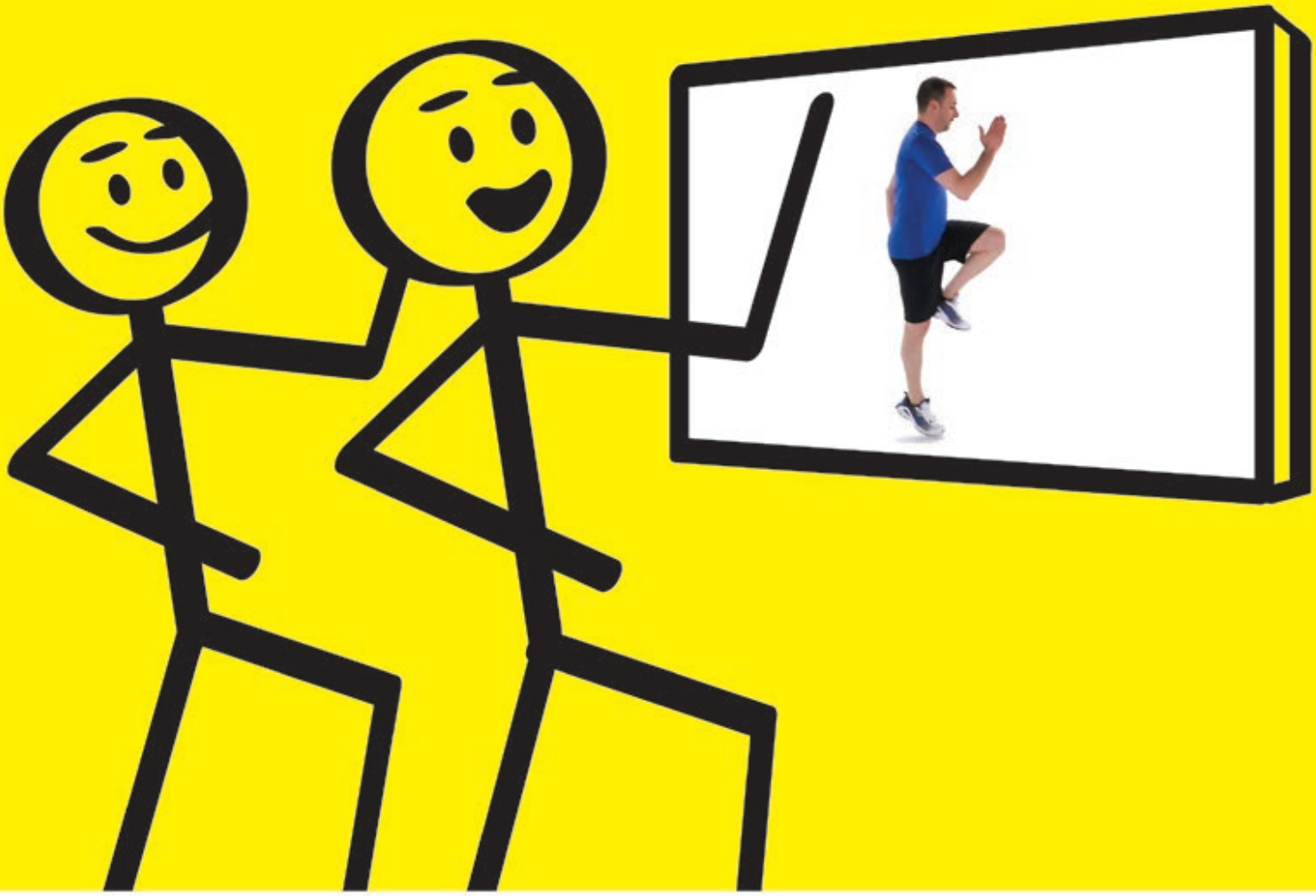

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Editorial

Some time ago I was reading a comment made by our General Secretary, Paul Donnelly, in relation to the aims of our Physio First executive and our need to be disruptive in the healthcare marketplace. To be able to exact a change in the market, we need to shake it all up and rattle its cage. Continuing with the status quo just wouldn't cut it.

At the time I thought "whoa… I don't like that word, its too harsh and aggressive". It wasn't how I saw us, as an organisation, influencing the marketplace to our advantage; what we were all doing was fine. However, I now realise that I was wrong about my perception of the word disruptive. Now I can't open up a magazine or newspaper without seeing it used in just the context we were all those months ago, and that is why individuals and organisation are using it; disruptive is all about making a change.

Change will come, but it must be for the better. We want to be in control of the changes ourselves and not being forced to change by letting others do it to us. We want to be in the decision loop, not cut out of it. Change will affect us as a trade organisation, in the same way that it has affected some of the biggest businesses and brands in the world. Think M&S and what happened when the disruptors came in and changed the market, and M&S didn't adapt. Think of every local cab company you have ever called for a ride home, and then think… Uber; a change that is decimating traditional taxi companies because a disruptor viewed their business model of "looking after the boys" and saw a way to change the market.

In every profession or business, those who are nimble, driven and care about their future will survive because they will adapt, consolidate and move with the market. Being a disruptor means not accepting the current way and is about being your own driver in how change takes place. We could all go down, complaining about what is happening, and why it's wrong, or we can grab the opportunity to shape the future as we want it.

This leads me into my thoughts about the last part of our 9 goal plan that is now upon us, the private, self-employed physiotherapist co-operative. We always wanted to attempt to disrupt the market to such an extent that we would no longer need intermediaries, and that we could offer our services based on our own evidence, collected by us, that proved we deliver a quality, cost-effective, evidence-based product to those who want to buy our expertise. So, the next step is to set up a means to examine the viability goal, which we will be doing at our groundbreaking symposium on Friday 31 March, just before our 2017 conference. This has been set up to give us the chance to look at what can be achieved in a brand that we can market, and that we can charge for in a way that reflects our quality.

Thank you again to all the authors who have given freely of their time for this edition, it is another brilliant one with information and expertise that will support our members in being disruptive in our marketplace and, supporting those who are participating, in their goal towards QAP status.

PAUL JOHNSON | MSc BSc MMACP MCSP | EDITOR

Contents

Editorial Panel

COVER IMAGE:
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Adherence to therapeutic exercise – how do we help our patients adhere to physiotherapy

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All clinicians will be aware of the frustrations of patients who do not seem to adhere to general treatment plans and, for physiotherapists in particular, patient adherence with therapeutic exercise programmes can be especially difficult to achieve. This article examines the problems with patient adherence in general, and discusses exercise adherence in particular, with ideas that focus on promoting therapeutic exercise, together with some key points that the reader may wish to adopt in their practice.

LEARNING OUTCOMES

1 Understand how (non) adherence to exercise impacts on physiotherapy.
2 Understand the terminology used in exercise adherence.
3 Appreciate the common myths relating to non-adherence of exercise.
4 Identify behaviour change techniques and strategies that can be used by physiotherapists to facilitate exercise adherence.

Introduction

The literature on adherence is most advanced in relation to medication (Horne *et al* 2005), where the cost attributed to poor medication adherence reveals how big this problem is. The figures are staggering and the full benefits of many medications cannot be realised at the levels of adherence that are currently being achieved (Nieuwlaat *et al* 2014).

In 2015, the cost of prescriptions dispensed in the community (England) was £9.27 billion, this represented an increase of 4.68% from £8.85 billion in 2014 (Digital NHS UK 2016). Reviews conducted across diseases / countries are consistent; an estimated 30% to 50% of prescribed medication is not taken as recommended (Sabaté 2003; Horne *et al* 2005). This is not only due to people not taking any of their prescribed medication, but also the expensive consequences of those who do not take medication correctly, for example adverse drug reactions accounts for 6.5% of hospital admissions in the UK (Pirmohamed *et al* 2004). Historically, the figures are similar for other interventions with 15% to 93% of patients failing to act on healthcare recommendations (Myers & Midence 1998; Turk & Meichenbaum 1991).

While uptake of exercise programmes during supervised programmes can be reasonable, participants often stop exercising after their treatment programme is finished, and, for a specific example, up to 63% of low back pain patients do not adhere sufficiently to exercise therapy to gain benefit (Sluijs *et al* 1993, 1998). This overall poor adherence to exercise and physical activity may limit long-term effectiveness of many interventions (Jordan *et al* 2010), and more recent reviews highlight that we, as clinicians and as researchers, are not very good at assessing adherence to rehabilitation based exercise (Bollen *et al* 2014; Beinart *et al* 2013), nor are we particularly strong at intervening to promote adherence (McLean *et al* 2010; Peek *et al* 2016).

Terminology

With the case made that treatment of non-adherence is a big problem generally, as well as one that specifically undermines the therapeutic benefit that is potentially possible from physiotherapy, here are some key terms and definitions to assist with a common understanding of later discussion.

The topic of **adherence** has two alternative terms; **compliance** and **concordance**. These terms are defined as follows:

- Compliance denotes the "extent to which a person's behaviour (in terms of taking medications, following diets or executing lifestyle changes) coincides with medical or health advice" (Haynes *et al* 1979). This suggests that the patient adopts a passive role with no choice over the prescription and that non-compliance is the patient's fault.
- Adherence can be conceptualised as empowering the patient and "implies a more active and collaborative involvement of the patient, working together with the clinician in planning

> "RECENT REVIEWS HIGHLIGHT THAT CLINICIANS AND RESEARCHERS ARE NOT VERY GOOD AT ASSESSING ADHERENCE TO REHABILITATION BASED EXERCISE"

and implementing the treatment regimen" (Myers & Midence 1998).

- Concordance is a term that has been mainly adopted for work investigating the extent to which health care professionals and patients develop a shared view of the problem and treatment involving medication with agreement reached after negotiation between patient and health professional that respects the beliefs and wishes of the patient (Marinker 1997).

Of these three terms, I always recommend "adherence". It is less likely to imply blame or regard the patient as a passive recipient of care than the word compliance and, although concordance was more recently introduced as a "better" term, it has not been widely adopted and tends to be used more with regard to medication taking from the medical sociology perspective. Concordance is also mostly about the therapeutic alliance, something that is very important but arguably does not explicitly determine whether or not a patient has actually undertaken their treatment as prescribed; it is this assessment that is needed in order to optimise the dose of treatment being prescribed.

There are a number of concepts that are also worth describing at this stage. Firstly, non-adherence can be distinguished into two distinct types (Myers & Midence 1998):

Unintentional non-adherence: where the patient may wish to adhere but something outside of their control, such as poor memory, lack of instruction, or the inability to travel to appointments, or pay for exercise classes, etc, prevents this from happening.

Intentional non-adherence: this concerns people who make the conscious decision not to take up their treatment (see case study). Such patients expect a quick-fix, do not believe in the exercise approach, or just do not want to exercise.

There are also several different phases of adherence:

Initial uptake or **adoption phase** of a treatment often occurs during a period of clinical supervision. This tends to be the phase when adherence, if it happens, is likely to be highest.

Maintenance phase is less likely to be supported by a clinician. The patient self-manages their condition. Adherence typically drops off in this phase, although if a routine has been established in the first phase then some ongoing adherence may still occur. The key is to make sure the patient understands the difference between their maintenance exercise dose versus the on-treatment dose, and to give them strategies to manage relapses, resume the on-treatment regimen if their condition flares up, and manage breaks in their exercise routine that can occur due to life events such as holidays or an acute illness.

Closure or discontinuation phase may occur for some patients when all treatment comes to an end and their condition has resolved fully (Vrijens *et al* 2012).

Another concept to discuss is that of the **healthy adherer effect**, where people do well just by the "adhering" regardless of the efficacy of a treatment. This effect was first reported in a trial of medication to reduce high blood pressure. Patients who adhered to 80% of their prescription had significantly lower cardiovascular related mortality at five-year follow up, and this was regardless of whether or not they were adhering to the active anti-hypertensive drug or the sugar placebo pill (Horwitz *et al* 1990). This effect has been summarised further in the review by Simpson *et al* (2006) that shows while adherence is typically seen as **the process** by which therapeutic outcome is achieved, it is also a potentially beneficial **outcome** in its own right. There are two implications here for our practice. First, we can promote this effect, encouraging this healthy adherence as much as possible, and second, it means we should be careful and only do this for evidence-based treatments or, when no evidence exists, only for the treatments that we can be certain do no harm.

There are also a number of myths about non-adherence. First, it is not condition specific or a feature of a particular disease, instead it is common across most long-term conditions, e.g. heart disease (Horwitz *et al* 1990), rheumatoid arthritis (Hill *et al* 2001), osteoporosis (Cramer *et al* 2007), and there is considerable literature showing patient and clinical features account for very little variance in adherence outcomes. Instead, other factors such as patient beliefs, which are discussed later, may be more important.

Second, there is no "adherent" personality and it is not consistently related to gender, educational experience, intelligence, marital status, occupation or income, or ethnic

> "THERE ARE A NUMBER OF MYTHS ABOUT NON-ADHERENCE"

"PHYSIOTHERAPISTS ALREADY USE A NUMBER OF BEHAVIOURAL CHANGE TECHNIQUES"

background (Horne & Clatworthy 2010). Instead, adherence patterns vary between patients and within the same patient over time and across treatments. Adherence is not an "all or nothing" phenomenon, as an individual can be adherent some of the time and in varying degrees. The concept of "partial adherence" may be useful here as it gives permission for a patient to declare honestly that they have done some, but maybe not all, of their exercises without feeling too guilty. However, we do need to know when this partial adherence is "sufficient" for therapeutic benefit to occur, which again requires robust measurement or assessment tools.

Finally, non-adherence is seldom "fixed" by providing patients with more education, reminders or by giving frightening messages (known as fear appeals) or by being overly authoritative with a patient and telling them what they must do.

Given that we have not yet solved the problem of poor adherence, the current direction of travel in the research literature is that concerning health behaviour change. From my perspective this is synonymous with helping someone adhere to their physiotherapy exercises, as promoting adherence is the same as helping them to change their health behaviour, such as engaging in a healthy lifestyle, adopting advice for self-management or doing the prescribed treatment, i.e. exercises. All these require behaviour change and the next section in this article will tackle some of the psychological literature on this topic.

The psychology of health behaviour change

There are many theoretical models that attempt to explain health behaviours, but it is beyond the scope of this article to cover them all. Of note is that which pertains to patient beliefs and expectations about their health condition and the proposed treatment. John Weinman and Rob Horne are lead researchers in this area, describing how patients have **general** versus **specific beliefs** (**necessities** and **concerns**) about their health condition and its treatment (Horne & Weinman 2002). For example, asthma patients may have a general belief that all medicines are poison, therefore potentially harmful, but have specific beliefs about their inhalers; their reliever is necessary, but their steroid inhaler gives them great concern. These concerns may be because of possible long-term side effects but also because, unlike the reliever inhaler, there is no perceived immediate benefit from using them so they wonder why they are necessary.

This leads beautifully to the next psychological consideration, that of patient **expectations**. In the asthma example, if a patient expects to see benefit from a treatment and this does not happen in their perceived timeframe, then why would they continue to adhere to a treatment? This highlights how important it is for clinicians to check patient expectations and give timeframes for when treatment benefits or recovery should occur. Similarly, in some of my own work, led by New Zealand based colleagues, it is clear that patients' expectations of treatment can be hugely influenced by what clinicians say to them. Darlow *et al* (2013; 2015) reveals the enduring impact of a GP's negative explanations of non-specific low back pain to patients, and the work required by the physiotherapist to undo these negative beliefs for the patients who subsequently attend physiotherapy. The "lay" explanation that "their back is worn out" or has "degenerated" or has signs of "wear and tear" means that many patients will rest, or be more cautious than necessary, they might even be concerned that exercise and activity will make things worse. This means patients can attend physiotherapy with a set of beliefs and expectations that are at complete odds with what is likely to be offered; why would such a patient adhere to a programme of exercises for their low back pain?

However, no single psychological theory or model provides sufficient explanation of how behaviour can be changed for all people in all settings, and few models take into account time, or they have a strict linear approach to behaviour change. This tells us that there really is not yet a theory that captures the complexity of adherence behaviour. In our review of the theories underpinning behaviour change in relation to adherence to pelvic floor muscle exercises (McClurg *et al* 2015), it became clear that no single model stands out, but some of the better models do include consideration of readiness for change, phases of adherence, relapse management and maintenance strategies.

Behavioural change taxonomy

One solution to the plethora of models has been to condense them into key strategies or techniques as seen in the Michie *et al* (2012) behaviour change taxonomy. This is a great start in helping us classify evidence-based behaviour change techniques (BCT) and allows us to select what we need rather than be constrained by a particular theoretical approach. It allows clear reporting of what we do in our research trial interventions, which then affords the opportunity of replication if, and when, the approach is implemented into clinical practice. Physiotherapists already regularly use a number of the BCTs and some, for example goal setting, would be regarded

as core business for all rehabilitation professionals. The taxonomy does have its critics, for example Ogden (2016) who argues against the use of "recipes" for promoting behaviour change. However, as with all classification systems it will evolve over time and more work is needed to fine-tune BCT specifications. Furthermore, it is often how these BCTs are delivered in a therapeutic relationship, along with other contextual factors, that actually matters and not just the BCT itself. These aspects of promoting behaviour change still need further investigation.

By taking a closer look at the taxonomy it is possible to show how some BCTs naturally fit into physiotherapy practice but could be fine-tuned to enhance adherence. This is because many are "common sense" approaches physiotherapists already use, but tend not to name them as BCTs, or indicate in their clinical records that they are being used to promote adherence.

Goal setting

The best example in the BCT is goal setting and planning, something that will be very familiar to those working in rehabilitation, and which now has a high-quality Cochrane review showing some evidence of effectiveness for promoting self-efficacy and quality of life (Levack *et al* 2015). In the taxonomy, my goal setting includes monitoring, reviewing progress and detailed planning, as well as goals that are strategically split into the setting and reviewing of **outcome goals**, e.g. health outcomes such as alleviating the problem of leaking urine, or having no more back pain, and the setting and reviewing of **behavioural goals**, e.g. the number of exercise sessions needed during a week in order to get the muscle training effect that will progress the patient towards their outcome goal.

Behavioural goals are closely linked with **action planning**, but how specific are we in agreeing these with our patients? Do we specify and include sets, repetitions, intensity of work, frequency and duration of sessions, recovery time, etc (Slade *et al* 2016)? Do we help patients with their plans to meet all the components of an effective exercise training programme and then also how to fit them in to their everyday lives? A final comment about goals relates to a BCT that may be much less familiar to physiotherapists: that of making a **behavioural contract** with their patient. This means asking the patient to say aloud to you that they are going to do their exercises! It may feel silly to ask this but it does help to have a verbal contract. Even better is getting the patient to sign a sheet detailing their agreed exercise programme. This type of behavioural contract has been used to good effect in occupational therapy trials of exercises for people with hand rheumatoid arthritis (Lamb *et al* 2015; Adams *et al* 2016).

Some of the work I have had the privilege to be part of is in pelvic floor muscle training for urinary incontinence. This area of work is a strong contender for the research leader in terms of exercise adherence, possibly because pelvic floor exercises, involving a hidden set of muscles, are so hard to teach, and it is such a private, seldom talked about condition that non-adherence is a big problem. It is also because researchers in this area have already established a strong evidence base for the efficacy of exercise interventions. They are now in the position to tackle the adherence issue, particularly the long-term adherence that is needed to maintain the benefits of the initial intensive, and often supervised, programme. The consensus statement and accompanying articles we have written provide a "state of the science" summary of this work (Dumoulin *et al* 2015).

Stemming from this collaboration are two exciting ongoing projects. The first is the optimising pelvic floor muscle training to achieve long-term benefits (OPAL) trial; a multi-centre trial to determine whether the BCT known as **biofeedback** makes a difference to long-term adherence and outcomes for 600 women with stress or mixed urinary incontinence, this trial is due for reporting in 2019. The second is the five-year antenatal prophylactic pelvic floor exercises and localisation (APPEAL) programme which began in 2016 and is investigating if, and how, we can implement pelvic floor muscle training into the antenatal care pathway in order to prevent incontinence.

While I suggest the pelvic floor muscle training researchers and clinicians have taken the lead, it is clear that other areas related to physiotherapy are catching up. For example, in October 2016 Arthritis UK held a workshop specifically to identify a research agenda for tackling treatment adherence for people with osteoarthritis and rheumatoid arthritis. My notes from this meeting identified at least four key areas for prioritisation:

- The need for robust measures of adherence
- Elucidating the best education strategies for patients and clinicians
- The design and use of interventions to facilitate adherence
- The promotion of adherence in health professionals so that they follow best practice and evidence-based ways of working.

In closing this article, I ask two questions: If you cannot change your behaviour is it reasonable to expect your patients to? What can you do to promote adherence?

The following is a brief checklist to consider putting into your practice:

- Be aware of your assumptions and dispel the myths
- Address barriers and the unintended reasons for poor adherence
- Check the patient's understanding, beliefs and expectations. Do they match your proposed treatment?
- Avoid overloading patients with more information or more "education"
- Make explicit use of behaviour change techniques to facilitate adherence.

About the author

Sarah has extensive experience of working in interdisciplinary environments, both teaching and in research at the Universities of Southampton, Otago (New Zealand) and

CASE STUDY

Male patient A, with a typical presentation of non-specific low back pain.

Following the standard assessment, I discussed my findings with him before agreeing a plan of action; some in-clinic treatment, some home exercises, together with implementing any advice or self-management strategies. Once I had shown him the exercises, checked he could do the techniques and had a list to remind him, we agreed a review date.

A week later my patient returned, smiling and happy, his back was better. I re-assessed and then checked his exercise techniques. He told me he had been doing them each day, and that he had taken on board the advice to adjust his chair and his posture at his work station. To me this fantastic result was what being a physiotherapist was all about. This patient was the sort we all love to treat, and one I came to call a "green-light" patient. However, the excitement in my abilities as a physiotherapist did not last.

Male patient B, almost identical in terms of low back pain presentation.

He seemed to take on board my advice, agreed to do the home exercise programme and adopt the changes to his work station. However, when he returned a week later his back was no better. Physiotherapy had not worked for him and what was I going to do about it? I felt a failure, but on further investigation, it quickly became apparent that he had not carried out many, if any, of the daily exercises or acted on any of the postural advice.

It was clear that this patient's expectations had not been met because I was unable to offer him an in-clinic quick fix. His disillusion manifested fully when he failed to turn up for the next appointment.

On reflection

Thinking about these two very typical patients I asked questions that I still have to find the full answers for. Why had one patient adhered, but not the other? What had been different about me, as a physiotherapist, when I had seen each of them? What were the differences in each patient's condition that meant the exercises were right for one, but not the other? Had I mismatched my assessment and treatment plan?

I wished I could bottle the magic I had when working with my first patient; I'd be rich and famous now! Instead, the experience started me on a research career to investigate treatment adherence. My passion for the topic was further fuelled when, while studying for my Masters, I read an article about a non-significant result of a clinical trial of physiotherapy exercise for low back pain (Faas *et al* 1993). I was incensed that all patients had been given exactly the same exercise programm. This seemed to me to be an unfair test of physiotherapy in that some patients may have been expected to adhere to exercises that might be inappropriate for them. I was already passionate about treatment adherence from my own experiences, but once I started to read more I realised how enormous the problem is, and not just for physiotherapy.

Exeter, and including her current role in the South West Peninsula Collaboration for Leadership in Applied Health Research and Care (PenCLAHRC).

She started her career at the University of Birmingham with a joint degree in psychology and physical education and went on to obtain a dual professional background, training to be a Chartered Physiotherapist at Guy's Hospital. She then completed two higher degrees in health psychology to become a Chartered Psychologist. Sarah worked clinically in the NHS and private sector, specialising in musculoskeletal rehabilitation, particularly exercise therapy for sports injuries and cardiac rehabilitation. During this time she was also training and competing as an international athlete for Great Britain in the 400m hurdles. Her expertise in health psychology includes recent work in behaviour change taxonomy, and methodological input for the process evaluation component of large multi-centre clinical trials and her research applies psychology to rehabilitation, such as goal-setting and facilitating adherence to exercise for stroke, back pain and urinary incontinence.

Sarah designs and evaluates research trials for assessing interventions based on therapeutic exercise, with a particular focus on how to assess and promote treatment adherence, she has recently become the deputy director of the Exeter Clinical Trials Unit, and she is lead editor of the textbook *Interprofessional Rehabilitation: a person-centred approach*.

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For more information

Arthritis Research UK: www.arthritisresearchuk.org/research/research-funding-and-policy/our-clinical-study-groups/adult-inflammatory-arthritis.aspx

OPAL: Optimising Pelvic Floor Muscle Training to Achieve Long-term benefits. www.opaltrial.co.uk/

Injury, tissue capacity and load management

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Injuries can be broadly categorised into two groups; direct and indirect. A direct injury is one that occurs from an external force imposed on the body, such as a kick in sport, or a fall in daily living. The cause is obvious and the injury could, for example, be a bruise (haematoma) or cut (laceration). An indirect injury is one which occurs as a result of internally imposed forces, such as shin pain or a pulled muscle. The cause is often less obvious, making management of this injury more challenging.

LEARNING OUTCOMES

1 To enhance knowledge of exercise therapy and its prescription for musculoskeletal injury.
2 To develop knowledge of tissue homeostasis and tissue loading during injury and rehabilitation.
3 To increase awareness of load monitoring during exercise and rehabilitation.

One of the ways of looking at the causes responsible for an indirect injury is to consider that the tissue involved was loaded to the extent that it exceeded its capacity. In this case, the capacity of a tissue is how much it can be loaded or stressed without breaking down. Tissue capacity will clearly differ between individuals, depending on the requirements of their work or sport, the condition of their tissues and their age. In any movement several tissues may be loaded, but it is the one with the lowest capacity that will represent the weakest link in the chain of movement, and is often the one which breaks down (Cook & Docking 2015).

Tissue homeostasis

Homeostasis is the method by which the body actively maintains a constant state in its internal environment. To maintain tissue capacity, there is a continuous process of physiological maintenance via adaptations in the body's metabolism (Dye 2005). Injury or overuse can disrupt homeostasis, leading to a cascade of biochemical changes. Excessive or supra-physiological loading on tissue will cause adaptation providing there is sufficient time for recovery. A sudden imposition of extreme force, however, may exceed the load capacity of tissue leading to maladaptation. Similarly, repetitive small forces which occur too frequently may not allow sufficient time for the tissue to adapt to the new loading level. At the other extreme, too little (sub-physiological) loading, that occurs with prolonged rest, also disrupts homeostasis leading to changes such as muscle atrophy and bone mineral loss, reflecting deconditioning. Clearly, with tissue function it's a case of "use it or lose it".

The region of loading between under- and over-usage represents the area of load acceptance, and has been described as the "envelope of function" (Dye 2005). Where loading exceeds capacity, the action can be envisaged as occurring outside the envelope of function, and may irritate the tissue, giving rise to symptoms such as pain and swelling. At this stage homeostasis may be restored by reducing or changing the loading, with a view to later increasing tissue capacity with progressive rehabilitation and elevating the upper limit of the functional envelope.

Poor load management can have effects on the body as a whole and at a local tissue level. Repetitive loading without sufficient recovery can cause cumulative tissue fatigue and increase susceptibility to injury. At whole body level, inappropriate loading can cause psychological impairment to the individual, for example, by impairing decision making ability, and physiologically with compromised co-ordination and neuromuscular control. Fatigue of this type reduces muscle force and muscle contraction velocity (Soligard *et al* 2016). Joint kinematics and neural feedback can be compromised with ongoing detriment to joint stability. Locally, excessive micro-damage may occur if the magnitude of loading is beyond the load-bearing capacity of individual tissues. Initially, when loaded, tissue changes are short-term and reflect reaction, and can show symptoms such as increased blood flow through muscle and increased metabolic activity that are reversed when the loading stops, homeostasis is restored, and the tissue resumes its resting state. Repeated loading, however, causes the tissue to change more permanently and adaptation occurs which may result in

"WITH TISSUE FUNCTION IT'S A CASE OF 'USE IT OR LOSE IT'"

increased muscle strength and bone mineral density. Training loads that are too low may not stimulate sufficient adaptation and can impair the tissue's ability to cope with higher loads in the future. Adequate training stimulates biological adaptation, increases the capacity to accept and withstand load, and builds resilience.

The aim of rehabilitation is to increase the capacity of the injured tissue and to offload it by enhancing the strength of surrounding muscle. Tissue capacity may be built with progressive overload, which may be either simple or complex (Cook & Docking 2015). Simple loading targets the specific tissue, for example the medial collateral ligament of the knee, while complex loading targets the tissue within the context of the whole limb or body region, for example a squat action. The load chosen for rehabilitation must accurately reflect the type of load the tissue may be placed under during any functional action in daily living or sport. Training specificity of this kind is vital to increase tissue capacity relevant to the patient's actions, rather than increasing the therapist's need to fulfil predetermined goals.

Monitoring tissue load

Load imposed on a tissue is often monitored using a variety of laboratory devices, such as dynamometry or EMG which measure the external load and may quantify training using, for example, sets, repetitions, poundage lifted, distance run, or watts produced. Internal load measurement assesses the physiological and psychological responses to an activity, for example heart rate, the rating of perceived exertion, or psychological inventories. While external load gives an understanding of the work completed, internal load can be viewed as more patient-centred in that it determines whether training is creating an appropriate stimulus for optimal biological adaptation. Internal load monitoring is generally more sensitive than external measures in determining both acute and chronic changes to the wellbeing of the patient (Soligard *et al* 2016).

There is a high correlation between the results of external measurement and the use of a rating of perceived exertion (RPE) scale focusing on each individual training bout. The RPE scale was originally developed in the 1970s by physiologist Gunnar Borg (Borg 1970) and has been modified several times since then. Currently, RPE is on a 10-point scale of body sensations to create a perception of how hard the patient is working. It is a measure of exercise intensity at a specific time point, and is extended to **sessional RPE** (sRPE) by multiplying the total time in minutes of an exercise session by the exercise intensity based on the score of the RPE 10-point scale. For example, a 30-minute workout at an RPE intensity of 5/10 would give a sRPE value of 150 units, whereas a longer, more intense workout of 40 minutes at 7/10 would give a sRPE of 280 units, clearly illustrating the difference between the two exercise sessions in terms of load.

Adding the sRPE values up over a continuous seven day period gives a value called the **acute workload**, and taking the average of these over a four week period gives a value for **chronic workload**. The ratio of these two values is known as the **acute to chronic workload ratio** (ACWR). If, for example, a subject's sRPE values for a week came to 2100, and their average to 2500, the ACWR would be 1.19 and this value can be used as part of an overview to predict risk of injury.

The ACWR and injury

The ACWR is a useful model of the relationship between changes in training loads. Absolute load represents less injury risk than rapid increases in load over and above that which the subject is prepared for. Large week to week changes in intensity, duration, or frequency may increase the risk of injury. Where chronic load increases slowly but progressively to high levels, and acute load is low, subjects are able to adapt to the changing workload and the risk of injury is lower. However, if acute load exceeds chronic load, injury risk is increased as tissue adaptation may not be sufficient.

In general, the body adapts more effectively to relatively small increases or decreases in training volume rather than large fluctuations. High training loads which have been brought about by controlled progression offer a protective effect against injuries by increasing tissue capacity. Where the ACWR exceeds 1.5, i.e. the load is one-and-a-half times greater than the average during the last four weeks, the likelihood of injury more than doubles. Monitoring over the training or rehabilitation is important as it has been noted that higher loads may have little immediate obvious effect, with latency periods shown to possibly delay injury risk for up to one month (Soligard *et al* 2016). Research has also shown that a "sweet spot" exists, at between 0.8 – 1.3, within the centre of the ACWR values (Gabbett 2016). Values below 0.8 represent undertraining, and those above 1.3 overtraining, and both make indirect injury more likely.

Consideration of both physical (sports / work) and mental (psychological wellbeing) loads is important when

"THE AIM OF REHABILITATION IS TO INCREASE THE CAPACITY OF THE INJURED TISSUE"

> "THE EFFECT OF TRAINING WILL DEPEND ON BOTH THE INTENSITY AND THE RECOVERY PERIOD FOLLOWING EXERCISE"

using exercise therapy and sports training. Stress imposed on the body can cause either adaptation (positive) or maladaptation (negative). The effect of training on the body will depend on both the intensity and the recovery period following exercise, with positive and negative effects represented on the overtraining continuum (figure 1). With light training and adequate recovery, acute fatigue occurs, followed by functional and non-functional overreaching as training intensity increases and recovery reduces.

Overtraining syndrome sees a reduction in sports performance and body function, with subclinical tissue damage and, eventually, clinical symptoms. The early part of this process can be reversed when adequate recovery time is given and tissue remodelling is allowed. Homeostasis is restored with an increased fitness level and improved sports performance. Maladaption can be triggered by poor load management interacting with psychological stressors and, if severe, complete recovery may not occur.

In sports, competition may represent a rapid increase in load and calendar congestion – an increased frequency of matches or events – has been shown in the majority of studies to lead to higher instances of injury rates. In addition, psychological variables such as negative life events, daily hassles and sports related stress may increase vulnerability to injuries. The mechanism is thought to include attentional and somatic changes leading to increased distraction and peripheral narrowing. Muscle tension, fatigue and reduced co-ordination may also be important factors (Soligard *et al* 2016).

Progressive tissue loading in rehabilitation

The challenge imposed upon the body through exercise can cause a series of tissue changes known as **super compensation**. To achieve a training effect, two principles are important; overload and progression. To **overload** the body, the load imposed by an exercise must be greater than that encountered normally through the activities of daily living. The body firstly reacts to this overload, but if loading is repeated frequently, tissue adaptation will occur. In the case of muscle, this includes neurogenic (neural control) changes such as motor unit synchronisation, recruitment of additional motor units and increased motor unit discharge frequency. With time, myogenic (structural) changes occur, such as additional actin and myosin protein production, more sarcoplasm and a greater amount of connective tissue. If the same overload is used repeatedly, however, the body will stop adapting as its tissues are now adequately prepared for the new imposed load. To continue to gain adaptation the overload must therefore **progress** to challenge the body further.

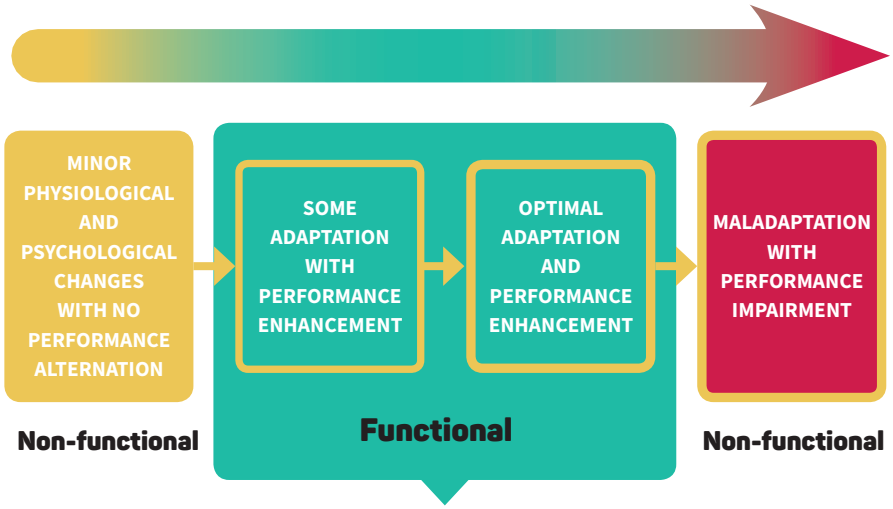

FIGURE 1: How much is too much? Levels of training and their effect on the body

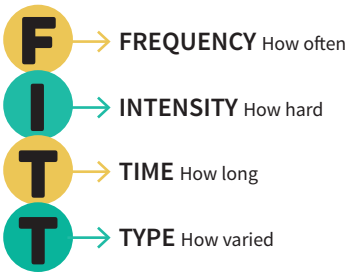

FIGURE 2: The FITT mnemonic

A simple method for remembering the basic training principles for overload is the FITT mnemonic, standing for Frequency, Intensity, Time and Type (figure 2). Originally designed to guide cardiopulmonary training, this mnemonic is also useful in strength and conditioning (S&C) training.

Frequency is how often an exercise is practised, for example, twice a day, or three times each week.

Intensity is how hard an exercise is. In strength training this is normally measured in comparison to the maximum weight the individual can lift once, or the maximum voluntary contraction (MVC) of a muscle. With stretching, intensity is measured in

how far the individual can stretch as a percentage of the maximum potential range of movement (ROM).

Time is the duration of the exercise, for example running for 20 minutes or one hour. It also refers to the duration of a repetition, for example using a very slow action (super-slow technique) in weight training to emphasise muscle contraction.

Type is the category of exercise, such as strength training, aerobics, stretching or plyometrics.

These four factors are called training variables and altering any of them will change the overall work intensity. The total amount of work is often expressed in sets and reps and together the description of an exercise, using these variables, is commonly referred to as training volume (Norris 2013).

As mentioned earlier, tissue may be loaded in isolation (simple loading) or within a whole limb action (complex loading). For example, when managing a recovering hamstring muscle injury a Nordic curl will place intense eccentric loading on the hamstrings. However, this type of simple loading selectively strengthens the target tissue, in this case the hamstring muscles, but may not work other tissues involved in limb movements, leaving them with a proportionally reduced capacity and perhaps open to secondary injury (Cook & Docking 2015).

The training must match the requirements of the individual and a needs analysis should be performed to determine which aspects of training are important to them. The tissue changes which occur as a result of training will closely match the training type selected. In exercise prescription terms this process is often referred to as the SAID mnemonic; **Specific Adaptation to Imposed Demand**. This is where the tissue adaptation closely matches, or is specific to the training load, also known as the imposed demand. Typically, a needs analysis in S&C includes

SUBJECT / ATHLETE	TASK / SPORT
Exercise history	Movement analysis
Current fitness level	Physiological requirements
Neuromuscular skill level	Injury risk

TABLE 1: Needs analysis and strength conditioning (Baechle & Earle 2008)

assessment of the individual and assessment of the task, i.e. the work or sport they wish to undertake, as outlined in table 1. When structuring, adapting and progressing a training programme, it can be useful to address the components of fitness with a simplified plan to guide exercise prescription dependent on the outcome of the needs analysis (table 2).

Example loading programme

How do we use these principles in a day-to-day private practice scenario? Let's take a grade 2 medial collateral ligament (MCL) injury to the knee as our example. Our patient is a 28-year-old young mum with two children aged five and seven. She works part-time in an office and is a keen gym user.

Needs analysis: Fitness level prior to injury was quite high and although her job is fairly sedentary, caring for her young children will make high activity demands on our patient's knee. She will need to be rehabilitated beyond her previous fitness level to increase the tissue capacity of the injured ligament and ensure that her knee is resilient. Initially, exercise therapy is designed to ease pain and stiffness and reduce the likelihood of movement impairment.

FACTOR	INTERPRETATION
Stamina	Cardiovascular and local muscle endurance
Suppleness	Static and dynamic flexibility. Agility
Strength	Concentric / eccentric / isometric
Speed	Acceleration and deceleration / power
Skill	Movement quality / sensorimotor training
Structure	Body composition / anthropometry
Spirit	Psychological fitness / psychosocial aspects of injury
Specificity	Task and sport related requirements

TABLE 2: Fitness component checklist

This latter feature has both physical and psychosocial aspects. We know that, following injury, the knee musculature will waste so muscle strength and hypertrophy will be required. In addition, we must ensure full range of motion to both physiological and in accessory movements as combined bending and twisting of the knee is inevitable when playing with young children. Following any painful injury, it is likely that aspects of illness behaviour will occur such as hypervigilance, fragility and sensitisation. It is imperative, therefore, that we include a large variety of movements, known as a wide movement vocabulary, in order to avoid the patient from tending to overprotect her knee in the future.

For convenience we can divide the healing process into two overlapping components; the reactive phase during which the joint is painful, perhaps swollen, and irritable and, as this stage progresses and these symptoms lessen, we move towards the recovery phase where changes to the injured tissue have settled and the subject is left deconditioned with respect to the knee, requiring more intense S&C training. In the reactive phase we can begin with simple flexion and extension movements initially within painful range, and finally, as irritability settles, move to a time contingent action. Actions which are symptom contingent will be stopped when pain occurs, those which are time contingent will be stopped when a given number of repetitions have been completed. Symptom contingent exercises tend to facilitate the interpretation of a nociceptive signal as pain, while time contingent exercise is likely to deactivate this type of descending (top down) facilitation (Nijs *et al* 2014).

Structuring rehabilitation: It is important that we begin muscle activation exercise as soon as possible in order to limit maladaptation through pain inhibition. Actions such as knee bracing and straight leg raise using maximum tolerable resistance ensure full locking (no extensor lag) and begin

FIGURE 3: Leg bracing

FIGURE 4: Leg extension

FIGURE 5: Leg press with resistance band

FIGURE 6: Leg press with gym ball

> "THE ABILITY TO ADAPT TO CHANGING AND UNPREDICTABLE SITUATIONS IMPLIES GREATER FLEXIBILITY WITHIN THE BODY SYSTEMS"

the redevelopment of muscle strength (figures 3 and 4). As we move into the recovery phase of the injury, exercises can progress to closed chain actions such as leg press using bands (figure 5), power loops, and gym balls as resistance (figure 6). Where a leg press machine is available this can be used to limited / controlled range, progressing resistance, speed, and motion range. Limited range squat actions together with supported lunge movements are further examples of closed chain progressions. Classic weight training actions such as squats, deadlifts and lunges can all be used with dumbbells and barbells where available, and adapted to the patient's needs.

So far, in the main we have addressed joint mobility and strength, together with initial confidence in the limb. We must now progress the programme further by increasing the variety of movements. Movement variability has been highlighted as an essential component of injury prevention (Glasgow *et al* 2013). The ability of an individual to adapt to changing and unpredictable situations implies greater flexibility within their body systems, while to reduce variability by training with constant repetition of the same actions is likely to prepare an individual to manage a limited number and types of load, i.e, the SAID mnemonic mentioned previously. Where loads are imposed outside the individual's experience, tissue capacity may be exceeded and injury can result. Varying load types will, therefore, better prepare an individual to manage a greater breadth of potential loading situations, making it less likely that their tissue capacity with any one load type will be exceeded.

Training for variability may begin with single leg balance and quarter squat actions, and while single leg standing, turning the shoulders and throwing a ball to a partner. Proprioception will be enhanced on an uneven surface such as a balance cushion, and by the individual performing the exercise with their eyes closed. In parallel we must enhance strength still further by getting our patient to take her full body weight on one leg while moving forward and twisting, an action that may be replicated when she plays soccer in the back garden with her children. To build a sufficiently robust limb the resistance on actions such as squats (figures 7 and 8) and the leg-press should increase to ¼ or ½ bodyweight. In addition, jumping, hopping and twisting actions should be progressed to full plyometric training. Acceleration, i.e. lunge, hop, sprint from a mark, and deceleration, i.e. hop-and-hold, run and stop movements, must both be incorporated within any training programme. Typically, plyometric actions include in-place, or jumping or hopping while staying on one spot, short response drills including moving forwards, backwards, sideways, twisting for a limited number of steps, and long response drills of repeated multidirectional actions over distance. By progressing the variety of movements we are incorporating additional fitness components such as speed, power and reaction time, and training specificity is providing the actions that closely mimic those to be used in the subject's future daily actions.

In the final exercise progressions we must ensure full movement range using actions such as kneeling and sitting back from heels and moving into a fall squatting position. In addition, while optimising lower limb alignment is required in the early phases of rehabilitation to reduce loading on the medial aspect of the knee, during later rehabilitation we must introduce valgus loading on to the knee to give our patient confidence that it will be resilient enough to withstand the very movement which caused the injury. Squat, lunge and leg press actions should therefore be performed pressing the knee into valgus and varus positions with gradually increasing degrees of movement and overload.

FIGURE 7: Goblet squat

FIGURE 8: Barbell squat

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Exercise in multiple sclerosis

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There is growing evidence of the value of exercise and physical activity programmes to manage the symptoms of multiple sclerosis (MS). Research shows that exercise does not increase relapses or exacerbate fatigue. Core-stability or Pilates exercises appear to be well-tolerated and to improve gait and balance in MS. Treadmill training with partial body weight support allows more disabled individuals to exercise safely, increasing gait speed and quality of life. Web-based interventions allow independent exercise at home. The importance of increasing everyday physical activity and of breaking up sedentary time with regular standing is also becoming more recognised in MS.

LEARNING OUTCOMES

1 Exercise and physical activity can be beneficial in managing the symptoms of MS.
2 Core stability and Pilates exercises are increasingly popular and that they can be used to improve gait and balance outcomes.
3 Those who are more disabled can improve gait speed using treadmills with partial body weight support.
4 Internet-based interventions are a growing way to aid people with MS to break up sedentary time, increase light physical activity and participate in programmes of exercise.

Background

Multiple sclerosis (MS) is a neurological condition with inflammatory and degenerative aspects which can affect mobility, vision, and cognitive function (Compston & Coles 2008). Often diagnosed in their 20s or 30s, people live with this condition for many years of their lives (NHS Choices 2016). As there is currently no cure for MS, medical treatments are primarily based on improving long-term disease outcomes through reductions in disease activity, particularly relapses, or using disease modifying or symptomatic therapies, e.g. for pain or muscle spasms. Due to their symptoms, people with MS tend to reduce the amount of physical activity and exercise they do. Those who would like to exercise may be unsure of what they can do safely, or what types of exercise are the most effective for their functional problems. This article aims to give an overview of current evidence for different types of exercise and their value for people with MS.

Aerobic capacity and safety to exercise with MS

A systematic review and meta-analysis of 40 studies into the aerobic capacity of people with MS was conducted (Langeskov-Christensen *et al* 2015). They found a difference between the aerobic capacity of people with MS and that of healthy controls, with the healthy subjects having a significantly higher aerobic capacity. However, this study found that aerobic training had the potential to improve maximal aerobic capacity as measured by the VO_2 max test, in ambulant people with MS. Such improvements are likely to be associated with other health benefits, such as reduced risk of cardiovascular disease.

There is now substantial evidence for the benefits of physical activity or exercise on the symptoms of MS (Latimer-Cheung *et al* 2013). In particular, in a systematic review of a wide range of exercise interventions in MS, improvements were found in muscle strength, speed and endurance of walking. Reduced levels of fatigue were also demonstrated in a number of studies, particularly those which included resistance training. Many participants also reported improvements in quality of life measures following their involvement in the exercise programmes.

Physical activity guidelines for people with MS aged 18 to 65, with mild to moderate disability, are not dissimilar to those for the general population. They state at least two 30-minute sessions a week of moderate to vigorous physical exercise and twice weekly strength training for major muscle groups (Latimer-Cheung *et al* 2013). These authors found no evidence that following the guidelines will result in increased rates of MS relapse, compared to those who do not take exercise. There was also no evidence that greater uptake of exercise was associated with an increase in fatigue.

Effects of fatigue on participation in physical activity and exercise

Fatigue is a significant problem in people with MS, reported by 76% in a recent study (Larocca 2011). This is

> "PARTICIPANTS REPORTED IMPROVEMENTS IN QUALITY OF LIFE FOLLOWING THEIR INVOLVEMENT IN THE EXERCISE PROGRAMME"

an important consideration as people tend to change their physical activity as a result of their fatigue. Blikman *et al* (2015) studied a group of 23 people with MS, all experiencing severe fatigue, in comparison to age-matched healthy controls. Physical behaviour was measured using an accelerometer device, which detailed the length of bouts of time spent in different postures and the energy expenditure through the day. The MS group were all independently ambulant with a mean Expanded Disability Status Scale (EDSS) of 2, out of a maximum of 10 (Kurtzke 1983). They spent significantly more time than controls in sedentary activities, defined as "any waking behaviour characterised by an energy expenditure <1.5 METs while sitting or reclining". They also spent significantly less time in moderate to vigorous physical activities such as brisk walking and cycling with energy expenditure above 3.0 METs. The bouts of sedentary time were also significantly longer in the MS group. They tended to have a less fragmented pattern of sedentary behaviour and more variability in the length of their bouts of sedentary behaviour.

Although people do tend to spend more time sedentary as a result of their fatigue, a recent Cochrane review (Heine *et al* 2015) showed no significant difference in the number of reported MS relapses in the groups who took part in exercise compared to the controls. The review also found a significant effect of exercise in comparison to control in the treatment of fatigue in MS. Sub-group analysis showed the greatest effects of endurance exercise, mixed exercise and exercise types such as yoga and balance-focused training in treating fatigue. This supports the value and safety of a range of different types of exercise for people with MS.

Exercise programmes targeting balance and stability

Balance and mobility are frequently impaired in people with MS. A number of recent studies have investigated the use of exercise programmes which specifically target balance outcomes. Freeman *et al* (2010) studied the effects of an eight-week programme of core-stability training on balance and mobility outcomes in ambulant people with MS. In the small group of participants, there was excellent compliance with the study interventions. Significant improvements were made between baseline and intervention phases for timed walk, MS walking scale, and forward and lateral functional reach, in five out of the eight participants. Timed up and go test (TUAG) also improved from the baseline phase to withdrawal phase.

Guclu-Gunduz *et al* (2014) investigated the effects of Pilates exercises which focus on voluntary recruitment of the deep trunk muscles to maintain a neutral posture. Their eight-week programme compared a group of 18 people with MS to controls. Berg Balance scale and TUAG scores significantly improved in the Pilates group, as did hip flexor strength. The study also demonstrated improvements in balance confidence scales. There were no significant changes in the control group for any of the measures.

In a larger, more recent study, Fox *et al* (2016) recruited 100 participants for a programme of mat-based Pilates, standardised exercise or relaxation. The standardised exercise and the Pilates groups both showed small improvements in the primary outcome, the 10-metre timed walk (10MTW), but there were no significant differences between the Pilates and relaxation groups. Mean 10MTW was quicker for the standardised exercise group than either of the other two groups, but the difference was not significant. There were no significant changes between the Pilates group and the relaxation group in forward or lateral functional reach. The standardised exercise group scored better than the relaxation group in forward functional reach, gait speed, and Multiple Sclerosis Walking Scale 12 (MSWS-12), a subjective scale measuring perceived difficulty with walking. It is likely that standardised exercise and Pilates include many of the same elements. However, unlike the standardised exercise group in this study, the Pilates group did not perform any exercises in a standing position. Attendance at sessions was higher in the standardised exercise group (84%) than the Pilates group (66%). A number of people volunteering to participate were excluded as they had already taken part in Pilates or core stability classes, showing the growing popularity of this type of exercise in MS.

AEROBIC EXERCISE

Aerobic exercise programmes are frequently investigated for people with MS. However, the improvement of aerobic capacity is rarely used as a primary outcome measure, perhaps because other measures are more meaningful to those living with MS. The use of treadmill training with

> "TREADMILL TRAINING WITH PARTIAL BODY WEIGHT SUPPORT ALLOWS PEOPLE WITH HIGHER LEVELS OF MOBILITY IMPAIRMENT TO PARTICIPATE IN EXERCISE THERAPY"

"THOSE WITH HIGHER LEVELS OF DISABILITY ARE OFTEN OVERLOOKED IN EXERCISE STUDIES"

partial body weight support as an exercise modality allowing people with higher levels of mobility impairment to participate in this therapy has been investigated by recent authors.

A pilot study by Pilutti *et al* (2011) found beneficial effects on quality of life and fatigue following a 12-week programme of thrice weekly training on a treadmill with partial bodyweight support. Participants with EDSS scores of 5.5 – 8, all requiring at least some assistance to walk, increased their gait speed and body weight support was reduced. Lo & Triche (2008) investigated treadmill use with and without robotic assistance in a six-week programme. They found significant improvements for both groups in performance in timed 25-foot walk, six-minute walk test and double support time. There was limited evidence of participants favouring the robotic assistance training prior to training without robotic assistance. The authors hypothesise that robot-assisted training may be beneficial earlier in rehabilitation for the development of co-ordination for more independent gait.

Programmes such as these are time and labour intensive, with a need for transport to a therapy department and for staff to assist participants with safe use of the treadmill. However, they do allow people with higher levels of disability to take part in regular exercise, which is well-tolerated. Both studies are relatively short term. Longer exercise interventions may be necessary to observe changes, as is highlighted by Pilutti *et al* (2011). Neither study carried out any follow-up to determine whether changes had been maintained, or measured functional outcomes other than gait. This would have given more information with regard to the long-term value of treadmill training in this more dependent group of people with MS.

STANDING AS AN EXERCISE MODALITY

Those with higher levels of disability are often overlooked in studies into exercise for people with MS, particularly those who use wheelchairs as their main method of ambulation. A current trial is investigating the use of a home-based standing frame exercise regime for people with MS (Freeman *et al* 2016). The participants being recruited for this study range from those who use bilateral aids to walk 20 metres or less, to those who are completely restricted to a wheelchair or bed (EDSS 6.5 – 8). The regime involves thrice weekly standing in an Oswestry standing frame for 20 minutes over a 16-week period with additional stretches and exercises to be carried out while standing. Recruitment has been successful with 92 participants joining this study within a year.

This method of exercise primarily aims to improve physical measures including sit-to-stand, balance, and upper limb function which are assessed in all participants. The study also aims to improve bladder and bowel function, respiratory function, reduce frequency of falls and improve health-related quality of life. This is a broad range of measures, many of which are often overlooked in exercise studies in MS.

Increasing breaks in sedentary time and light physical activity

For some people with MS, the value of interventions which either break up standing, or encourage light activity, may be most suitable. Recent evidence points to the detrimental effect of prolonged sedentary time on health. A longitudinal study of 1,304 healthy men assessed in 1982 and followed up over a 30-year period (Shuval *et al* 2014) showed that greater sedentary time was significantly associated with a higher BMI, larger waist circumference and higher body fat percentage. Longer bouts of sedentary time in people with MS compared to the general population may predispose them to these health implications. Manns *et al* (2011) advocate beginning interventions at the "low activity" end of the scale for people with mobility disabilities, which make it more difficult for them to carry out formal exercise. They argue that we should aim for people to first replace entirely sedentary time with light physical activity, gentle walking or domestic activities.

Evidence is also emerging for the functional benefits of regularly breaking up sitting (Sardinha *et al* 2015). Standing or active "breaks" may be of particular value to those with MS where symptoms such as muscle spasms and stiffness can be exacerbated by lengthy periods of sitting. People with MS may be more able to break up their sedentary time than to engage in formalised exercise. There may also be value in the accumulation of their physical activity in shorter bouts of 10 minutes and upwards, rather than first aiming for the guideline amount of 30 minutes.

Evidence for internet-based exercise programmes

The evidence base is growing for the use of unsupervised internet-based programmes for people with MS. Klaren *et al* (2014) piloted a six-month internet-based behavioural intervention. This was not called an exercise programme, but had the dual goals of reducing people's sedentary time and increasing physical activity. The website included practical suggestions for changing behaviour as part of daily life, e.g. standing during telephone conversations and parking further away from shops. There was also formalised activity goal setting and weekly, one-on-one coaching sessions via Skype. Daily self-reported sedentary time reduced by more than 90 minutes in

the intervention group compared to the control group. The participants in this study attended a laboratory for physical assessments before and after taking part; however, objective measures of activity and function were not reported.

Paul *et al* (2014) piloted a programme of web-based physiotherapy with a group of 30 people with MS. Following individual assessment, participants were assigned a personal exercise programme to carry out at home twice a week for 12 weeks using a specially developed internet site for support. There was a statistically significant improvement in the physical subscale of the Multiple Sclerosis Impact Scale (MSIS), and a small non-significant increase in gait speed in the intervention group compared to the control group. Participants were very satisfied with using the website, all rating it good or excellent. They also highlighted the advantages of being able to exercise at home rather than having to take up time and energy travelling to a class. Although these web-based studies were initially small scale, there is potential for such interventions to reach large numbers of people with a reduced need for regular therapist input once the resources are in place. A summary of various studies and the effects of exercise / physical activity interventions used in people with MS is shown in table 1.

Conclusions

In the same way that there should be exercises to suit all lifestyles and preferences in the general population, it is right that, for people with MS, there are a range of exercise options available based on a thorough objective assessment and discussion of the needs of the individual. This article has given an overview of some examples which can be applicable to people with different levels of disability.

> "STANDING, OR ACTIVE BREAKS MAY BE OF PARTICULAR VALUE TO THOSE WITH MS"

In general, exercise programmes particularly involving a core-stability or Pilates component appear to be well-tolerated and do not exacerbate MS symptoms. There appears to be little difference between the results of standardised physiotherapy and Pilates. Both types of exercise show modest improvements on a range of gait and balance measures when compared to controls. Partial body weight support treadmill training is another well-

AUTHOR	PARTICIPANTS	EXERCISE / PHYSICAL ACTIVITY INTERVENTION	DETAILS	OUTCOMES
Fox *et al* 2016	100 people with MS (EDSS 4.0 – 6.5). All ambulant for 20 metres or more with or without aids – divided into three groups.	12-week programme of *Pilates*, (n=33), *Standardised exercise* (n=35) or *Relaxation* (n=32). Follow-up at 16 weeks.	*Pilates and Standardised exercise*: 12 half-hour sessions plus daily home programme. *Relaxation*: four one-hour relaxation sessions.	*Pilates and Standardised exercise*: small non-significant reductions in 10MTW. *Control*: No significant changes. Standardised exercise group were quickest overall at four-week follow up.
Freeman *et al* 2010	Ambulant people with MS, n=8 EDSS 4-6.5	Core stability exercise training done face to face.	30 minutes of one-to-one training, twice a week for eight weeks.	Significant improvement in at least 7/9 outcome measures for 5/8 participants including 10MTW, forward and lateral functional reach.
Freeman *et al* 2016	Target of 140, 70= usual care, 70= intervention. Able to walk up to 20 metres with bilateral aids (EDSS 6.5 – 8)	Home-based Oswestry standing frame programme.	Minimum of 30 minutes three times a week for 20 weeks.	Primary outcome: Amended Motor Club Assessment (functional ability of upper and lower limbs). Other health-related quality of life measures.
Guclu-Gunduz 2014	26 total – 18 in Pilates group, 8 in control group. Mean EDSS 1.94	*Pilates*: Group-based Pilates exercises in a range of postures, *Control*: Home-based breathing and extremity exercises.	Two hours a week for eight weeks.	*Control* = no significant changes. *Pilates* = significantly improved Hip flexor strength, Berg Balance and Timed up and Go scores.
Klaren *et al* 2014	33 people with MS	Internet based intervention aiming to reduce sedentary time and increase physical activity.	Web content delivered in stages over six months. Face-to-face assessments.	Self reported sedentary time reduced by 99 minutes.
Lo & Triche 2008	13 participants – all able to walk 25 feet without assistance. (EDSS= 4.9±1.2)	Partial bodyweight support treadmill (PBST) and robotic assisted PBST using a computer-controlled exoskeleton.	(N=6) three weeks = *robotic assisted PBST*, followed by three weeks = *non-assisted PBST* or vice versa (n=7). Two 40-minute sessions per week of each type of training.	No clear differences between the two groups. Significant improvements in 25-foot walk, and six-minute walk test. Reductions in double support time, one point gain for EDSS.
Paul *et al* 2014	30 ambulant people with MS (EDSS 5-6.5)	*Intervention*: web-based balance, strengthening cardiovascular, and exercises. *Control*: usual care.	12-week individualised home-based programme done at least twice a week.	*Intervention group*: non significant increase in gait speed, improvement in physical subscale of MSIS. *Control*: No notable changes in physical measures.
Pilutti *et al* 2011	Six patients with progressive MS (EDSS=6.9±1.07)	Partial body weight support treadmill (PBST).	30 minutes of training, three times a week for 12 weeks.	Increase in treadmill walking speed. Reduction in body weight support. Gait speed and scores on the MS Quality of Life measure also significantly improved.

TABLE 1: Summary of the effects of exercise / physical activity interventions used in people with MS

"EXERCISE PROGRAMMES INVOLVING CORE-STABILITY APPEAR TO BE WELL-TOLERATED BY PEOPLE WITH MS"

tolerated intervention which improves gait speed and quality of life measures. Although treadmill programmes are often short-term interventions, with a lack of follow-up beyond the trial period, they do allow those with higher levels of disability to exercise safely and should be investigated further. There are a growing number of web-based interventions with the aim of increasing everyday physical activity levels, or allowing people to carry out an exercise programme independently at home. We also now know more about the value of light intensity physical activity, and of breaking up sedentary time with periods of standing being used as an exercise. This is the focus of some current research and may be a way of improving health in those who are more functionally impaired.

About the author

Marianne Hensman is a physiotherapist with a special interest in neurology. After a number of years working in the NHS, Marianne moved into physiotherapy education in 2007. She has been involved in teaching and clinical research, including a study into the use of a virtual reality treadmill in the rehabilitation of stroke. In 2015, she started a PhD focusing on reducing sedentary behaviour and developing exercise interventions for people with MS. Her work so far has focused on the assessment of sedentary time in people with MS with a planned study which will trial an exercise programme.

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Exercise with pain

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There is so much literature on the themes of the role of exercise when it comes to pain that it is difficult to offer a comprehensive review. This article will therefore highlight three key areas and follow each with a clinical discussion. Each statement will be naturally debatable and expose the bias of the author, but it is hoped that, together with the clinical suggestions made throughout each section, these statements will spark further and wider discussion.

LEARNING OUTCOME

1 To discuss and critique the following ideas related to exercise and pain:
- All patients with persistent pain should engage in exercise.
- Exercise has a short-term analgesic effect which may not be important for its long-term effectiveness.
- "Just load it!" and "You can't go wrong getting strong" are important mantras for therapists to follow.

For the purpose of this article we will use the definition of exercise found in Daenen *et al* (2015) as "planned, structured and repetitive bodily movements that are performed to improve or maintain one or more components of physical fitness". We can roughly split exercise into aerobic, resistance training and motor control, recognising that these categories will overlap and that exercise will have a multitude of effects.

Aerobic exercise is not viewed as, or limited to, structured exercise typically found in a gym session. Rather, it is any physical activity that requires moderate to vigorous effort with a corresponding increase in heart rate and metabolic demand. Thus activities of daily living such as walking, free play, dancing and sex can be listed under this umbrella.

Resistance exercise is that requiring muscle contraction against some external force with the intent of improving any of the bio-motor abilities such as strength, power, strength-endurance etc, via mechanotransduction, or that makes changes in the nervous system via plasticity.

Motor control exercises (MCE) may also involve voluntary muscular contractions and could also involve changes in bio-motor abilities and nervous system changes. However, for the purposes of this article, MCE are considered to be those that are performed with the intention of changing the timing and activation of specific muscles relative to other muscles, during both simple and complex tasks, which might also be accompanied by changes in joint kinematics perhaps affected by nervous system plasticity.

Having defined our use of the term exercise, we can now look in more depth at our learning outcomes posed as three debatable statements.

1) ALL PATIENTS WITH PERSISTENT PAIN SHOULD ENGAGE IN EXERCISE

For patients with chronic pain, exercise is routinely considered an important component of a multidimensional rehabilitation programme. Daenen *et al* (2015) suggest that exercise is helpful for chronic neck pain, osteoarthritis, headache, fibromyalgia (FM) and chronic low back pain. This assertion is supported in the examples of recent reviews and randomised controlled trials (RCTs) during which different forms of exercise were compared to no treatment, or usual treatment:

- Low-to-moderate quality evidence shows that MCE are effective for improving pain at short, intermediate and long-term follow-up, with medium effect sizes (Saragiotto *et al* 2016).
- Pilates is probably more effective than minimal intervention in the short and intermediate term for pain (Yamato *et al* 2015).
- Moderate-to-high intensity resistance exercise improves pain in FM (Busch *et al* 2013).
- Aerobic exercise is superior to moderate-to-high intensity resistance exercise in FM (Busch *et al* 2013).
- High-quality evidence suggests that exercise shows moderate effect sizes in decreasing pain in patients with hip osteoarthritis (Fransen *et al* 2014).
- High-quality evidence suggests that land-based exercise programmes decrease knee pain in the short term and that is maintained in the intermediate term (Fransen *et al* 2014).
- There is very low-quality but consistent evidence that exercise can improve pain associated with patellofemoral pain syndrome (van der Heijden *et al* 2015).

Clinicians often take the above conclusions from reputable sources such as Cochrane reviews and make big and comprehensive claims that exercise works, or perhaps more conservatively, that exercise is effective in decreasing pain in many persistent pain conditions.

> "EXERCISE CANNOT BE VIEWED AS THE PANACEA FOR ALL PAIN AND ALL OF OUR PATIENTS"

Such statements would certainly be consistent with our professional bias of exercise as medicine. However, when we look deeper into these reviews the benefits of exercise are not extremely robust. What does it mean for the patient in front of us? Aerobic exercise, resistance exercise, or MCE may have some effectiveness, but cannot be viewed as the panacea for all pain and all of our patients.

In two separate Cochrane systematic reviews on Pilates and on MCE, the improvements in pain were compared to a reference group that was typically either no treatment or treatment as usual. Even when comparing such a wimpy sham we only see modest change in pain. For example, when comparing motor control exercises to the sham, Saragiotto *et al* (2016) concluded that, in the short term, there was a greater average pain reduction of 7.43 points (out of 100) when patients performed MCE. The authors suggested that, while this was statistically significant, it was not clinically important. The lack of a clinically important difference was also seen at medium-term (six months) and long-term (one year) follow up. In the systematic Cochrane review of Pilates (Yamato *et al* 2015) the Pilates group averaged a 14.05 greater reduction in pain (on a 100 point scale) versus the control group. The authors report that this is a moderate effect size and is clinically relevant. Looking at this positively, we can say that both types of spine exercises show statistically significant greater improvements in pain versus a minimal intervention control group, with only the Pilates exercise showing a clinically meaningful difference. However, when comparing Pilates to general exercise the authors conclude that there is no clinically significant difference in disability between the two groups. Unfortunately, the systematic review could not pool results on pain in order to make a conclusion in this area.

This trend for the small influence of exercise on persistent pain states is seen in other disorders as well. In the Cochrane review of exercise for patellofemoral pain syndrome (PFPS) van der Heijden *et al* (2015) conclude that "there is insufficient evidence to determine the best form of exercise therapy". They write that if 250 out of 1,000 patients improve in the control group the addition of exercise will result in 88 additional patients improving their pain and recovering in the long term with therapy, and with short-term exercise resulting in a decrease in pain of 1.46 points (out of 10) for those involved in an exercise programme versus the control group. Similarly, small changes were seen in patients with hip OA in a separate systematic review (Fransen *et al* 2014). Those who completed an exercise programme rated their pain at 29 points, while the control group rated their pain at 21 points. With knee OA, those who completed an exercise programme rated their pain at 32 points while those who were not on an exercise programme rated their pain at 44 points. All ratings were out of 100.

Interestingly, there was a slightly better response to exercise from those with fibromyalgia (FM), albeit there were fewer studies evaluated. Women who underwent resistance exercise showed a 3.53cm improvement on a 10cm VAS while those who did no resistance training showed only a 1cm improvement (Busch *et al* 2013). In the two studies documented in the systematic review comparing aerobic exercise to resistance training, the aerobic exercise results showed a 3.57cm improvement in pain while resistance training showed only a 2.7cm improvement (Busch *et al* 2013).

As clinicians, we want to be able to answer whether the blanket statement can be made that all patients with persistent pain should exercise. The systematic reviews suggest that we can make this assertion, but with a few caveats, i.e. that the type of exercise seems less important and relevant to making changes in pain than is generally considered and that, while exercise can be a component of rehabilitation, it should not be viewed as an incredibly strong mediator of pain and we should not expect it to make dramatic improvements in pain for all patients. This makes sense clinically as there are many factors that might determine why a patient is in pain. Are they in pain because they are weak? Do they have poor endurance levels? Is their pain due to lack of motor control to such an extent that it creates nociception? There is no strong rationale for how weakness, poor endurance or changes in motor control can cause nociception in the majority of our patients and, while these elements may be more relevant when the demands placed on the patient exceed their current abilities, how often does this occur? As fatigue is such a major part of FM, perhaps the greater improvements with exercise seen in this condition are in part due to something as simple as increasing fatigue resilience, whereas, in hip OA or PFPS, fatigue may not really be a contributor and so exercise is less effective.

> "WHILE EXERCISE CAN BE A COMPONENT OF REHABILITATION, IT SHOULD NOT BE VIEWED AS A STRONG MEDIATOR OF PAIN"

"THE RESEARCH SUGGESTS CAUTION IN PRESCRIBING EXERCISE FOR THOSE WITH HIGH PAIN SENSITIVITY"

While we can make recommendations that some form of physical activity or exercise can be helpful for some patients, as the research findings show, it would be difficult to justify a treatment programme that is primarily exercise based as this appears insufficient when addressing the multidimensional nature of pain.

2) EXERCISE HAS A SHORT-TERM ANALGESIC EFFECT WHICH MAY NOT BE IMPORTANT FOR ITS LONG-TERM EFFECTIVENESS IN THE TREATMENT OF PAIN AND INJURY

Isometric exercises are very trendy in the world of tendon treatment, primarily because of their well-documented, short-term analgesic effects. Rio *et al* (2016) have demonstrated that, for patellar tendinopathy, isometric actions for 30-45 seconds duration at 70% of maximal effort for five repetitions are superior to isotonic exercises for short-term pain relief. It should be noted, however, that when isometric exercises are compared with isotonics over a four-week period there is no difference in pain reduction (Rio *et al* 2016).

Vaegter *et al* (2015; 2016) investigated the influence of exercise-induced hypoalgesia in both pain-free participants and in those with pain. They conducted a series of experiments typically involving painful pressure delivered via a cuff placed around a limb and inflated slowly. The participants were asked to rate the pain level of the pressure continuously during inflation, which was stopped when the pressure pain tolerance (PPT), i.e. the maximum pressure the participant could withstand, was reached. This painful stimulus was repeated after aerobic exercise or isometric contractions in order to establish the temporal summation of pain (TSP), measured by repeating the same pressure application over time. Typically, this repetition leads to temporal summation, a form of sensitization causing the same amount of pressure to lead to more pain.

In general, aerobic exercise induces decreased pain, or increased PPT to the region performing the exercise, compared to distant regions. During their experiments, Vaegter *et al* (2015; 2016) performed isometric contractions at 30% or 60% of maximum contraction with two repetitions of 90 seconds duration, following which they documented decreased PPT and decreased TSP both at the site of the isometric contraction, and at distant regions, suggesting a central effect of isometric contractions on the modulation of nociception. A caveat with these findings is that the influence of isometric and aerobic exercise on pain thresholds is small, for example, a participant might tolerate peak pressure of 68.8kPa before an isometric contraction and, following the contraction, will tolerate 69.5kPa.

In patients with chronic musculoskeletal pain, exercise-induced hypoalgesia and conditioned pain modulation is reduced. This is quite unfortunate as these individuals are those we would hope would benefit from exercise. Vaegter *et al* (2016) conclude that exercise-induced hypoalgesia is partly impaired in patients with high pain sensitivity and, in this specific subset of patients, TSP following aerobic, but not isometric, exercise is increased. Further, those with high pain sensitivity had a reduced exercise-induced hypoalgesia response to aerobic and isometric exercise as measured with PPT, when compared with those with low pain sensitivity. It should be noted that there was still a small positive response as after aerobic or isometric exercise the high pain sensitivity group still had a small increase in PPT, thus suggesting that high sensitivity does not completely obliterate the beneficial hypoalgesic effect of exercise.

The conclusion of the research indicates that, for individuals with no pain, exercise induces hypoalgesia, as measured with PPT or via TSP. Patients with high sensitivity to pain have increased, rather than decreased, TSP and less of an analgesic response to exercise when this is measured with PPT. In practice, the results suggest some caution in prescribing aerobic exercise for those with high pain sensitivity. While it can be beneficial for short-term pain thresholds, it can also lead to temporal summation, perhaps leading to a wind-up of pain.

Clinically, Daenen *et al* (2015) recognise the dysfunctional descending modulation of nociception seen in those with persistent pain, yet they continue to recommend exercise for non-painful body parts, assuming that exercise has a systemic effect on pain. Further, the same research group (Nijs *et al* 2014) recommend that exercise be part of a multifaceted treatment approach which recognises that exercise, graded activity, graded exposure and pain biology education might all work together to modulate the cognitions related to persistent pain. The authors suggest that cognition-target exercise therapy may alter pain memories and influence central sensitisation, implying a time-contingent exercise prescription rather than a symptom-contingent one. At its simplest, this approach suggests that pain in and of itself is not harmful and should not be the limiting factor to performing physical activity. It is proposed that a patient performing physical activity that they might view to be harmful or threatening without experiencing that harm or threat, results in an expectancy violation, i.e., there is a conflict between the threat or fear that the patient expected before the activity, and their actual experience. Zusman (2008) suggests that it is necessary to expose the patient to physical activity

without danger in order to convince the brain of the error in its expectations and ultimately decrease the production of pain associated with that "error".

Nijs *et al* (2014) recommend prerequisites to apply cognition-target exercise therapy. As these are paraphrased here, please refer to the primary source for full details:

- Therapists should have a firm understanding of pain mechanisms
- Therapists should have the skills to explain pain mechanisms
- Therapists should have the appropriate communication skills to deliver these messages and implement the exercise / physical activity – preferably a form of socratic communication.
- Therapists should be familiar with biopsychosocial driven pain management strategies and well versed in graded activity, graded exposure in-vivo and acceptance based interventions.
- Therapists should have the skills to apply a variety of exercise interventions.

3) "JUST LOAD IT!" AND "YOU CAN'T GO WRONG GETTING STRONG" ARE IMPORTANT MANTRAS FOR THERAPISTS TO FOLLOW

As mentioned earlier, exercise can be helpful for some patients with pain, but there is a concern that we simplify all painful predicaments and suggest that "just loading it" or "getting stronger" is helpful for everyone. Viewed in this way we could strongly argue against the "just load it" mantra. However, there is a more optimistic view that the advice advocates that simple exercise selection, that uses progressive overload can be just as, if not more, effective than a complicated exercise regime. The "just load it" mantra is a reaction to exercise rehabilitation principles that suggest therapists must correct or change muscle activation timing, joint kinematics and arthrokinematics with precise, highly specific exercise selection and cueing. It is a rebuke of the corrective exercise movement.

"Just load it" is more about the body and the patient responding positively to stress, and that rehabilitation is about preparing the patient to tolerate the loads on the body, rather than creating some ideal movement options or muscle sequencing. At its simplest we can see this in tendinopathy rehabilitation.

When a tendon is painful, it is assumed that there is associated tendinosis; that the tendinopathy is most likely caused by a failure to adapt to the applied loads on that tendon, and so load management ultimately becomes the basis for treatment. Stressors or loads contributing, mechanically and psychosocially, to the sensitivity are modified, while at the same time a simple progressive loading regime is placed on the tendon (and the person) to ask that tendon (and the person) to adapt and improve their load tolerance abilities. Very simply, most tendon loading protocols simply ask "what can this joint do and what must this joint do?" Rehabilitation then prepares the tendon to tolerate those demands.

In the Achilles, for example, the tendon must tolerate heavy loads with a straight knee, heavy loads with a bent knee, explosive loads where the tendon stores elastic energy and the muscle works isometrically, powerful loads where the ankle joint moves fast but under heavy loads and a combination of these in and out of the sagittal plane. Rehabilitation simply aims to load the tendon in such a way that prepares it for these challenges. There is no special emphasis on changing activation synergies between muscles, or on drastically changing technique.

Similarly, it could be argued that PFPS rehabilitation also follows this approach. There does not appear to be one specific type of exercise that is beneficial for PFPS. Studies which compare a neuromuscular training programme with an emphasis on changing muscle timing are equally effective as simple strength training exercises (Bennell *et al* 2014). Further, systematic reviews suggest that no one type of exercise is more valuable than another. Closed chain versus open chain appears irrelevant. The common factor is again "just load it". Interestingly, the effects of loading may not even be due to improving the strength of the muscles around the joint (Lack *et al* 2015) and may merely be due to training that joint to once again tolerate the loads that may be currently sensitising it.

> "SIMPLE EXERCISE THAT USES PROGRESSIVE OVERLOAD CAN BE JUST AS EFFECTIVE AS A COMPLICATED EXERCISE REGIME"

This shift from complicated exercise selection and execution is illustrated by McQuade *et al* (2016) when discussing the role of the scapula in shoulder pain. Traditionally, it has been argued that scapular kinematics are important in shoulder pain and that it is therefore important to identify the presumed faulty kinematics and choose and teach exercises aimed at changing them. Yet, McQuade *et al* (2016) reason that this paradigm is deeply flawed and that changes in timing and kinematics are inconsistently being related to pain, and unnecessary for pain relief. Rather, the authors argue to ask the most out of the scapular movement and surrounding joints, thus applying exercise selection to facilitate all functions in the region. This is consistent with the "just load it" mantra with rehab consisting of exercises which target the entire rotator cuff, the scapula-thoracic musculature, and related musculature in the thoracic and lumbar spine. Furthering the notion that changing kinematics or muscle timing is flawed are a number of studies which show improvement in pain that is not consistent with changes in scapular kinematics (McClure *et al* 2004; Roy *et al* 2009; Camargo *et al* 2015; Struyf *et al* 2013).

Exceptions

While the previous paragraphs suggest that a general loading programme is sufficient in treating pain, and specific corrections or applications of stress are not always necessary, we should always consider the exceptions, such as a lesion that appears to primarily contribute to the nociception and dysfunction and necessitates a more specific intervention. This would also be seen in something along the lines of a hamstring tear when specific exercises designed to load that region in a manner similar to the type of injury appear important and beneficial for rehabilitation.

However, more general and non-specific conditions such as PFPS or low back pain in which the dysfunction appears less identifiable, e.g. no specific tendinosis or tear, will respond to a more general exercise therapy regime. Perhaps because it is in these cases that the exercise works for secondary reasons, i.e. in increasing general load tolerance, changing perception of threat, targeting cognitions about the painful area, utilising exercise induced analgesia, changing systemic variables such as inflammation, or changing sensitivity via the associative "exposure without danger" and violation expectancy learning mechanisms.

Summary

Exercise can be a helpful component of a multidimensional and comprehensive rehabilitation strategy for people in pain. The long-term benefits of exercise for various conditions have been demonstrated in systematic reviews, but their effects should not be considered large. Many patients will not respond to exercise and some improvements may be small. Thus, like so many interventions, exercise should be part of a multidimensional approach to pain.

About the author

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Pilates as a therapeutic exercise

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The use of the exercise method known as Pilates within the field of exercise rehabilitation has grown steadily over the last few decades. It is reasonable to suggest that today it is now one of the most widespread forms of therapeutic exercise used in many areas of health and fitness. However, exactly how the exercise method is best adapted to be used within the field of therapeutic exercise is often poorly understood.

LEARNING OUTCOMES

1 Understand the importance of the movement philosophy of Pilates in a therapeutic program.
2 Review the role of the "inner core" with that of the "powerhouse" of classical Pilates.
3 Outline the five-stage model of a proposed therapeutic approach to Pilates.

Over the years many different approaches to Pilates have prevailed. Some of these remain very true to Joseph Pilates' original methods of teaching and sequencing, while others have adapted Joseph's original work to specific populations, modifying the movements considerably to match the requirements of these various groups. Others still have attempted to merge the core elements and movements of Pilates with other exercise methods such as yoga and, in doing so, have changed the original repertoire substantially.

While there is clearly merit in the more classical approaches that loyally preserve the very core 1920s beliefs of Joseph Pilates, it is questionable whether these traditional movements now reflect the needs of our evolving 21st century population. It is important to appreciate Joseph's original movements in the context of suiting the lifestyle and activities of a very different era, compared to the computer age and more sedentary lifestyles of today. Before we investigate the use of Pilates in terms of therapeutic exercise, let us first review the history of the Pilates method.

History

Joseph Humbertus Pilates was born in Germany in 1880. He spent his childhood fighting rickets, asthma and rheumatic fever. Determined to become physically immune to his ailments, Joe studied yoga, zen meditation and the rigorous exercise regimes of the ancient Greeks and Romans and, by his teens, he was excelling in boxing, diving and gymnastics.

In 1912, Joe moved to England where he worked as a boxer, a circus performer, and trained detectives in self-defence. When the First World War broke out, Joe, as a German national, was interned in Lancaster and was later moved to the Isle of Man. While there, Joe was trained as an orderly in the hospital and was appalled to see so many ill people in bed doing no exercise. He devised a gentle exercise regime and it soon became evident that those patients practising Joe's exercises were improving faster than expected. With the endorsement of the doctors, Joe progressed his exercises to incorporate the use of springs from old hospital beds with the aim of providing simultaneous progressive resistance and weight bearing that enabled partial loading forces on muscles, tendons, and ligaments and thus improve healing.

Pilates' legacy continues to evolve and benefit thousands of people around the world today.

Understanding the Pilates method

The Pilates method is essentially a mind-body centering technique that emphasises the importance of beginning movement from a central core of stability, namely the lumbo-pelvic region.

From this central core, the Pilates method works by adjusting the intensity of each exercise through the use of differing length levers (various limb movements) and resistance (use of Pilates equipment). Combine this with appropriate breathing control and the essence of the mind-body technique that is Pilates is evident.

Joseph Pilates believed that by concentrating on precision of movement, awareness of breath control and a continued flowing movement, the exerciser could alter abnormal patterns of movement and achieve a carryover effect into daily function.

The Pilates technique is taught in two categories; matwork and machine based work. Matwork is a combination of the original 34 Pilates exercises Joe developed back in his early years. They consist of strength, mobility and stretching exercises completed on an exercise mat, and a main theme of maintaining a central core of stability in the lumbo-pelvic region.

> "PILATES BELIEVED THAT INJURIES WERE CAUSED BY IMBALANCES IN THE BODY AND HABITUAL PATTERNS OF MOVEMENT"

Machine based Pilates takes the concepts of matwork on to spring-loaded resistance machines originally designed by Joe himself. The most widely used Pilates machine is the reformer. Others include the Cadillac table and the Wunda chair.

Joseph Pilates also believed that injuries were caused by imbalances in the body and habitual patterns of movement. He observed that when a person had a weakness or maligned area, that person overcompensated or overdeveloped another area to achieve a certain functional movement. Thus, Joe found it was critical to correct the malalignment and to re-educate the body to prevent recurrence. This is a belief that, 50 years later, is commonplace in the muscle imbalance theories of today's physiotherapy practices.

Principles of Pilates

Pilates is based on the following eight principles:

BREATHING

Focus on the breathing cycle is designed to assist the client in gaining a connection between the flow of the movement and the connection of the mind to the performance of the movement. Various theories for the exact breath pattern have been devised over the years, such as the belief that the diaphragm and transverse abdominis (TrA) activate earlier in expiration (Allison *et al* 1998; Hodges *et al* 1997) compared with inspiration, and this may be used to facilitate control of the movement. The current accepted theory is based on the idea that exhalation with the movement of greatest effort provides the spine with the greatest local muscle stability. However, it must be noted that the key aspect of Pilates is to regain a smooth, fluid, flowing movement with the least amount of muscle activity for that given task. Therefore, the way that the breath pattern is used may differ from client to client depending on their particular flow of the movement.

CONCENTRATION

Pilates is a movement programme that is designed to engage the mind and body to create fluid movement. Unlike various other forms of exercise, the mind cannot switch off. Concentration on every movement is vital to promote correct alignment and body awareness.

CONTROL

Movement control is a fundamental principle of Pilates, be it when working across, with or against gravity during mat exercise and when working against the spring resisted Pilates apparatus. The key point is that the client should engage the strategies required to perform the task with the least amount of muscular effort for that task, therefore enhancing the efficiency of their movement control.

FIGURE 1: Progression levels of shoulder bridge exercise demonstrating initial core stability (level 1) with added challenge (level 2)

FIGURE 2: Leg Pull in Prone exercise level 1 demonstrating precision and control

CENTRING

In more classical Pilates programmes the centre was considered the "powerhouse". This was used to generate a large amount of activation in the "core" muscles irrespective of the task at hand. In the more clinically focused programmes such as the APPI Pilates programme, the word "centre" is used to replace the classical "powerhouse". In the Australian Physiotherapy and Pilates Institute (APPI) philosophy the client engages the appropriate muscles that they need for the task at hand. The "intensity" of the connection to the "core" muscles will alter as the load alters. This avoids the unnecessary "bracing" that can be caused by the "powerhouse" concept when not required on lower load tasks, but encourage this connection on higher load tasks. The exercises therefore can primarily facilitate core stability and then challenge this through various arm and leg movements, thus developing an efficient "control" centre at lower load tasks and a strong "powerhouse" for higher load tasks (figure 1).

PRECISION

Precision of movement is a long-term goal in the Pilates method. Routine in the execution of the techniques creates this precision and leads to greater awareness and control (figure 2).

FLOW

Pilates exercises are performed in even, continuously flowing movements. Recent progressions in the APPI philosophy has seen the use of repetitions replaced by time based

"PILATES AS A FORM OF THERAPEUTIC EXERCISE ADDRESSES MANY OF THE BIOPSYCHOSOCIAL ASPECTS THAT CAN INFLUENCE PAIN"

FIGURE 3: Progression of swimming in standing exercise demonstrating mind-body awareness

exercises prescription to enhance this crucial element of Pilates and its functional link to normalised movement.

INTEGRATED ISOLATION

Pilates builds mind-body awareness, thus kinaesthetic awareness. Routine in Pilates allows one to recognise incorrect patterns of movement, isolate them and correct them (figure 3).

ROUTINE

As with any exercise therapy, repetition leads to greater skill and greater benefits.

Pilates as a therapeutic exercise modality

Research has widely purported the use of exercise as a major intervention in the treatment of non-specific low back pain. Indeed, exercise has been shown to be successful in a pain management strategy (Yamato 2016).

Many studies maintain that the Pilates method assists in pain relief, functional retraining and social wellbeing. It is these wide reaching benefits that may well be one of Pilates' key assets as a therapeutic exercise.

Schütze *et al* (2014) highlighted the importance of the biopsychosocial element of pain management. The authors stated that the burden of low back pain can be reduced if management is more aligned with evidence that supports a patient-centred approach that empowers them to actively self-manage their pain. This study highlights many of the attributes that, in this author's opinion, Pilates has to offer.

As a form of therapeutic exercise Pilates, especially when used within a modified framework such as that of the Australian Physiotherapy and Pilates Institute (APPI), addresses many of the biopsychosocial aspects that can influence pain. The key element to Pilates' success in this field is its focus on retraining, and regaining, normal movement. The client is encouraged to regain a fluid, controlled pattern of movement and links that control to the breath pattern. These links may lead to a decreased anxiety level often connected with other forms of exercise.

The APPI approach uses a unique, five-step model to help the clinician build a successful therapeutic Pilates programme.

Stage 1: **conscious incompetence** teaches the client to initiate the process towards a normalised movement strategy by using the relevant tools and imagery required to bring awareness to dysfunctional muscle systems.
Stage 2: **conscious competence** progresses through low-load, closed chain movements that combine control, mobility and co-ordination.

Stage 3: **progress continues** through to increasing load by adding open chain movements or changing gravity, base of support and lever lengths to further progress movement in multi-directional ways.

Stage 4: **progressing to unconscious competence** develops movement sequences that improve strength, endurance and speed.

Stage 5: **unconscious competence** undertakes functional movement patterns in a variety of positions. Encourage the maintenance approach to wellbeing.

The above model focuses on the importance of gaining the cortical connection of the brain to the muscles that formulate the inner core of abdominal support. This is achieved through a number of ways and is aimed at the connection of the Transversus Abdominis (TrA), multifidus, pelvic floor, internal oblique, lumbo-pelvic fascia, diaphragm and lumbar erector spinae muscles as an integrated unit. Hides *et al* (2011) showed that a client is four-and-a-half times more likely to gain a correct multifidus contraction if you first achieve a good TrA contraction.

Vleeming *et al* (2014) demonstrated the importance of this connection as they developed the concept of the common transversus abdominus tendon (CTrA). This study demonstrated the stabilising capacities of this integrated system that must be retrained through

a fluid movement approach and not from a static, individualised muscle recruitment.

It is this co-ordinated integration of the multiple muscles of the "inner abdominal core", with the surrounding fascia and ligamentous system that the APPI refers to in its approach to the "stabilising core". This is in contrast to previous held beliefs that this was a single muscle connection to the TrA, a common misinterpretation of Pilates, current approach to that of static, stabilising exercises that have recently been discussed in the literature.

Further evidence has also suggested that cortical connection is important in the function of the pelvic floor. An ultrasound study by Junginger *et al* (2010) found both yoga and Pilates exercise, without pre-connection of the pelvic floor muscles, descended the neck of the bladder by up to 17mm. Comparatively, with pre-connection, performing the same exercises saw the bladder neck being supported throughout.

Once the cortical connection is achieved, the client is then asked to perform a series of low-level movements using the arms and legs as levers in order to challenge their ability to control the optimised spinal position. It is vital in a well-planned Pilates programme that this involves movements in multiple planes, and at a variety of speeds to truly retrain the client's adaptability to movement control. The key focus here is on the client's capacity to control the movement pattern, and they may use a variety of approaches and feedback tools to achieve this, and through repetition, the brain begins to learn the optimal control for the given movement. Teaching visual imagery allows the client to use past experience or memory to assist successful movement. Tactile feedback, correct demonstration of the movement and verbal cueing is also used ensure that, from the first repetition, the client is learning the movement sequence correctly.

The next phase is to increase gradually the load being asked of the system through the introduction of open chain movements and additional equipment that aims to alter the base of support, or to challenge the movement pattern. The programme can be tailored to the individual and progressed at a speed relative to the client's abilities. A key part of this stage is the integration of the muscle "slings", first reported by Vleeming *et al* (2014) and later reinforced in a multitude of studies.

Muscle slings

In the APPI method, we use five key muscles slings:

1) Primary – the inner abdominal core of transversus abdominus, multifidus, diaphragm, pelvic floor and thoraco – lumbo-pelvis fascia.
2) Posterior oblique – linked by the latissimus dorsi on one side and the gluteus maximus on the opposite side.
3) Anterior oblique – this is the internal oblique linked with the opposite adductor via the anterior abdominal and pelvic fascia.
4) Deep longitudinal – the erector spinae, deep lumbo-pelvic fascia, SIJ ligaments, biceps femoris.
5) Lateral – the deep gluteal muscles (medius and minimus), tensor fascia latae and the deep pelvic fascia linked with the opposite adductor longus.

These slings are all connected to certain exercises throughout the programme and allow the clinician to identify which sling, or part of it, they believe to be weak, or in need of improvement within a client's movement pattern.

The client can then progress to the challenge of increased strengthening exercises, endurance loads and speeds. It is vital that a well-rounded therapeutic Pilates programme aims to progress the client to higher loads and engagement of what is referred to as the extended core (inner core + slings + arm and leg strength).

The final piece of a successful therapeutic Pilates programme is to bring all the components of the movement control and movement awareness gained through the exercises into upright functional standing. Many Pilates exercises taught by APPI have been adapted into a standing Pilates programme to ensure that the concept of movement control in weight bearing has been addressed.

> "VISUAL IMAGERY USES PAST EXPERIENCE OR MEMORY TO ASSIST SUCCESSFUL MOVEMENT"

Conclusion

The overall aims of the APPI Pilates method is to develop the client's connection to their deep, postural "core" muscles that support the spine throughout movement, enhance normal movement patterns and improve overall body alignment. The final result is the creation of a body that is more efficient in daily activities and less prone to future pains and injuries.

Further studies have investigated how a therapeutic Pilates programme is optimised. In a Delphi study of Australian Physiotherapists it was recommended that people with chronic low back pain should undertake supervised Pilates sessions for 30-60 minutes twice a week for three to six months. Participants also suggested that these patients would benefit from individualised assessment and exercise prescription, supervision and functional integration of exercises, and use of specialised equipment (Wells *et al* 2014).

While the focus of this article is on the implementation of a therapeutic Pilates programme for the lumbo-pelvic area, it must be highlighted that Pilates is an exercise programme for the whole body.

Therapeutic Pilates programmes can be used in a multitude of ways in women's health, osteoporosis, paediatrics and even neurological rehabilitation.

While the practical benefits of Pilates is demonstrated every day in centres across the world, it must also be highlighted that more empirical research needs to be done to show its effectiveness in strong research based studies.

About the author

Glenn graduated as a physiotherapist more than 10 years ago from Melbourne, Australia. He then went on to postgraduate study and enhanced his skills further by spending a year training with one of Australia's leading clinicians. Following further study into the clinical effectiveness of the Pilates method, Glenn co-founded the world-renowned "Modified Pilates Rehabilitation Programme" and lectures worldwide on its effectiveness.

Glenn continues to lecture internationally and currently consults to a number of premier league football clubs, local athletics clubs, the British Bobsleigh Association and sporting teams travelling to the UK from Australia. Nominated for the Physiotherapist of the Year award in 2007, Glenn is now considered one of London's premier physiotherapists in the rehabilitation and acute and chronic spinal pain and, as Vice-Chair of the Association of Chartered Physiotherapists in Exercise Therapy, he is now involved in setting exercise therapy standards.

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Why shouldn't we just stick to stickmen and be done with it?

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Today's purchasers of healthcare are seeking the highest standard of clinical effectiveness. Optimising treatment sessions to produce better outcomes is the challenge and is at the heart of Physio First's Quality Assured Practitioner scheme. The evidence shows that patients are more likely to adhere to home exercises and perform them more accurately using narrated video clips than static line drawings. Is it, therefore, time to consider how you deliver self-care to patients?

LEARNING OUTCOMES

1 Understand the way exercises are delivered says a lot about the practitioner, their clinic and whether they truly offer an evidence-based service.
2 Appreciate that patients have an increasing expectation of quality and innovation.
3 Be aware that exercise software can be cost-effective.
4 Understand how the delivery of exercise as a treatment modality can be part of the Physio First intent towards Quality Assured Practitioner status.

There is a rather dry, clinical conversation that can be had about evidence-based research, pointing to better patient adherence and performance accuracy using exercise videos instead of stickmen or line drawings. However, in my opinion this shouldn't be the basis for choosing exercise software. There is a deeper, more probing way of approaching this decision, which would be to ask:

- what would my patient want?
- what would they expect?
- what would they prefer? and
- how can I impress them?

These questions should not just be in this regard, but in every aspect of our business.

Many physiotherapists begin their conversations with "I prefer...", "we've always done it this way" and when asked what they think their patients might want, a fair bit of back tracking ensues often with a presumption "we've never had any complaints", which isn't probably the best outcome clinicians should be seeking.

There are many examples of companies not moving with the times. Woolworth stores thought they would be selling Pick 'n' Mix forever regardless of the changing face of the High Street. Blockbuster felt that it could ignore the internet and keep renting videos despite the changes in how we now view our movies. HMV didn't react quickly enough to the emergence of film and music downloads and had to be bailed out by investors who understood they would have to do more than sell DVDS and CDs. These companies took a path of complacency, failing to realise that their dominant position could be threatened until it was too late to react. The lesson learnt in their cases and in our businesses is that we can't afford to stand still and what we've always done in the past cannot guarantee success in the future. We need to be focused and continually question the strengths, weaknesses, opportunities and threats to our businesses. Providing our patients with the highest quality care within an evidence-based framework is the best chance of thriving in a fast moving healthcare market.

The efficacy of exercise software

The fact that the evidence for the efficacy of exercise software, and its use in ensuring adherence to the programmes we give to our patients, supports exercise videos over static line drawings shouldn't come as a surprise. We live in a video based world. If we want to learn how to bleed a radiator, cook a favourite recipe, or dance the Cha Cha, then we head straight for YouTube or we "Google it".

If proof is needed over common sense, then the Cochrane Review (Jordan *et al* 2010) has pretty much all the evidence needed. Patient adherence levels are greater, performance accuracy is better; there are twice as many errors in performing exercise following static line drawings when compared to video examples (Jordan *et al* 2010), and here's the biggie: patients **unanimously** prefer videos over static line drawings (Weeks *et al* 2002).

Interestingly, there is no difference in performance accuracy when it comes to the clinician performing the exercises in front of their patient, and the patient following a video instruction. This surely has implications in terms of how

> "WE CAN'T AFFORD TO STAND STILL AND DO WHAT WE'VE ALWAYS DONE"

clinicians manage their time and the treatment time for the patient (Weeks *et al* 2002).

Anyone can do simple exercises

It is easy to fall into the trap of thinking that exercises are easy to follow, but that's only because, as physiotherapists, it's what we do day in, day out. We are not burdened with the concerns many patients have, that they may be doing more harm than good, and that any pain attributed to performing the exercises constitutes more damage. Put another way, if a plumber scribbled down a few steps to change the cistern flush, with the assurance that it was straightforward, how confident would we be about doing it? I imagine that adherence would be pretty poor. However, with access to a full video instruction, we might be more confident about attempting it (**https://www.youtube.com/watch?v=Wj-5YXnY-_Y**). In short, we don't know what we don't know, that's why there should be no guess work involved for our patients.

Doing all the right moves, but not necessarily in the right order

We've all seen the patient who comes back to us with some elaborate hybrid of the exercise they were prescribed. Not only is it frustrating, but time lost while your patient is doing the wrong thing means a greater chance of worse outcomes and poor patient satisfaction, and if our sessions with the patient are limited, then we are playing catch-up to improve. Worse still, this incorrect performance could lead to further injury.

It may come as a shock to many therapists that our patients have more in their lives than their physiotherapy session, which is often just one, small interaction in their busy day. So, a scribbled stickman and some verbal instructions at an early morning appointment, are likely to be a distant memory after a hard day at work. It's important to understand that patients are no different to us. They think the same, they work the same, they learn the same, and they have the same expectations that we have when buying a product or using a service: they want to experience high quality and innovation, and that applies equally to the older generation, or "silver surfers", who many clinicians assume do not engage with technology.

Filming exercises on the patient's mobile

Some therapists may wonder why use software, when we can just use the patient's mobile phone to video them performing the exercise. Well, this approach depends on whether it can be done within the regulations of the Care Quality Commission (CQC), Health and Care Professions Council (HCPC) and the Chartered Society of Physiotherapy (CSP) with regard to keeping accurate clinical records of the exercises prescribed. As the patient's mobile phone heads out the door with its owner, so does our clinical record and, if it's not recorded it didn't happen. Additionally, for therapists who are proficient with their favourite exercise software, content can be sent electronically to the patient in seconds, which has to be better than spending time instructing a patient and then filming them. This way, more time can be spent on "hands-on" treatment, or in seeing more patients.

Cost-effective software packages

For clinics that make a profit, software packages are definitely cost effective. They are tax deductable as an operating expense and by choosing an exercise software package that emails videos directly to the patient, savings can be made on the cost of printer ink and paper.

For those who still prefer stickmen, the time it takes to draw them, and then talk the patient through the exercise instructions, should be taken into account.

Exercise software also gives the clinician more control of their time management – no more rushed instructions with only moments to spare in the appointment time, no more hanging around the photocopier or filing cabinet with your patient.

Many exercise software providers offer info-pages to the patient about their condition, and providing this, together with verbal advice, can be the most effective form of treatment (Watson & McKinstry 2009). If a patient knows why they are doing the exercise, they are more likely to do it; reassurance results in improved adherence. Anecdotally, we've all seen the patient who has come to us from the GP with a diagnosis of a "crumbling spine". Human nature only recalls the worst parts of any explanation and disregards the rest. Providing online info-pages also saves on the cost of buying booklets, or printing information sheets, so we can do our bit for the environment, too.

Exercise software: what to look for

Usability: As with any software, the user should be able to dive straight into it as though they have been using it all their

> "PATIENTS WANT TO EXPERIENCE HIGH QUALITY AND INNOVATION IN THE DELIVERY OF THEIR EXERCISE PROGRAMMES"

> "IF A PATIENT KNOWS WHY THEY ARE DOING THE EXERCISE, THEY ARE MORE LIKELY TO DO IT"

life. If it isn't intuitive and it takes longer to send an exercise programme than it does to treat the patient, then try a different software provider.

Cost: Most products are relatively cheap to buy initially, but adding multiple users can make them expensive. Some clinics get around this cost by using a generic name, but sending information to a patient without the treating clinician's name on it looks amateurish and is poor in terms of clinical governance.

Multiple users at multiple locations: Where a software programme is accessed by multiple users, the ability to switch elegantly from one user to another without fuss is essential, as is the facility for those who work out of multiple clinics to match the details of each patient specifically to the clinic where they were seen. It is worth noting that not all companies offer these options and some that include them do so at an additional cost.

Fit for purpose: We've all bought an expensive product like a mobile phone or laptop and then never used half of the functionality. The advice here is to be thoughtful about whether the product matches current needs and aspirations. While it may suit some clinicians to offer a 24/7 chat feature for patients to make contact, and others may want to create and scrutinise elaborate graphs of their patient's daily performance and adherence levels, others may want to avoid the glitz and choose a software package that effectively meets the more basic needs of their clinic.

Patient perception: What impresses our patients? We should be aware of how helpful our output is in encouraging our patients to carry out prescribed exercise programmes effectively. Software should be slick and professional, rather than something that looks as though it was designed in the 1980s, and narrated video instructions should include both the left and right side, rather than leaving the patient to work that out for themselves.

Data safety: Congratulations on becoming a data controller. This involves the responsibility of ensuring that all patient details remain confidential and secure. To avoid a "Talk-Talk-esque" fiasco look for ISO27001 accreditation on the software provider's website and check whether the server is based in the EEC, and so complying with the EU data protection regulations. For more information on the regulations see Hawthorn (2016).

The path to Quality Assured Practitioner

As we are all aware, Physio First exists to champion evidence-based, cost-effective private physiotherapy with members in the changing healthcare marketplace and, to support this intent, our organisation has launched our Quality Assured Practitioner (QAP) scheme to enable us to benchmark our outcomes and prove to existing and potential clients how effective we are. It follows, therefore, that there will be an increasing need to reflect these values and demonstrate high-quality service standards that should delight patients and their private medical insurers. It would seem unlikely there will be a place for scrawled stickman diagrams when, as previously mentioned, the evidence for patient adherence, outcome performance and preference (Cochrane 2010) points to the increasingly accessible exercise software packages from a wide variety of suppliers.

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About the author

As well as running his own physiotherapy practice, Gary Martin is the Managing Director of **exerciseprescriber.com**, a company with the mantra of "Making clinical lives easier... patient lives better". As a British company, employing a talented British workforce, **exerciseprescriber.com** mainly supplies software to the corporate sector and has the largest healthcare provider in the UK as one of its many clients. As a physiotherapist, Physio First member and volunteer on our membership committee, Gary is acutely aware of the specific needs physiotherapists have with regard to innovative and functional software, and through **exerciseprescriber.com** he is currently addressing the "business of physiotherapy" with developments that will be posted on Facebook and Twitter in the coming months.

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Education programme courses

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Physio First clinical courses

REGION	TITLE / TUTOR	DATE	EVENT REF	VENUE	STANDARD COST†
East Anglia	Young athlete from screening to application **Sid Ahamed**	**Saturday 13 May 2017**	**MUS21717**	Bury Physiotherapy, Bury St Edmunds	**Member** £145* **Non-member** £175*
Essex	Treating the neuro patient **Sarah Daniel**	**Friday 09 June 2017**	**NEURO0217**	Cressing Temple Barns, Braintree	**Member** £145* **Non-member** £175*
Mercia	Road cycling injuries **Michael Callaghan**	**Saturday 10 June 2017**	**CYL1717**	National Cycling Centre, Manchester	**Member** £145* **Non-member** £175*
NW Met	Sport specific rehab **Sid Ahamed**	**Saturday 10 June 2017**	**SSR117**	Ruislip Golf Course	**Member** £145* **Non-member** £175*

For more information on our centrally run courses, please go to our ***Events*** page at **www.physiofirst.org.uk** or call our Education team on **01604 684 968**

Painless Practice business courses

REGION	COURSE TITLE	DATE	EVENT REF	VENUE	COST
East Pennine	Taking action and turning plans into results	**Thursday 18 May 2017**	**PAINPRAC2A** celia@painlesspractice.com	Novotel, Leeds	**Member** £175 **Non-member** £200
	Ethical and effective marketing for practices	**Thursday 29 June 2017**	**PAINPRAC3A** celia@painlesspractice.com		
	Create a robust social media strategy for your practice	**Thursday 14 September 2017**	**PAINSOCIAL172**		
London	Taking action and turning plans into results	**Wednesday 10 May 2017**	**PAINPRAC2** celia@painlesspractice.com	Meat & Co, Ariel Way, London W12	**Member** £175 **Non-member** £200
	Ethical and effective marketing for practices	**Thursday 27 June 2017**	**PAINPRAC3** celia@painlesspractice.com		
	Create a robust social media strategy for your practice	**Tuesday 12 September 2017**	**PAINSOCIAL17** celia@painlesspractice.com		

Regional courses

REGION	COURSE TITLE	DATE	EVENT REF	VENUE	STANDARD COST†
Midlands	Delivering a competent DSE assessment and report	**Saturday 13 May 2017**	**DSEAR0116** Contact: Susannah Solt midlands@physiofirst.org.uk 01926 800101	Custard Factory, Birmingham	**Member** £140 **Non-member** £150

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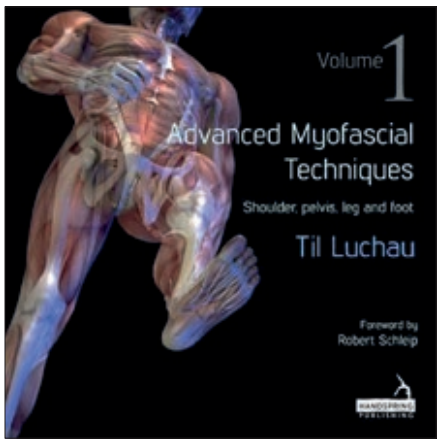
Transforming Practices

Painless Practice will be offering free 30-minute business surgeries on the conference weekend. The main purpose is to evaluate your business and identify the key areas that need to be addressed to be ready for the Physio First Quality Assured Practitioner scheme. Should you wish to book a free 30-minute slot, please email **celia@painlesspractice.com**

We hope to see you at the Physio First conference!

†All rates may be subject to the addition of VAT at prevailing rates



Book review

Tobias Bremer Book Editor

Advanced Myofascial Techniques: Shoulder, Pelvis, Leg and Foot

Til Luchau

Publisher: Handspring Publishing | ISBN: 9781909141162
RRP: £40.69 | Paperback | 208 pages

This book does what it says on the tin and does it extremely well. Basically, after the initial introduction in chapter one entitled "how it works", the text takes you on a fascia release journey, covering release techniques for the shoulder, pelvis, leg and foot, with each chapter offering a crystal clear explanation of the clinical reasoning behind its featured technique. What really makes this book different however, is the multifaceted teaching approach it employs.

The accompanying online content enables the reader to analyse the very enticing images and use the "key points" box to facilitate the learning of the new skill. Scientific reasons for either holding a position or using movement to enhance mobility are also explained along the way, making this a very comprehensive text.

If you are looking for a book to enhance your myofascial release skills, then I have no issues in recommending this one to you!

Tobias Bremer

NEW PPEF logo really makes a difference

The Trustees of the PPEF are delighted to announce that they have adopted a new logo and strapline for their charity which will show very clearly that the Foundation's aim is "helping physiotherapy make a difference". They achieve this through funding research and education programmes which benefit physiotherapists, their patients and members of the public.

PPEF have also developed a new website which can be found at **www.ppef.org.uk**.

Please visit this website to see if you can benefit from the work of the Foundation or if you are eligible to apply for a grant. Grants are available to all HCPC registered physiotherapists whatever setting they work in.

This year the Foundation is pleased to be supporting the Physio First conference once again and also the Physio First Data for Impact project as well as many other individual projects.

The Annual General Meeting of PPEF will take place at the East Midlands Conference Centre in Nottingham on Saturday 1 April at 13:00hrs and is open to all PPEF members.

If you would like to become a member of PPEF, an application form can be found on the website for you to download.

PPEF grant awards

The Electrophysical Forum

Professor Tim Watson
University of Hertfordshire

INTRODUCTION AND CONCEPT

The Electrophysical Forum is an online, open access, free-to-use, internet based resource which aims to provide an interactive platform for questions, comments, discussion and opinion related to the use of electrophysical modalities in therapy. It is supported by an internationally renowned expert panel and used by a broad sphere of clinicians, researchers, educators and students.

The development and initial running costs have been generously met by the Private Physiotherapy Educational Foundation (PPEF), whose support is very much appreciated and fully acknowledged on the forum pages.

WHY WAS IT NEEDED?

I get, on average, 20 or more emails a day seeking advice, or answers to specific questions relating to the use of electrotherapy (now, more properly identified as the electrophysical agents). I can't complain! Some 20 years ago I set up web pages on electrotherapy, initially to give extra support to the students at Brunel where I was head of school at the time. However, if it is on the web anyone can see it and over the years – and thanks to Google – it became known about. Last year, more than 346,000 people from more than 200 countries / territories accessed the site; as you can imagine, it attracts a fair amount of email correspondence with questions on all aspects of electrotherapy.

So, even though it's my own fault, I was finding that I was spending several hours a day, every day, responding to these emails, which is simply not feasible to sustain. But I still wanted to be able to offer the open access and free resource that I originally intended. The idea of the forum was to provide this free, open access place where questions could be asked, opinions sought and views expressed and where, as importantly, the answers would come from a variety of experts and users – let's call them the electrophysical community, rather than just the "opinion of Tim"!

THE FORUM – SHAPE AND FUNCTION(S)

In order to ask a question, or proffer an answer or opinion on the forum, the user registers, free of charge, with their email address which will **never** be sold on, distributed or used for purposes other than forum registration. Anybody, registered or not, can see the questions and all the answers/responses.

At the moment, there are three groups of questions/discussion topics:

- General electrotherapy
- Modalities
- Contraindications

> "I GET, ON AVERAGE, 20 OR MORE EMAILS A DAY SEEKING ADVICE, OR ANSWERS TO SPECIFIC QUESTIONS RELATING TO THE USE OF ELECTROTHERAPY"

These were set up because we needed a starting point and they were based on the questions that I was historically getting by email. This grouping is not fixed and is likely to change as the content and usage develops.

THE PANEL

In order to assist the provision of the widest range of expert opinion, views and knowledge, I approached 20 of the most influential academics, clinicians, and researchers from around the world to join me in this enterprise. Impressively, they all agreed to participate – for free. Some have been more active than others when it comes to responding, **but** some people have very specialised interest areas (I happen to be a generalist), so they are likely to pipe up when a topic close to their field of knowledge comes along. The panel includes people from all continents, which also helps to give a wider perspective. The use of, and current practice with electrophysical agents certainly varies from country to country; what is the norm in the UK might be very different to that in Singapore or Brazil or Canada.

The manufacturers have also been invited to participate as some of the queries are best answered by people who make the machines, **but** they are requested **not** to use the forum as an advertising platform and, if they do, moderators remove these messages or the replies. As a moderated forum, the panel take, very seriously, their responsibility for making sure what is posted is fair, not offensive, not advertising, etc.

FORUM FIGURES TO DATE

The forum is in its infancy. We officially launched in early November and have been working to increase awareness of the resource ever since. Panel members have "advertised" it to their professional colleagues and we have used places like iCSP, and its equivalent in other countries, to make sure that as many people as possible get to know about it. At the time of writing, just over two months post launch, 20 questions have been posed to the forum attracting 103 responses. More than 4,900 people have viewed the questions and answers area, so not a bad start at all.

The questions have been varied, from contraindication issues through to "best settings" and "which machine should I get?" with numerous topics in between. The most popular question in terms of the number of responses and the number of people looking at the answers was about the use of electrical stimulation when there is metal in the tissue.

THE FUTURE

The forum appears to be meeting a worldwide "need" for a wide range of therapists and practitioners who use, or are considering the use of, electrophysical modalities. One hopes for continued growth and, given that all questions and their associated responses stay up and visible even after the discussion has finished, this forum should continue to act as a resource for those in the future with the same or similar queries. I still get numerous emails every day from people who are not yet aware of the forum and its potential benefit, and from those who do not want to post to a public forum as they feel embarrassed at asking a "silly question". While I still answer as many as I can, hopefully these will diminish with time. The public discussion of professional issues is a "new" way of working and learning, and for some, it takes some getting used to.

However, as more and more training programmes from around the world promote the forum to their students, and as more and more professional bodies let their members know about it, I would anticipate the usage stats will rise.

ACKNOWLEDGEMENT AND THANKS

The PPEF has been fully acknowledged on every visible page of the forum. The generosity of the foundation is genuinely appreciated and, without it, the forum would not yet be live. I am indebted to the panel members who contribute and give their time. A full list of who is involved is up on the site and you will recognise a lot of names from textbook / journal paper authors, teachers, and well-known authorities in the field.

When it comes to the web design and implementation, the idea might be mine, but I was assisted by Sinclair Ashman (at Reverse Design) and Nick Chambers (Web Development) who made the idea happen, with what I believe to be a simple, but eye-catching and very effective website.
www.electrophysicalforum.org

Physio First reaping awards

Crystal Palace Physiotherapy Group win Laing Buisson Award in the Rehabilitation Clinical Services category

Ishmael Beckford, Chris Hall and Stuart Patterson with their award for Outstanding Service to Rehabilitation

On 29 November 2016, the Crystal Palace Physiotherapy Group, represented by their Managing Director and Physio First member Stuart Patterson, Head of Private Services and Physio First member Ishmael Beckford, and Private Service Manager Chris Hall, collected the Laing Buisson winner award for Outstanding Service to Rehabilitation, ahead of nominees from some of the largest and most established providers of healthcare in the UK, US and other international regions.

Laing Buisson is the UK's leading healthcare market intelligence provider and its annual awards recognise and celebrate industry excellence and innovative service in the public, private and third sectors.

In order to be nominated for this award, Crystal Palace Physiotherapy Group was required, using evidence across all of their private, NHS, occupational health and support services, to demonstrate its:

- positive and customer-focused core values and aims
- excellent patient feedback and outcome based successes
- proven and planned longevity of its organisation
- ability to create opportunities for its patients and staff
- importance of its role in the independent sector framework.

Physio First would like to congratulate Stuart and his dedicated team at Crystal Palace Physiotherapy Group on receiving such an amazing accolade and for the recognition of their ongoing commitment to excellence, clinical standards and customer service.

Karen Winrow looks the part with her Distinguished service medal

Karen Winrow awarded Distinguished Service medal

In November last year, Physio First Vice President Karen Winrow stood on the stairs of the Rum Warehouse in the Titanic Hotel, Liverpool, proudly displaying her Distinguished Service medal, awarded to her by Baroness Finlay, President of the Chartered Society of Physiotherapy, at the annual awards ceremony which this year formed part of the ER-WCPT dinner.

Karen was nominated for the award by fellow physiotherapists who acknowledged her vital contribution to our profession and her dedication to championing evidence-based physiotherapy.

Karen was also recognised as the driving force behind the development, in partnership with the University of Brighton, of the MSc in Independent Practice (Physiotherapy) and for promoting postgraduate education as an element of CPD.

We, at Physio First, are hugely proud that Karen has been recognised by the CSP and congratulate her on receiving the Distinguished Service Award (DSA) of the Chartered Society of Physiotherapy.

> "KAREN WAS ALSO RECOGNISED AS THE DRIVING FORCE BEHIND THE DEVELOPMENT, IN PARTNERSHIP WITH THE UNIVERSITY OF BRIGHTON"

Time spent on our site has risen by:

Karen Willcock and Mark Potter attended the event

Physio First website nominated for the Association of Association Executives award

Last year, Physio First was nominated for the Association of Association Executives award in the category of "new website", thanks to the intervention of our web designers Pixel8.

The event was attended by our Commercial Officer Karen Willcock, and our IT Officer Mark Potter, and included a pre-prepared presentation on the concept and delivery of our innovative website, highlighting the fact that our aim was to communicate our intent to our members, achieve our business goals, and create an engaging user experience for our primary audience.

The project to build a user-friendly website that our members would love was co-ordinated with insight, knowledge and expertise from a team comprising Karen, Mark and Pixl8, together with Donna Partoon, our Physio First Assistant Manager, Laura Pegg from We Are Circle marketing, MTL who supply our MRM system, Blue Zinc who are supplying our booking portal, and Pages Creative who developed the website content.

IMAGE: Physio First's new website is now responsive, so works equally well on desktop, tablet and mobile devices

SOME STATS

Since its launch in July 2016, our new website has had a dramatic effect on membership engagement. Comparing the results in the two weeks following its launch with the same period in 2015:

- **Our website had a 51% increase in the number of users**
- **Bounce rates (people entering the site and immediately leaving) reduced by 40%**
- **There was a 352% increase in page views**
- **The time spent on the site increased by 197% from 01.37 to 04:49 minutes per visit.**
- **Users of our website had increased by 19% and we were getting 147% more page views**
- **The amount of time spent on our site had risen by a further 81%**
- **Returning users had increased by 61.6%.**

We revisited the stats three months later and compared the quarter July – September 2016 against the previous one of March – June. We realised that these periods would not be a like for like comparison, as the second quarter was liable to be negatively affected owing to it being a prime holiday period. However, the results showed that:

RUNNERS-UP

Unfortunately, despite more than 200 hours of work, over a nine-month period and a highly complex website design, our nomination for the Association award was unsuccessful. However, Karen Willcock did manage to hold the trophy for a few minutes to see what we would have won!

We may have been runners-up in the award category, but we are exceptionally proud to have been nominated. Our new website has achieved 100% of our objectives, achieved some great results in member engagement, enjoyed amazing feedback and we are sure that, as we increase our marketing activities, the user-friendly format and functionality will continue to enhance our site as an important tool in communicating our intent and Goal 9 objectives to our members, stakeholders and the general public.

"Here's what we could have won." Karen Willcock holds the trophy we were nominated for

Physio First Working for us

Tips from our team

QUALITY ASSURED PROVIDER

In January 2017 we launched our Quality Assured Practitioner (QAP) scheme. If you missed the first wave of applications, there will be two more opportunities in 2017 to join this scheme.

In order to be considered for QAP status, members are required to input to our Data for Impact programme, at least 50 data sets which will then be tested against our baseline criteria of:

- Goal achievement
- Outcome of referral
- Number of treatments
- Functional, physical and subjective (FPS) changes between initial and discharge appointments
- Time between referral and commencement of treatment.

The deadline for submitting your data sets to meet our next extraction date is **01 May 2017.**

FIND A PHYSIO ONLINE BOOKING

For those of our members who have opted to include their practice details on our Find a Physio search directory, you can now sign up, if you haven't already done so, for our newly launched online booking tool, which is compatible with a range of Practice Management systems, including TM2/TM3/PPS. Even if you do not use these systems, you can still access this benefit with a standalone package.

To find out more about these benefits of being a Physio First member, go to our website **www.physiofirst.org.uk**, or call our friendly membership team on **01604 684960**, or email us on **minerva@physiofirst.org.uk**

Commercial report

UPCOMING PARTNERSHIPS...

The Microcurrent Site

The Microcurrent Site are pioneers of microcurrent technology and, at the time of writing, we hope to have signed-off a Physio First strategic commercial partnership with them. The aim is to help Physio First members enhance patient outcomes through education and the use of the Painmaster and Alpha-Stim devices, and to support Physio First on our journey towards our intent.

We have received a case study from Bob Grainger, Physiotherapist and Managing Director of PhysioFixx Ltd. Bob started using Painmaster, a new form of microcurrent pain therapy in December 2015. He comments: "I attended a seminar session with Tim Watson, Professor of Physiotherapy at Hertfordshire University. It was on microcurrent therapy and this sparked an interest in trying the Painmaster with our patients... The Painmaster has helped with a multitude of conditions. These range from lower back pain, acute joint sprains to more chronic osteo-arthritic joints. It's a simple, cost-effective treatment and a good mechanism for delivering microcurrent therapy and has been successful in most of my patients and for some it has been invaluable." The Microcurrent Site will be attending our 2017 Physio First conference – please visit them at stand 16.

UPDATES FROM EXISTING PARTNERS...

Blue Zinc

Physio First's new online booking tool is delivered by leading referral network Pronto from our transformational partners, Blue Zinc. Pronto integrates seamlessly with popular practice management systems TM2, TM3, and PPS. If you do not have any of these practice management systems, you can still use the booking tool through Pronto Portal, a standalone online diary that allows you to share your availability with Physio First's Find a Physio service. It is a convenient way of gaining new patient referrals and booking 24/7 with the minimum administrative effort. To find out more and sign up, visit **www.physiofirst.org.uk**.

Blue Zinc also introduces the next wave of clinical innovation with TM3's new clinical notes, giving you greater flexibility and clinical functionality built around the people who matter most. With features such as scores and goals, flags and alerts and freehand drawing, TM3 clinical notes will soon become a vital extension to your treatments.

Painless Practice

Attending conference? Then book your free business surgery now! Painless Practice will be offering free 30-minute business surgeries during the Physio First conference weekend. The main purpose is to evaluate your business and identify the key areas that need to be addressed to be ready for our Physio First Quality Assured Practitioner scheme. To book a free 30-minute slot, please email **celia@painlesspractice.com**

Members and patients to benefit from Physio First and Simplyhealth alliance

Physio First and Simplyhealth have joined forces in a strategic commercial relationship, to help deliver our vision of championing evidence-based, cost-effective private physiotherapy.

Simplyhealth, the largest cash plan provider in the UK, will promote the professional and marketplace value of Physio First members, and Quality Assured Practitioners in particular, to customers in need of private physiotherapy. We expect that Simplyhealth customers will derive great benefit from this alliance and Physio First members will be offered access to Simplyhealth cash plans at a competitive price.

Why this alliance?

More than 80% of the average self-employed physio's patients pay for their own treatment, so this partnership provides significant opportunity for Simplyhealth to grow customer numbers. As part of the agreement, Simplyhealth allows members to decide on the appropriate levels of treatments for their patients, rather than working to fixed fees.

Pam Simpson, Physio First's Chairman, said: "We're delighted to have formed this strategic commercial relationship with Simplyhealth and feel it will benefit our members in a number of ways.

"From April, Simplyhealth cash plan holders in need of MSK treatment will be guided to Physio First members, giving significant opportunity for our members to build their practices.

"Simplyhealth's vision 'to help people to take control of their everyday health, so that they can make the most of life' sits comfortably with our own.

"In exploring this partnership we were impressed with Simplyhealth's collaborative approach with practitioners, its less-is-more approach to paperwork, and the fact that they do not ask practitioners to work to set fees. We look forward to working together to build the private physiotherapy market in the UK, for the benefit of both our members and patients."

Mark Hamson, Managing Director, Corporate & Consumer, at Simplyhealth said: "Our partnership with Physio First underlines our commitment to work alongside physiotherapists and other practitioners to provide people with the support they need for their everyday health, when it is most needed.

"Our simple cash plan model allows practitioners to set their own fees and agree the best course of treatment direct with their customers, without the need for a GP referral. Customers pay for their treatment and claim it back from us, meaning no complicated paperwork and more time for physiotherapists to concentrate on achieving the best possible health outcomes.

"We look forward to introducing customers to Physio First members through our new online Practitioner Community, which will be launched in time for the Physio First conference."

Find out more and register on Simplyhealth's Practitioner Community by visiting **https://simplyhealth.co.uk/practitioner**

Visit the Simplyhealth stand at the Physio First Conference 01-02 April 2017 to find out more about great value cash plans for Physio First members.

SIMPLYHEALTH AND AXA PPP

Simplyhealth sold its private medical insurance and self-funded health plan businesses to AXA PPP healthcare in August 2015. The two companies are now entirely separate entities.

Simplyhealth is a business with no shareholders, its profits go straight back into supporting customers and healthcare charities. Last year Simplyhealth donated £1.4m to charitable causes, touching the lives of more than two million people.

Small ads

The Christie NHS
NHS Foundation Trust

CONNECTIVE TISSUE COURSES: "Understanding our connective tissue and its role in the management of complaints after Breast Cancer Treatment": **Level 1 – September 9th, 10th and 11th, 2017**

The Christie NHS Foundation Trust, Manchester: Lena Richards / Chelsey Gilmour, Rehab Unit. Tel: 0161 446 3795, e-mail: lena.richards@christie.nhs.uk, chelsey.gilmour@christie.nhs.uk

Course Programme: This workshop will be a mix of practical and academic work exploring new and integrated treatment strategies as a tool to relieve the post-surgical and radiotherapy trauma following surgery. Suitable for Physiotherapists working with breast cancer patients, e.g. Oncology, Women's Health, Primary Care and Musculoskeletal settings.

Course Tutor: Willie Fourie, Johannesburg, South Africa, £400 (includes course notes, tea and coffee).

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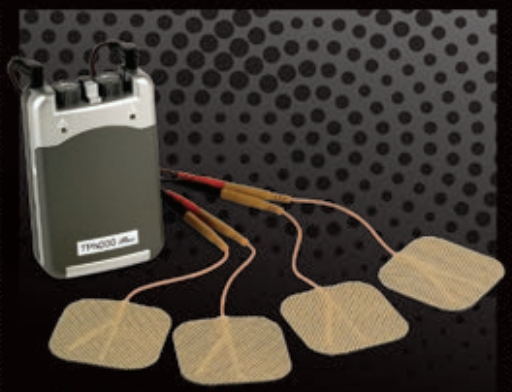

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