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Contents

Editorial Welcome
Welcome to Volume 5, Issue 2 of the JST – The 2012 Summer Issue!

We are sure that everyone reading this will be reeling in from the glow of an incredible summer of sport. The London 2012 Olympics and Paralympics were an absolute celebration of sport, human endeavour, community and inclusivity – with a legacy for all but the most cynical to observe. In July, the Journal of Sports Therapy held its own ceremony in Birmingham; a very successful website launch was attended by sports therapy students and practitioners who were treated to an afternoon of hospitality, trade exhibitions and presentations. Speakers included ex-England football manager, Graham Taylor, consultant orthopaedic surgeon, Professor Lennard Funk, and English Institute of Sport physiotherapist, Ian Horsley, as well as a series of short presentations from members of the JST editorial board. Our new website was launched and is now (obviously) live and kicking, and we welcome you all to it!

This issue, albeit a little later in publication than planned, is a bumper pack of articles! I have worked over the past months to produce our feature article: *The United States of Sports Therapy: A commentary on current progress and challenges of the profession*. With this article, I have set out to be both bold and objective. Much of the content was informed by responses to an original letter I sent out to professional bodies and figures. As an article, it reviews the development of the sports therapy profession as a whole (and its educational evolvement) both nationally and internationally. It identifies a number of issues historically and currently faced by the profession, and presents a number of recommendations for future discussion. The objectives are twofold: to provide sports therapists (and others) with a paper (and source of reference) that clarifies certain professional points; and to stimulate some constructive debate… Adam Hawkey, from the University of Wolverhampton, provides his final osteoporosis article, which examines both risk factors and the efficacy of lifestyle and pharmacological interventions most succinctly and eloquently. This has been an extremely useful series which surely must assist any practitioner in their approach to the prevention or management of such a prevalent condition. Dr Stephen Pack and Christopher Roberts, from the University of Hertfordshire, share with us their research into the subject of compassion fatigue and the practitioner-patient relationship. This paper is an interesting read, and in particular highlights implications for sports therapists' self-care. Adam Hawkey and Sivasubramanian Shunmugam investigate rectus abdominis electromyographical activity during a series of abdominal exercises, with key findings which are certainly of interest to any practitioner aiming to improve the functioning of abdominal musculature. David Jenkins provides us yet again with another lesson in research methods. In *Research concepts and methods (part 5)*, David explains the method of generating qualitative inputs with qualitative outputs, which may also be recognised as being interpretivist analyses. Finally, Jeanette Lewis undertakes the role of book reviewer with a detailed critical appraisal of *Postural Assessment and Therapeutic Stretching*, both by Jane Johnson.

We hope you enjoy, and we look forward to receiving your feedback.

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Invited commentary

The United States of Sports Therapy: A commentary on current progress and challenges of the profession

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KEY WORDS

Professional Title
Professional Regulation
Professional Association
Professional Competencies
Scope of Practice
Intra and Inter-professional Issues

ABSTRACT

Context: Sports therapy is an emerging strand of autonomous healthcare in the UK. The sports therapy profession has developed and established itself against a backdrop of inter and intra-professional debate regarding the regulation, and scope of practice of its practitioners.

Objectives: This article will attempt to review sports therapy's development and outline definitive differences and similarities of sports therapists to other established healthcare professionals both nationally and internationally. It will also aim to identify considerations and potential challenges for the short-term developmental future of the profession. A short set of recommendations for potentially furthering the improvement of the professional and public identity of sports therapists will be presented.

Method: A review of available, reliable and valid literature was undertaken (national and international journal articles; textbooks; and published regulator and professional association documentation). An open letter was also constructed and distributed by the author to a representative selection of 15 practitioners, educators or directors of professional associations with an interest in or involvement with the profession of sports therapy. The letter presented an overview of the author's understanding of the professional debate surrounding the regulation, education and competencies of sports therapists, and posed a series of open questions. Of the 15 professionals approached, 8 responded with detailed personal communications. The article which follows presents an objective appreciation of the topics in question, and is contemporaneously informed by the comments and opinions of significant experts in the field (who are each acknowledged and thanked at the end of the article).

Introduction

"The evidence suggests that although sports participation is beneficial, injuries are a significant side effect. To promote physical activity effectively, we have to deal professionally with the health problems of the active patient."

(Engebretson and Bahr, 2009)

In the UK, the sports therapy profession has steadily evolved, in little over 20 years, to a position whereby practitioners are generally accepted for being able to provide a safe, reliable, effective, autonomous and evidence-based contribution to the well-being, fitness, performance and recovery of their athletes and patients. As an emerging profession, it is experiencing the numerous and various challenges which must naturally accompany the essential process of gaining acceptance and recognition from other healthcare professions, sporting associations and the general public. Sports therapy has legitimately claimed its place on the field, but there are issues abound which surround its position; not least the issues of professional identity and unity.

There are a number of levels from which the profession can present unification. Most obviously, there is a certain subgroup unity found within each of the handful of professional member associations – each of these having significant membership numbers. Secondly, the various educational providers are, in the main, whether higher education institution (HEI), further education (FE) or private training college, delivering education which is underpinned by established scientific principles and are qualifying their graduates with recognisably appropriate competencies. Thirdly, there is a general and palpable perception of unity amongst the growing numbers of established and successful practitioners, almost regardless of their training history or professional membership.

As sports therapists are establishing their reputation in the UK, comparable international professionals, such as athletic trainers in the USA, who have been in formal development since 1950 with the National Athletic Trainers' Association (NATA), are demonstrating successful integration into specified fields of practice (such as professional sport, school, college and university facilities, the military, industry and public health) (NATA, 2012a); and certified athletic trainers became formally recognised as allied healthcare professionals by the American Medical Association in 1990 (BOC, 2012a). NATA are also proactively developing working links with the wider international community of sports and exercise professionals (therapists and medics) (NATA, 2012b); WFATT (the World Federation of Athletic Trainers and Therapists) has been established, and is a "coalition of national organizations of health care professionals in the fields of sport, exercise, injury/illness prevention and treatment" (WFATT, 2011a; WFATT, 2011b).

Although the professional area of 'sports therapy', and the occupation title of 'sports therapist' are to be the focus of investigation in this paper, the reader should acknowledge the challenge to consider each of the subtle similarities and differences of related professional areas such as 'sports physiotherapy', 'sports rehabilitation', 'sports massage' and 'athletic training', and the associated occupational titles of 'sports physiotherapist', 'sports rehabilitator', 'sports massage practitioner' and 'athletic trainer'. To achieve such understanding, one must appreciate the educational pathways, practitioner competencies, professional association definitions and membership criteria, and the regulatory systems in place.

Current Issues

The growth and development of sports therapy is all very well and good, but there also exists confusion in some quarters (justifiably) regarding what exactly constitutes a sports therapist? Debate continues regarding such fundamental issues as: minimum educational standards; competencies and scope of practice; definitive differences to comparative professions; professional regulation; professional titles; and future directions.

A recent and well-documented series of events finally saw the professional area of sports therapy being formally recommended by the HPC (Health Professions Council) for statutory regulation (HPC, 2011) – only for the UK coalition government to publish their 'Enabling Excellence' (Department of Health, 2011) white paper proposing voluntary regulation for all new aspirant healthcare professions. Hence, it is arguable that, in 2012, the professional situation of sports therapy, in terms of both its educational standards and where it is best placed on the healthcare regulatory framework in the UK, is still to be universally agreed and finalised. It is, however, important to consider that for the establishment, acceptance and integration of any legitimate healthcare profession such a comprehensive developmental process is essential. Swisher and Page (2005) presented a contextualised appreciation of the 'occupation to profession continuum' as first proposed by Pavalko (1971). Central to such a continuum are the fundamental qualities of autonomy, ethical standards, and accountability, which clearly underpin this debate.

Discussion

Development, Qualifications and Regulation

Sports therapy arrived in the UK in the late 1980's. At this time, various practitioners (medical, allied medical and lay) may have provided aspects and forms of 'sports therapy' in various sporting and fitness settings, specific qualifications in sports therapy were developed at this time. The first specialised sports therapy qualifications were vocational diplomas, taught in either FE or private training institutions. Such qualifications included the popular level 3 VAI (Vocational Awards International) (latterly VTCT – Vocational Training Charitable Trust) 'Diploma in Sports Therapy'.

Smith (1990) first proposed The Society of Sports Therapists (SST) in order to address "the increasing demands from both sport and leisure on everyone involved in the management and care of injured sports people". Therapeutic support and intervention for active, sporting populations, from all ages and levels, was at this time seen to be not as effectively delivered as could have been. The ACPSM (Association of Chartered Physiotherapists in Sports Medicine) had been established in the mid 1970's as a post-registration clinical interest group, and have now become firmly established as the membership body for registered physiotherapists working in sport. Currently, entry to the ACPSM is open to physiotherapists with a pre-registration qualification in physiotherapy, and members may achieve ACPSM accreditation via a tiered 'bronze, silver and gold' membership criteria representing developing levels of practitioner competency which may be achieved by specified validated CPD (continued professional development) courses (ACPSM, 2012). Johnson (1990) had suggested that, by 1990 (when the SST were in formation), the ACPSM had not fully established itself as a significant speciality group; this Johnson (1990) intimated, was a contributory factor to the strengthening rationale for the development of a different association of professionals specifically trained to work with sporting individuals. It was also at this time (1990) that sporting organisations, such as the English FA (Football Association), were developing their own injury management training courses for persons wishing to work in professional football – this was because such associations were struggling to

attract sufficient and appropriately skilled practitioners (physiotherapists) to work in the sport (Johnson, 1990).

In 1996, the first SST validated BSc degree in sports therapy was launched at the University of North London (now London Metropolitan University) (SST, 2012a). In 2012, there are 16 SST validated degree programmes in successful operation, 5 MSc programmes, and a growing number of graduate sports therapists undertaking Phd qualifications. In addition to this, there are a number of HEI sports rehabilitation programmes in existence. BASRaT (British Association of Sports Rehabilitators and Trainers) currently validate 7 BSc sports rehabilitation programmes (BASRaT, 2012a). Furthermore, there are also at least 5 HEI BSc degree programmes in sports therapy/rehabilitation (or with dual honours) which are not validated by either SST or BASRaT (UCAS, 2012). Several HEI and FE institutions also offer foundation degrees in sports therapy, and in addition, there are a number of HNC and HND programmes in sports therapy.

The number of non-HEI sports therapy courses on offer in the UK does fluctuate year on year, hence it would be inappropriate to suggest a current reflective number. However, such organisations as AHG (Active Health Group), NIM (Northern Institute of Massage), Sports Rehab and Educational Services, the Barnes School of Sports Therapy, and the Raworth Centre, amongst others, specialise in the delivery of private sports therapy education, and offer diplomas in sports therapy (the first three of these institutes offer diplomas which are currently approved and validated for full membership of the SST).

Other sports therapy professional associations are in existence. The Sports Therapy Organisation (STO) was established in 1999, and has itself a growing reputation for proactivity in sports therapy and its related fields. Although the STO do not require a validated degree in sports therapy for full membership, full members "must hold qualifications that meet minimum standards of training, up-to-date insurance and a first aid qualification". The STO aims to represent "those working as sports therapists, soft tissue therapists and athletic training specialists" (STO, 2012), and as such their remit is somewhat broader than that of the SST or BASRaT.

The SRTC (Sports and Remedial Therapies Council) was established in 2010 as "an independent, not for profit, professional forum comprising professional associations that represent professional sports and remedial therapists who are qualified, experienced, insured and regulated" (SRTC, 2012). However, although the SRTC is directly involved in developing the core curricula for sports and remedial therapies on the Qualifications and Credit Framework (QCF) and "is recognised by the UK's official regulator for sports therapists, the CNHC (Complementary and Natural Healthcare Council), as the governing body for sports therapy" (SRTC, 2012), such a positional stance has not been met with universal satisfaction, not least because the CNHC evolved from a working group whose mandate was to look at the regulation of complementary healthcare, and at its inception sports therapy was not in the remit of the CNHC (SST, 2011).

Developmental debate is essential and healthy. Sports therapy has established itself at all educational levels and, despite its intra-professional issues, is an aspirant allied healthcare profession. Statutory regulation (via the re-named Health and Care Professions Council [HCPC]) remains a primary objective for the lead professional associations, but in the short term it is highly likely that, following the recent UK government's recent recommendations in the 'Enabling Excellence' white paper (Department of Health, 2011), Assured Voluntary Regulation (AVR), under the validating wings of the CHRE (Council for Healthcare Regulatory Excellence), will be the next step on the road for improving the regulation of sports therapy practitioners.

In 2012, the CNHC, a government-approved voluntary regulator – which although designed as a register for complementary and natural professions, announced that it would be creating a new register for sports therapy (the Sports Therapy Profession Specific Board [PSB]). This register is open to all practitioners who are able to demonstrate evidence of having achieved competencies in keeping with the established National Occupational Standards (NOS) and core curriculum for sports therapy. The CNHC, it must be said, do offer a government-approved 'quality mark', and NHS professionals are recommended to use CNHC registration as a pre-requisite when considering referrals to a 'complementary' healthcare professional (CNHC, 2012). Skills for Health (SfH), the Sector Skills Council for Health, are currently responsible for the NOS (up to level 3) in sports therapy (SfH, 2012). It should be noted that NOS are not directly linked to educational levels; they are designed to set the occupational competence. SfH are one of 25 sector skills councils licensed by the UK Commission for Employment and Skills (UKCES) (UKCES, 2012).

The CHRE currently oversee (and therefore validate) 9 professional healthcare regulators; these are: the GCC (General Chiropractic Council); the GDC (General Dental Council); the GOC (General Optic Council); the GMC (General Medical Council); the GOsC (General Osteopathic Council); the GPhC (General Pharmaceutical Council); the HCPC; the NMC (Nursing and Midwifery Council); and the PSNI (Pharmaceutical Society of Northern Ireland) (CHRE, 2012a). Each of these named regulators represent statutorily regulated professions. The CHRE will become the Professional Standards Authority for Health and Social Care (PSA HSC) by the end of 2012, and, as a result of the recent Department of Health (DoH) (2011) recommendation, will at this time be launching a new

accreditation scheme for voluntary registers (CHRE, 2012b). Hence, reputable professional associations are currently being invited to make a formal and detailed application to the CHRE so as to be accepted for accreditation on their register. Essentially, it would be assumed that CHRE/PSA AVR accreditation will provide some progression on the route for improving regulation of the profession; whether this is the long term and appropriate solution will remain to be seen.

Whilst the process for regulation of sports therapists has been protracted and convoluted, the reality is that the profession must remain accepting and patient of this essential process. All involved must be mindful to recognise the importance of seeking the most favourable and workable outcomes – so that practitioner employability is protected and enhanced, and so that the general and sporting public are able to access the support of an effectively regulated sports therapist or sports rehabilitator, and in so doing will be effectively protected from harm.

Professional Titles

Table 1 presents a short list of the main professional titles (and associated definitions) of practitioners recognised in the field of sports and exercise healthcare. Practitioner definitions are taken from the main representing professional associations. In a field growing in popularity, where practical therapeutic support of active individuals is the focus, there will be a certain degree of crossover in terms of practitioner competencies, scope of practice, educational background and autonomy.

It will be recognised in the field of sports and exercise, and most noticeably within multidisciplinary teams (MDT) working in sport, that there are a number of additional professional practitioner titles to be familiar with (in addition to the sports medicine doctor/physician, these can include: sports scientist; exercise physiologist; sports biomechanist; strength and conditioning coach; sports nutritionist; and sport and exercise psychologist). Some of these professional titles are protected and are statutorily regulated (i.e. 'sport and exercise psychologist' is a protected title and said practitioners are regulated by The British Psychological Society [BPS] under the HPC) (British Association of Sport and Exercise Sciences [BASES], 2012).

Table 1. Professional titles in the field of sports and exercise healthcare

Professional Title	Definition
Athletic Trainer (AT)	As explained by NATA (National Athletic Trainers' Association) (2009), athletic training is practised by athletic trainers (AT) – health care professionals who collaborate with physicians to optimise activity and participation of patients and clients. Athletic training encompasses prevention, diagnosis and intervention of emergency, acute, and chronic medical conditions involving impairment, functional limitations, and disabilities. Members of NATA must abide by the Association's Code of Ethics. The Board of Certification Inc. (BOC) requires that all credential holders abide by the Standards of Practice. This definition is provided by NATA; however there are a number of other international professional AT associations, including those in Canada, Japan and Taiwan (see table 2).
Athletic Rehabilitation Therapist (ART)	As explained by ARTI (Athletic Rehabilitation Therapy Ireland) (2012), Athletic Rehabilitation Therapists (ART) aim to promote and maintain the health and physical wellbeing of individuals in all sporting, physical and occupational activity. The competency areas of athletic rehabilitation therapists have been divided into four general areas: injury prevention and pre-participation screening; on-field emergency care; injury assessment, diagnosis and treatment; and rehabilitation and reconditioning. Members of ARTI must hold as a minimum an honours degree in a field related to sports medicine (with a minimum of 500 hours of related clinical experience).
Chartered Physiotherapist/ State Registered Physiotherapist (SRP)	As explained by the CSP (Chartered Society of Physiotherapy) (2012), chartered physiotherapists are allied healthcare professionals specifically trained to restore movement and function when someone is affected by injury, illness or disability through the use of exercise, manual therapy, education and advice. Physiotherapy is a degree-based healthcare profession which involves work in a variety of specialisms in health and social care, such as: neurology; neuromusculoskeletal; cardiovascular; and respiratory. 'Physiotherapist' is a protected title. All physiotherapists in the UK have to be registered with the Health and Care Professions Council (HCPC). Members of the CSP are entitled to use the letters MCSP. Chartered physiotherapists may elect to join any of a number of CSP specialist and clinical interest groups, such as the ACPSM (Association of Chartered Physiotherapists in Sports Medicine).
Graduate Sports Rehabilitator (GSR)	As explained by BASRaT (British Association of Sport Rehabilitators and Trainers) (2012b), a Graduate Sport Rehabilitator (GSR) is a graduate level autonomous healthcare practitioner specialising in musculoskeletal management, exercise based rehabilitation and fitness. Sport Rehabilitators have graduated with a degree in Sport Rehabilitation, a course of study suitable for them to be recognised as a graduate member of BASRaT. The role of a GSR requires competency in the following areas: recognition, evaluation and assessment; prevention, recognition and evaluation of the individual; management of the individual; therapeutic intervention, rehabilitation and performance enhancement; and immediate care.
Graduate Sports Therapist (GST)	As explained by the SST (2012b), a Graduate Sports Therapist (GST) is a practitioner who has the knowledge and ability: to provide first aid and attend to injuries in a recreational, training and competitive environment; to assess and, where appropriate, refer on for specialist advice and intervention; to provide sports massage pre and post event activity; to implement appropriate rehabilitation programmes; and to utilise sport and exercise principles to optimise preparation and injury prevention programmes. The SST accredit 16 university degree programmes, which qualify graduate sports therapists and entitle such graduates to join the SST as full members. Members of the SST: have reached the minimum benchmark level of knowledge; are eligible for professional liability insurance; are required to undertake an annual programme of mandatory CPD in order to maintain their right for re-registration; hold a current and valid first aid qualification; are governed by standards of conduct and disciplinary procedures that are transparent and serve to protect not only the member but also the public; and are a member of an organisation that strives to increase the levels of care provided for sports and recreational participants regardless of age, level and ability.
Sports Massage Practitioner (SMP)	As explained by the SMA (2012), sports massage is the management, manipulation and rehabilitation of soft tissues of the body including muscles, tendons and ligaments. Members of the Sports Massage Association (SMA) will be able to identify anyone for whom sports massage would be ill-advised or detrimental to their short or long-term well being. Sports Massage Practitioners (SMP) will assess each individual and provide the appropriate massage techniques, and advise on alternative action if required. The catalyst for this education initiative was the development of the National Occupational Standards (NOS) for Massage, released in November of 2009. The profession now has a progressive suite of qualifications on a government approved educational framework (the Qualifications and Credit Framework [QCF]). Sports massage qualifications are obtainable at Levels 3, 4 and 5 all of which have been mapped against the relevant NOS and are endorsed by the SMA.
Sports Therapist (ST)	A sports therapist is a practitioner who has the training, underpinning knowledge and understanding, competencies and skills so as to provide advice and therapeutic support to active and sporting individuals and teams in terms of injury prevention and rehabilitation and recovery from training and competition. The practitioner is expected to be able to perform effective assessment of their patients and may be able to provide such interventions as soft tissue therapy, taping and strapping, electrotherapy and exercise rehabilitation. The title 'sports therapist' is not a protected title; there a number pathways for achieving differing levels of qualification; and there are a number of sports therapy professional associations, each with differing membership criteria. A sports therapist may hold a degree in sports therapy (and hence be entitled to use the title Graduate Sports Therapist [GST]), or may have undertaken a diploma training course. The current minimum National Occupational Standards (NOS) for sports therapy are set by Skills for Health.

What is a Sports Therapist?

The topic of professional title (and identity) in this field has been discussed somewhat intermittently in the available literature. The title 'sports therapist' is established in the UK; but because the educational pathways for qualification, the resulting practitioner competencies and the fundamental scope of practice have not as yet been universally standardised, there still exists a less than clear interpretation of what, exactly, constitutes a sports therapist. Back in 1998, Hudson provided the following definition of a sports therapist: "a sports therapist might be someone capable of offering advice on exercise – or someone who delivers massage before and after a sporting event – or a highly trained practitioner able to recognise common orthopaedic conditions and soft tissue injuries as well as being able to complete a progressive and effective rehabilitation programme of treatment and rehabilitation". Briggs (2001) highlighted that the title 'sports therapist' lacked a certain specificity "having something to do with sports, and something to do with therapy" which could be a seen as a reason for other professionals working in the field of sport to develop cynicism. Briggs (2001) further elucidated "a sports therapist in essence acquires an identity that differentiates them from others working in the healthcare field because of not only what knowledge, skills and expertise they should and must possess by training specifically with sport in general in mind, but by the fact they have an interest in sport, whether directly or indirectly". In 2004, I attempted to present a foundation overview and introduction to the developing subject of sports therapy: "sports therapy is, theoretically, about understanding safe and effective principles of fitness and athletic training and injury rehabilitation, and practically, about the application of a selection of manual and electrical interventions to achieve a range of therapeutic objectives" (Ward, 2004). I did then, as now, emphasise the need to "build on early empirical endeavours, continually integrate new scientific developments and evaluate practice and intervention through rigorous research" and I still hold the view that "sports therapy is as much an art as it is a science" (the art is in the delivery and the beauty of the science and the outcome). In 2004, I stated that sports therapy was complementary practice; this statement requires reconsideration – sports therapy must now be recognised as being allied medical practice – it is based on science and evidence, and on recognised medical principles and methods such as clinical neuromusculoskeletal assessment, applied knowledge of health, pathology and trauma, immediate first aid care, biomechanics, progressive rehabilitation, soft tissue and manual therapy, and electrical therapy. Today, in 2012, we must turn first to our governing bodies, who are informed by the experience, knowledge and wisdom of practitioners and researchers of high repute, to provide us with our definitions, our code of conduct and our guidelines for practice.

Intra and Inter-professional Issues

The 'sports therapy profession', however, is somewhat hindered at this point in time by its apparent failure to effectively clarify the different levels of qualification, professional membership and competencies for practice. These are intra-professional issues, and ones that will surely be overcome eventually. Training providers, membership bodies, and practitioners tend to favour the titles, qualifications and competencies that they have been involved with – and there are many in this field (as in any other) with vested interests; but there must be a place for idealistic utilitarian thinking. Both intra-professional issues (as highlighted) and inter-professional issues, such as those pertaining to employability, conflicts of duty, multidisciplinary teamwork (MDT) and legitimation discourses, are far from being unique to the sports therapy profession. Malcolm and Scott (2011) investigated professional relations in elite sports healthcare and found, particularly in the case of policy-led organisational changes involving specialist MDT's, significant impacts upon relations both within sports medicine doctors and sports physiotherapists, and between the respective specialisms. They concluded that "professional relations are therefore fundamentally processual...and should be seen as a complex balance of conflict and cooperation within and between members of distinct groups". The SST, in their "Clouding the issues" statement (2011) explained that "the breadth of competency requirements and core skills (for sports therapists) extends from sports trauma management through to final functional and sports specific rehabilitation...whilst there may be practitioners from other disciplines who undertake some 'sports therapy' within a clinical or complementary healthcare environment – it does not mean that they are sports therapists".

At this point in time, any prospective student of sports therapy or sports rehabilitation has to make an informed but fairly calculated decision as to whether a diploma or degree pathway best suits their needs and their future prospects, and further, either as students, or as qualified practitioners, they are then required to select their PA. There are obvious advantages and disadvantages to both pathways for qualification. The prospective student must weigh up: the full cost of a course; its duration; its methods of delivery; its geographical location; its clinical, exercise and sporting facilities; the credentials of its lecturing team; the access to patient groups during training; access to academic and learning support; its library, database and multimedia resources; its record and reputation for educational standards, achievement and retention; the satisfaction of current and past students; the accreditation and validation that the course provides; the resulting awarded qualification(s) and what they offer in terms of professional title on qualification, professional mem-

berships, long term employment opportunities and advanced study progression routes.

One additional issue worthy of discussion is that of pass marks and qualification classifications. In a university setting, modules are developed according the particular educational level (i.e. levels 4, 5 and 6 for a bachelor's programme). In any particular module, the usual minimum pass mark (or 'total' mark – combining coursework and examinations) is usually 40%. For progression to the next level, students are required to pass all mandatory modules and to also achieve sufficient credits across the board. On completion of their degree, graduates will be awarded a classification (1st class, upper 2nd, lower 2nd or 3rd class) depending on their academic profile and credits. This is in contrast to, potentially a 2 year level 5 diploma programme, where the minimum pass mark is typically 70%. Such a consideration will present a challenge to anyone's comprehension! To defend a 40% pass mark is to clearly recognise that such a pass mark is deeming that the student has met the minimum standards of safety, effectiveness, underpinning knowledge and application of the competencies in question. Rigorous internal and external verification processes must ensure that this is the case.

Clearly, a reputable HEI will be expected to offer a strong package to prospective students. However, for some students there will be additional considerations, not least cost, a typically 3 year educational programme, achievement of necessary UCAS entry points and the formal application process that goes with it, and the perceivably higher level of academic study which culminates in a research dissertation at level 6. The process of achieving a degree is often cited as a major reason for undertaking a degree in the first place – it is considered to be a recognisably commendable endeavour, regardless of the discipline studied, and is a frequently requested qualification essential criteria for job applications. Diploma qualifications may still remain the first choice for many students, for numerous reasons, and they can certainly provide all of the underpinning knowledge and skills to enable a practitioner to begin their career as a sports therapist, but a diploma is not a degree. Perhaps the main consideration to reflect upon, is that across the growing international field of comparable practitioners, the minimum qualification is a validated degree. If sports therapists are to be considered in a similar professional standing to their international counterparts, and to physiotherapists, then, again, the degree would provide an appropriate starting point.

Definitive Differences

Regarding professional identity, the topic of 'definitive differences' must arise; and regarding the definitive differences, between that of a sports therapist and a physiotherapist, one of a series of documents from the SST to the HPC (now HCPC) as part of their application process for statutory regulation (HPC, 2010) clarified these eloquently. The document paper expanded on such considerations as the occupation of sports therapy being required to display a certain homogeneity, and that it must be able to demonstrate that it practises activities that are distinctly its own; and that said activities are distinct from the scope of practice of other occupations (namely physiotherapy) and "although there may be some overlap in some of the clinical skills, it is the specificity of the scope of practice of sports therapists with regards to sport and sporting contexts that makes it distinct from physiotherapy" (HPC, 2011). Once qualified, a physiotherapist has skills and knowledge to provide therapy at a threshold competence level across the breadth of physiotherapy practice and lifespan. At the same point, "a graduate sports therapist has specialist knowledge of sports medicine and sports science with the theoretical background and therapeutic skills that are specifically applied to work in a sport and exercise environment" (HPC, 2010).

Essentially and importantly, the definitive differences between sports therapy and sports rehabilitation and physiotherapy become most apparent when educational pathways and core competencies are examined. The main competency areas which are unique to the sports therapist or sports rehabilitator, and which do not feature specifically in any undergraduate physiotherapy programme are: injury prevention; and acute (or pitch-side) first aid and trauma management. Beyond this, the graduate sports therapist or rehabilitator will have undertaken, as a specific emphasis on their undergraduate programme, significant guided learning hours and formal assessment and examination in a host of directly sports-related subjects. These include: sports medicine and pathology; soft tissue therapy (or sports massage); taping and strapping; exercise physiology; strength and conditioning; and fitness profiling and screening. Students on such undergraduate courses are likely to undertake optional study in areas such as sports nutrition, sports psychology and sports coaching. All this in addition to a full induction into the research process and significant study of the topics of professionalism and ethics.

Physiotherapy is unquestionably the primary profession that all other health care professions and patients will recognise as the specialised provider of cross-disciplinary general allied physical medical care. This is due to its long-standing professional development, organization and infrastructure; its rigorous and continual development of standards of proficiency; its evidence-based research focus; its physical

membership numbers; its complete integration into the National Health Service (NHS); and its reputation for exemplary standards of care, professionalism and ethics, continued professional development (CPD), disciplinary procedures and public information service.

The crossover between physiotherapy and graduate level sports therapy is also quite clear, when carefully considered. Essentially and simply, the following subject areas are common to both fields and all graduates must be able to demonstrate full competency in all: concepts and recognition of professionalism and ethical practice; fundamental, developmental and applied knowledge and understanding of anatomy and physiology; fundamentals of pathology; subjective and objective physical examination of the neuromusculoskeletal system; professional clinical practice (including: effective communication; record keeping; clinical reasoning and reflective practice; documented minimum clinical hours; placement work); exercise instruction; manual therapy; electrotherapy; appreciation of the research process; and completion of a final year research project. It is also clear to observe the number of CSP clinical interest groups and each group's obvious proactivity to support each of their specialised members, and to contribute to the development of evidence to support professional practice in said areas of clinical interest. A firm description of a sports physiotherapist is provided by Bulley *et al*. (2005) under the auspices of the IFSPT (International Federation of Sports Physiotherapy), which, when simplified, states that a sports physiotherapist is a professional who "demonstrates advanced competencies" (of which there are 11 detailed) and who "aspires to work at master's level".

National and International Developments

Table 2 presents a list of sports therapy, sports rehabilitation, sports massage, athletic training, physiotherapy, sports physiotherapy and sports medicine national, international organisations, associations and regulatory bodies. When looking at the wider international situation, there is now clear evidence of a developing field of specialised athletic healthcare and of established integrated or multidisciplinary practice.

Moreover, models are in place which work to effectively certify practitioners' standards of practice. The Board of Certification Inc. (BOC), which began as a committee of NATA, was incorporated in 1989 to provide a certification programme for entry level athletic trainers (AT) (BOC, 2012). To qualify (and become a 'Certified Athletic Trainer'), practitioners must have first graduated from an accredited bachelor's

Table 2.

National and International Organisations, Associations and Regulatory Bodies	
ACPSM	Association of Chartered Physiotherapists in Sports Medicine
ACSM	American College of Sports Medicine
ARTI	Athletic Rehabilitation Therapy Ireland
BASA	Biokinetics Association of South Africa
BASEM	British Association of Sports and Exercise Medicine
BASES	British Association of Sport and Exercise Sciences
BASRaT	British Association of Sports Rehabilitators and Trainers
BOC	Board of Certification for the Athletic Trainer
CHRE	Council for Healthcare Regulatory Excellence
CATTE	Commission on Accreditation of Athletic Training Education
CATA	Canadian Athletic Therapists' Association
CNHC	Complementary and Natural Healthcare Council
CSP	Chartered Society of Physiotherapy
ECOSEP	European College of Sports and Exercise Physicians
ESATT	European Society of Athletic Therapy and Training
FHT	Federation of Holistic Therapists
FIMS	International Federation of Sports Medicine (Fédération Internationale de Médécine du Sport)
IFSPT	International Federation of Sports Physiotherapy
ISRM	Institute of Sports and Remedial Massagef
JATO	Japan Athletic Trainers' Organisation
KATA	Korean Athletic Trainers' Association
HCPC	Health and Care Professions Council (previously the HPC – Health Professions Council)
NATA	National Athletic Trainers' Association
OSCA	Osteopathic Sports Care Association (UK)
REPS	Register of Exercise Professionals
SMA	Sports Massage Association
SRTC	Sports and Remedial Therapies Council
SST	The Society of Sports Therapists
STO	Sports Therapy Organisation
TATS	Taiwan (Republic of China) Athletic Trainers' Society
UKRC	UK Rehabilitation Council
UKSCA	UK Strength and Conditioning Association
WFATT	World Federation of Athletic Training and Therapy

or master's degree programme (from CAATE – the Commission on Accreditation of Athletic Training Education); they must then apply to undertake a certification examination (conducted by the BOC) (NATA, 2012a).

There are also a number of establishing international organisations, such as WFATT (World Federation of Athletic Training and Therapy) with a common aim of promoting high standards of education and practice (WFATT, 2011). In the UK, especially at this time where we have all either witnessed or worked to create an incredible Olympic Games delivery and the realisation of a national and global togetherness, we must take inspiration from what we have all achieved to date and remain excited about the future potential of our professional activities.

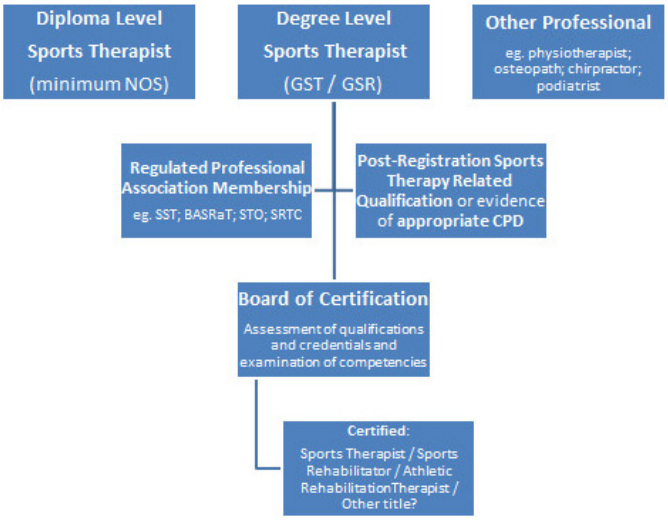
Recommendations

In a constantly evolving field of health care, where health, fitness, sport and exercise is a primary focus, the main professional bodies must continue to liaise and work to achieve improved standardisation of regulation and competency. There may well in this process be a need for subtle compromise – not necessarily in terms of core objectives (i.e. statutory regulation and protection of title), but perhaps in terms of the development of improved interaction between different organisations; and there must remain a place for all reputable players in this field, especially as an improved and universal understanding and appreciation of the scope of practice of a sports therapist is required. Improving the recognition of sports therapists must also be a priority of professional associations across the health professions, the national governing bodies of sport – at all levels, as well as the general public so that each can appreciate the specialised professional remit of a sports therapist or rehabilitator. Evidence of such development is occurring – sports therapists and rehabilitators are now being formally recognised (by the associated governing bodies) at all levels of sport, in military rehabilitation, in the performing arts, in certain NHS settings and with health insurance providers. However, this field, like any other, is competitive; and, especially in a challenging economic situation, there can be no guarantee for a qualified practitioner (regardless of their qualification) being able to gain a well-remunerated permanent full-time employment contract. As many qualified practitioners will testify, it is the work that is put in after one is qualified that can really make the difference (i.e. the gaining of experience; networking and self-promotion; the advancing of knowledge and skills and undertaking of CPD; the development of language skills; and practitioner specialisation).

As *table 1* highlights, there are a small number of national and international professional titles which reflect the type of qualified practitioner an autonomous allied health professional working in the field of sport and exercise can be clearly compared to, and the development internationally appears to be for achievement of an accredited degree qualification so as to achieve the highest professional memberships. This must not however, be viewed as a castigation of all non-degree level training programmes.

The main consideration to this topic is that of minimum competency levels for professional practice. One potential consideration, as an addition to the imminent CHRE/ PSA HSC AVR system, could be the establishment of a UK BOC. If an organisational infrastructure and process could be agreed and developed for the standardisation of minimum standards, the reviewing of applications and the overseeing of certification examinations, in a model similar to that of the BOC for athletic trainers in the US, then practitioners and professional associations in the UK may be in a better position to present the resulting 'certification' more cleanly to all associated fields of healthcare, potential employers, sporting bodies and the general public. Such a system could be open to all practitioners who were able to demonstrate that they had undertaken a recognised training course in sports therapy (or closely comparable programme). Regardless of whether the process for statutory regulation of sports therapists is eventually successful or whether it falters, an internationally validated certification model could provide a system for consolidating the position of sports therapists, sports rehabilitators, athletic rehabilitation therapists, sports and exercise therapists or whatever other generic professional titles present or result. On a relatively small scale, ARTI (Athletic Rehabilitation Therapists Ireland) have recently developed such a working certification model (ARTI, 2012). A similar system of accreditation is in place for full membership applications to such established UK organisations as the UKSCA (UK Strength and Conditioning Association), who hold a national register for strength and conditioning coaches who have proven their professional competencies through a rigorous accreditation process (UKSCA, 2012). *Figure 1* presents a potential certification model which may be worthy of consideration for the UK sports therapy profession as it prepares for its next developmental steps. This particular recommendation must be viewed more as a suggestion for consideration and for intra-professional discussion, rather than as a firm recommendation for implementation, as there are a host of obvious challenges to such an initiative.

Figure 1. Potential Model for Board of Certification for Sports Therapists



As with any investigation or commentary, a set of recommendations is never complete without the author expressing a direction, a request, for further research. In this case, the political landscape will continue to be observed for movements and developments by all. Whilst recognising that there is rarely one succinct, clear-cut or definitive answer, there are innumerable questions which require open, informed and ongoing discussion. Can the profession work to continue to establish itself effectively (for integrated acceptance and protection of employability) under the AVR system? Should, or could, the occupational titles 'graduate sports therapist' and 'graduate sports rehabilitator' be used interchangeably? Should the sports therapy practitioner become, even more specifically, a sports specialist?

Obviously, it is essential for the sports therapy profession to add to its own research base. Further investigative studies are required to advance the knowledge and evidence-base pertaining to the professionalism of sports therapy. Such topics for investigation may include: the attitude of qualified sports therapists to the direction of the profession; special interest groups for sports therapists; sports therapist employment destinations; the demographic and quantitative analysis of sports therapy practice; the value and cost of post-qualification internships; comparative analyses of competencies, ethical codes and standards of proficiency in different sports-related healthcare professions; athlete and team perceptions of professional sports care; best working practices in MDT – roles and relationships; and the list goes on.

Finally, the author welcomes comments and response to this article. Formal letters to the editor may be presented through the usual channels, and less formally, a moderated discussion forum is available at http://jst.ucb.ac.uk (contributors must first register with the Journal of Sports Therapy website).

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Reviews and invited commentary

Understanding the causes, prevention, and treatment of osteoporosis: parts 3 and 4

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KEY WORDS

Bone mineral density
Ageing
Sex
Race
Exercise
Smoking
Alcohol
Bisphosphonates

ABSTRACT

While bone loss is a natural and normal consequence of ageing, some people are more predisposed to suffering from the associated fractures. Bone mass decreases with age and those older than 80 are at particular risk. The lifetime risk for women is as high as 50%, compared to around 20% in men; the reduced risk due to generally higher bone mass levels in males, and women ceasing to produce oestrogen following the menopause. Fracture risk has also been reported to be reduced for those of black origin when assessed against Caucasian, Hispanic and Asian populations. Heavy smokers and those who consume large amounts of alcohol are at greater risk due to reduced osteoblast activity and accelerated bone loss through decreased calcium absorption efficiency, respectively. Those individuals with low body weight, and those who lead sedentary lifestyles, are also at greater risk due to reduced mechanical signals being transmitted to the musculoskeletal system. The incidence of osteoporosis can be significantly reduced by maximising skeletal mass during the growing years, consuming 1000 to 1500mg of calcium each day, regulating alcohol consumption, refraining from smoking and participating in weight-bearing exercise throughout life. Ideally, the aim should therefore be the achievement of optimum bone health throughout life by age-specific non-pharmacological intervention, following the age-old adage of prevention being better than cure. However, for some, pharmacological intervention is necessary. Treatment options available aim to reduce the risk of fractures by either slowing down the activity of osteoclast cells, through the stimulation of osteoblasts, or a combination of both. The choice of any pharmacologic treatment is a clinical decision, which should be made by the patient and the referring physician, and be based on an assessment of the individual's risk of fracture and on the efficacy and side-effects of those drugs likely to be prescribed.

Risk Factors

There are a number of factors, which can contribute to bone mineral density (BMD) and, therefore, osteoporosis risk (Table 1). Some of these we have no control over, such as age, sex, and our genetic make-up, which account for as much as 75% of the variance in peak BMD. The other 25% can be attributed to personal characteristics and lifestyle factors, such as dietary intake, smoking, alcohol consumption and exercise participation. It has long been believed that genetic factors are important in the determination of bone density (Pocock *et al*., 1987; Jouanny *et al.*, 1995). There is evidence that a greater concordance of bone mass exists between monozygotic than in dizygotic twins, and that the daughters of osteoporotic women generally have lower bone density than would usually be expected (Slemenda *et al.,* 1991). This is supported by studies, which show that women who have a female relative with osteoporosis are more likely to suffer from the disease than women with no family history (Byyny and Speroff, 1996), and evidence that parental fractures are reported to increase fracture risk, independent of BMD (Kanis *et al*., 2008). There is evidence to suggest that ethnic differences can also influence BMD. Research conducted by Liel *et al*. (1988) suggests that Caucasian, Hispanic and Asian populations are at greater risk of suffering from osteoporosis than those of black origin, due to populations of black origin having generally higher bone mass levels. This theory is supported by Kellie and Brody (1990) and Griffin *et al.* (1992) who found that incidence rates for hip fractures and all other fractures, respectively, were considerably lower in black women when compared with white women. Further, it has been suggested by Cauley *et al.*, (1994) that black populations may have a lower rate of bone turnover than white populations, which may result in slower rates of bone loss during ageing. However, the reason for this disparity remains unclear, with some suggesting that an over-simplified representation or variations in the site of BMD measurement could be partly responsible (Seeman, 1997; Seeman, 1998; Gilsanz

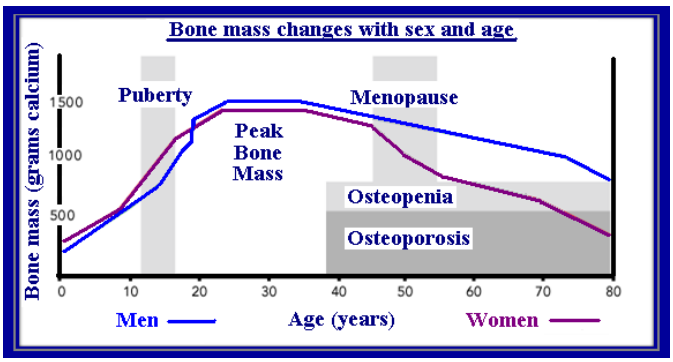
et al., 1998). Curtis *et al* (2009) found that among the 25,000 participants they investigated, estimated fracture risk was highest for Caucasian women. However, while fracture rates among Caucasians are often reported to be higher than those for other racial and ethnic groups, the prevalence of osteoporosis among non-Caucasians is expected to increase at a faster rate than for Caucasians (Burge *et al.*, 2007). Also, outcomes following fracture are worse among men and non-Caucasians compared to Caucasian women (Jacobsen *et al*., 1992; Curtis *et al.,* 2009).

Table 1:

Selected Risk Factors for Osteoporosis
Radiographic evidence of osteopenia (T-score between 1 and -2.5)
Previous low-trauma fragility fracture (especially of the spine or wrist)
Prolonged corticosteroid therapy (prednisolone or equivalent, 7.5mg daily with an expected use of 6 months or more)
Premature menopause (age < 45)
Prolonged secondary amenorrhea (> 1year)
Primary or secondary hypogonadism
Maternal history of hip fracture
Low Body Mass Index (< 19)
Age (fracture rates highest in those over 80)
Sex (1 in 2 women compared to 1 in 5 men suffer from osteoporosis)
Ethnicity (Caucasian, Hispanic and Asian populations at increased risk)
Poor nutrition (<magnesium, phosphate, zinc, potassium, fibre and vitamins C, D and K)
Calcium intake (<1000mg adults, <1200mg adolescents, postmenopausal women and older)
Alcohol consumption (> 2-3 units daily for women, > 3-4 units daily for men)
Smoking
Sedentary lifestyle (especially < weight-bearing exercise)
Chronic disorders associated with osteoporosis: rheumatoid arthritis, anorexia nervosa, malabsorption syndromes including chronic liver disease, inflammatory bowel disease, primary hyperparathyroidism, chronic renal failure, prolonged immobilisation and Cushing syndrome

Widely perceived as more of an an 'old woman's disease', osteoporosis actually affects both men and women, and can do at any age. However, it is acknowledged that men generally have greater protection against osteoporosis than women due to them, on average, having higher BMD levels (Kellie and Brody, 1990; Taaffe *et al*., 2001). Women are, therefore, particularly at risk as they generally have a lower bone mass, which is often further decreased after the menopause, when oestrogen production falls (Figure 1). Some women reportedly lose as much as 15% of their bone mass in the first five years after the menopause (Hansen, 1991), while other research suggests the loss can be as much as one-third of a woman's total lifetime loss of bone mass and occurs within the first 5-6 years after the menopause (Horowitz, 1993; Manolagas and Jilka, 1995). Those women who have experienced a premature (before age 45) menopause, either naturally, surgically or radiation induced, are therefore considered at particular risk of osteoporosis. Although the relationship and interaction between oestrogen and bone density levels is still unclear, oestrogen receptors have been found on osteoclasts and osteoblasts (Lindsay *et al.,* 1993); indicating a role for the hormone in the formation of new bone and the prevention of bone resorption. It has been previously estimated that in the United States alone 13-18% (4-6million) of women suffer from osteoporosis, with a further 37-50% (13-17million) classed as having osteopenia (Looker *et al.*, 1997). This compares to 3-6% (1-2million) men suffering from osteoporosis, with a further 28-47% (8-13million) classed as having osteopenia (Looker *et al.*, 1997). In the UK, the lifetime risk of osteoporotic fractures has previously been reported to be as high as 40% in women, and 13% in men, with 1 in 3 post-menopausal women and the majority of older people being affected by the disease (Barlow *et al.*, 1994; Delmas and Fraser, 1999). More recent reports from the National Osteoporosis Society (NOS) suggest that this figure is now 50% in women and 20% in men (NOS, 2010). Studies have also shown that women in the lowest quartile of BMD have an eight-fold increased risk of hip fracture compared with women in the highest BMD quartile (NOS, 2010). Increasing age, in both men and women, correlates strongly with an increased risk of osteoporosis and the associated fractures (Hui *et al.,* 1988). Bone loss continues in the elderly years, even past the age of 85 (Greenspan *et al*., 1994; Cali and Kiel, 1995; Hannan *et al*., 2000), with the incidence of osteoporotic fractures highest in those aged over 80; at this stage of life fragility of the bone is often compounded by an increased vulnerability to falls (Figure 1). Results from a variety of longitudinal studies including the Framingham (Hannan *et al*., 1992), Rotterdam (Burger *et al.,* 1994; 1998) and Dubbo (Jones *et al.*, 1994a and 1994b) osteoporosis studies have indicated that age is inversely related to BMD in both men and women. Therefore, according to Hannan *et al.* (2000), slowing age-related bone loss may lead to the prevention of a considerable number of fractures. However, with an increasing number of people 65 years and older and with the proportion of the population aged over 80 set to increase rapidly in the coming years, the overall prevalence of osteoporosis and related fractures worldwide will increase substantially; something which is likely to be accompanied by a rise in human suffering and spiralling healthcare costs (Anderson and Delmas, 2002).

Figure 1:



There are a number of diseases and conditions, which have a direct connection with, or implication for, osteoporosis. Rheumatoid arthritis is linked to an increased fracture risk, independent of BMD (Kanis *et al*., 2008). Individuals with the condition Paget's disease have overactive osteoclasts and osteoblasts, often leading to irregular thickening and softening of bones. Those with Osteoarthritis suffer from degeneration of cartilage at ends of bones, which leads to painful friction of bone on bone. Bone cancer, known as Osteogenic sarcoma, occurs mostly in the femur, tibia and humerus of teenagers and has a direct and significant affect on osteoblasts. Other factors that indicate a moderate risk of future fracture include conditions that affect food absorption, such as Crohn's disease and celiac disease, type 1 diabetes, chronic obstructive pulmonary disease, hyperthyroidism, and low levels of the male hormone testosterone (Elliot, 2011). If combinations of these moderate risk factors are present or one factor is present in post-menopausal females or males aged over 65 years, a fracture risk assessment is indicated (Kanis *et al.,* 2008). Also at risk are those with a Body Mass Index (BMI) of <19kg/m2; which in females is thought to be linked to the decreased production of oestrogen (some of which is produced in fatty tissue), and reduced mechanical strain on bones as a result of reduced weight (Compston *et al.,* 2010). While this is prevalent in those with anorexia, it can also be rife in unexpected populations, such as elite female athletes, dancers and gymnasts; often linked to the female athlete triad (Birch, 2005).

The National Osteoporosis Guideline Group (NOGG) suggests that a combination of a low BMD with one or more clinical risk factors identifies individuals who may benefit from treatment (Compston *et al.,* 2010). This identification can be further enhanced by using the World Health Organisations' (WHO) fracture risk assessment tool known as FRAX (www.shef.ac.uk/FRAX). The FRAX tool uses recognised risk factors to estimate an individual's 10-year fracture risk, with or without a BMD measurement; this has two major advantages – it can be completed in a matter of minutes and can be linked to the NOGG clinical management algorithms (Compston *et al.,* 2010). Elliot (2011) states that FRAX should be used on postmenopausal women and men aged over 50 years to assess fracture risk; assisting with decisions regarding referral for DXA scan (see Hawkey, 2012), lifestyle advice or medical treatment.

Lifestyle Factors

Lifestyle modifications can help in the attainment and maintenance of peak bone mass and wherever possible should be recommended for general health benefits. Until relatively recently, lifestyle changes had been referred to as 'alternative' (Minne, 1997). However, it is now apparent that bone density can be improved by positive lifestyle behaviours, such as limiting alcohol and tobacco consumption, adequate calcium and other essential vitamin and mineral intake, and regular weight-bearing exercise throughout life.

Smoking and alcohol consumption

Heavy smoking has long been associated with a greater risk for osteoporosis (Daniell, 1972; Law and Hackshaw, 1997), a higher incidence of bone fractures and lower bone density (Johnston, 1994; Law and Hackshaw, 1997), and a decrease in new bone formation (Yuhara *et al*., 1999). Grainge *et al*. (1998) found significant reductions in BMD when comparing smokers with non-smokers, at all ages; results also suggested that the longer an individual smokes, the greater the effect on BMD. The detrimental effect of smoking on BMD is due to the suppression of osteoblast activity and, specifically in women, by causing oestrogen levels within the body to reduce, hastening the onset of the menopause. It has been suggested that smoking increases the lifetime risk of developing a vertebral and hip fracture by approximately 20% and 35% respectively (Ward and Klesges, 2000). Ward and Klesges (2000) also found that absolute effect sizes, at most bone sites, were greatest for current smokers compared to never smokers, intermediate for current smokers compared with former smokers, and lowest for former smokers compared with never smokers; this suggests that smoking cessation may have a relative, positive affect on bone mass. Other suggestions for the negative effect smoking has on bone have included smokers' generally lower body weight, decreased physical activity, and accelerated bone loss through decreased calcium absorption efficiency (Krall and Dawson-Hughes, 1999).

Smokers are also 86% more likely to drink alcohol excessively than non-smokers (Shiffman and Balabanis, 1995), which has been shown to have a further detrimental effect on BMD. This link between smoking and alcohol consumption is of significance because consuming large quantities of alcohol can prevent the absorption of calcium. Almost all epidemiological studies of alcohol use and human bone health indicate that chronic heavy alcohol consumption, particularly during adolescence and young adulthood, can dramatically affect bone health and may increase the risk of developing osteoporosis later. Although alcohol appears to have an effect on bone-forming cells (i.e. osteoblasts), slowing bone turnover, the specific mechanisms by which alcohol affects bone are poorly understood. Heavy drinkers, especially, have been reported to have particularly low bone density levels (Grainge *et al.,* 1998). Current government guidelines suggest that alcohol consumption should not regularly exceed 2-3 units daily for women and 3-4 units daily for men (Table 2). Those who consume larger amounts than advised are at

greater risk of suffering bone loss than those who drink moderately or not at all (Hannan *et al.,* 2000). Furthermore, studies have shown that the effects of heavy alcohol use cannot be reversed, even if alcohol consumption is terminated (Sampson, 1998). Alcohol intake is particularly detrimental as it has been reported to increase fracture risk independent of BMD (Kanis *et al*., 2008). It is therefore recommended that individuals completely refrain from smoking and reduce alcohol consumption to reduce the negative impact these products have on osteoblast activity and the body's ability to absorb calcium.

Table 2:

Alcoholic drinks and their corresponding units				
Beer, lager, cider	**Bottle (330ml)**	**Can (440ml)**	**Pint (568ml)**	**Litre**
2% (low alcohol)	0.7	0.39	1.1	2
4%	1.3	1.8	2.3	4
5%	1.7	2.2	2.8	5
6%	2	2.6	3.4	6
9% (super strength)	3	4	5.1	9
Alcopops	**1 bottle (275ml)**			
5%	1.4			
Wine and Champagne (red, white, rose, sparkling)	**Small glass (125ml)**	**Standard glass (175ml)**	**Large Glass (250ml)**	**Bottle (750ml)**
10%	1.25	1.75	2.5	7.5
11%	1.4	1.9	2.8	8.3
12%	1.5	2.1	3	9
13%	1.6	2.3	3.3	9.8
14%	1.75	2.5	3.5	10.5
Fortified wine (sherry/port)	**Standard measure (50ml)**			
17.5 – 20%	0.9 – 1			
Spirits, shots (gin, rum, vodka, tequila, sambuca)	**Small measure (25ml)**	**Large measure (35ml)**	**Spirits, small double measure (50ml)**	**Spirits, large double measure (70ml)**
38-40%	1	1.3 – 1.4	1.9 – 2	2.7 – 2.8

Nutrition

Good nutrition and a balanced diet with adequate calories are important for normal growth and everyday function. The most important nutrient for attaining peak bone mass, and consequently in the treatment and prevention of osteoporosis, is calcium. This is because calcium plays an important structural role in the development and maintenance of bone tissue by slowing the rate of bone loss and reducing the frequency of fractures, especially in older women and those with a low calcium intake (Dawson-Hughes *et al*., 1990; Reid *et al*., 1995; Recker *et al.,* 1996). It is therefore recommended that people consume a healthy, well-balanced diet including foods high in calcium content (Table 3). While adolescents and adults are recommended to consume 1200-1500mg and 1000mg respectively per day, older people and post-menopausal women not receiving oestrogen should ensure they consume 1500mg of calcium on a daily basis (National Institutes of Health, 1994; National Institutes of Health, 2001). A diet low in calcium is likely to be deficient in many other micronutrients as well, but few studies have addressed these potential relations. New *et al.* (1997) stated that our understanding of the influence of nutrition on bone health is limited due to most studies concentrating primarily on the role of calcium and paying less attention to other micronutrients. Studies have shown that bone health is likely to be dependent on a full suite of nutrients such as calcium, magnesium, phosphate, zinc, potassium, fibre and vitamin and vitamins C, D and K (New and Bonjour, 2003; New *et al.,* 2000). Certain vegetables, such as broccoli, could also aid bone growth not only because of their high levels of calcium, but also due to their abundance of vitamin K; believed to help osteocalcin bind to the mineral portion of the bone (Iwamoto *et al.,* 2004).

The National Institute for Health and Clinical Excellence (NICE) guidelines suggests co-prescribing calcium and vitamin D because vitamin D controls the absorption of calcium from the intestine (NICE, 2010a; 2010b). Primary sources of dietary vitamin D include oily fish, margarine and certain breakfast cereals with added supplements (NOS, 2009). However, only 20% of the required vitamin D comes from dietary intake; the remainder is supplied by sunlight. Holick (2004) suggests that 5-10 minutes of sunlight to the arms and legs, or the hands, arms and face, 2-3 times-a-week, combined with increased dietary and supplementary vitamin D are reasonable approaches to ensuring vitamin D sufficiency. Elliot (2011) similarly recommends 15-20 minutes of exposure to the arms and face daily during the summer months to provide adequate vitamin D for the entire year. If an individual has sufficient amounts of calcium, through the diet, and vitamin D from exposure to sunshine, then supplements will generally not be necessary, as there is no evidence to suggest that taking more than the required level will provide any extra benefit to bones.

Table 3:

Food (100g portions)	Calcium (mg)
Full fat milk (silver top) approx. 100ml	115
Skimmed milk	120
Semi-skimmed milk	120
Cheddar cheese	720
Cottage cheese	73
Low-fat yoghurt	150
Vanilla ice-cream	120
Sardines	460
Boiled prawns	150
Orange	33
Boiled broccoli	34
Baked beans	53
Peanuts	60
Brazil nuts	170
Watercress	170
Boiled spinach	160
Dried figs	250
Steamed or fried Tofu	510
White/Brown bread	110/16

Physical activity

Those who lead a sedentary lifestyle are at much greater risk of developing osteoporosis than those who incorporate regular activity into their daily routine. This is because stressing the musculoskeletal system enables bones and muscle to maintain or even improve strength, endurance and integrity (American College of Sports Medicine, 2006; Hawkey, 2011). This is supported by studies showing that those who are confined to long-term bed-rest, immobilised by disease or disability, those who are inactive, and astronauts exposed to reduced gravity levels, are at increased risk of suffering from osteoporosis (Hawkey, 2003a; 2003b). Kanis *et al*. (2008) state that prolonged immobilisation not only leads to a loss of bone density, but also increases fracture risk. Physical activity early in life contributes to a high peak bone mass, with various activities, including walking, weight training and high impact aerobics inducing increases in BMD. While general fitness has been shown to indirectly protect individuals from fractures by improving mobility and muscle function, increasing muscle mass and strength, therefore reducing the risk of falls (Taaffe *et al,* 1999), results from clinical trials and meta-analyses suggest that load-bearing exercise is more effective for increasing bone mass than other types of exercise (Frost, 1997; Nevill *et al.,* 2004). This is supported by studies showing that increasing, or at least maintaining, lean mass aids in the maintenance of BMD in older people (Taffe *et al.,* 2001).

The exact nature of the relationship between exercise and bone mass is not yet fully understood, and the type of weight-bearing exercise that is most effective in preventing bone loss has not yet been identified (Wolffe, 1999; Hawkey, 2004). There are a wide range of exercises that can be performed using an individual's own body weight including press-ups, squats, and lunges. In addition, exercises using fixed resistance machines and free weights, often found in gymnasiums, can also be used. Although swimming is a very beneficial exercise, especially for people with joint problems, it is not specifically beneficial in the prevention of osteoporosis because it is not weight bearing. However, aquatherapy and water exercises are highly recommended as the force of walking in the water and performing exercises with water equipment places beneficial stress and loading on bones (Krupskas, 2004). Those individuals who have or that are at risk of osteoporosis should avoid exercise that puts excessive stress on bones, such as running or high impact aerobics. They should also refrain from activities that require deep forward bending, like rowing, as these may cause a vertebral fracture. Individuals with vertebral fractures should follow a supervised programme designed to maintain strength and flexibility of the thoracic and lumbar spine. Not only does exercise strengthen bone and muscle, it can also improve balance and co-ordination (Department of Health, 2002). Exercise programmes should therefore be tailored to the individual's needs, by a suitably qualified, trained professional, and where possible should include activities that put weight or stress on the musculoskeletal system. Recent research has suggested that high frequency, low-level mechanical signals (vibration) can maintain bone health in some populations, and actually stimulate bone formation in others (Hawkey, 2007). Those studies conducted on children with cerebral palsy (Ward *et al.,* 2004), girls with extremely low BMD (Pitukcheewanont *et al.,* 2002) and women who have recently undergone menopause (Rubin *et al.,* 2004), have all indicated that this unique biomechanical intervention may provide a means of successfully treating osteoporosis. Other studies appear to show that resistive vibration exercise completely prevents bone loss in healthy humans during prolonged bed-rest; those exposed to these vibration signals, during 30 days of head-down bed-rest, maintained their BMD compared to control subjects who exhibited a 4% loss in BMD (Rittweger and Felsenberg, 2004); leading to suggestions of vibration training being incorporated into human spaceflight and rehabilitation programmes (Hawkey, 2006; Hawkey, 2007).

Pharmacological Interventions

While lifestyle modifications are the preferred method by which to attain and maintain peak bone mass unfortunately, for some individuals, pharmacological intervention is often necessary. As a low bone mass is considered the major risk factor for fractures, the treatment of osteoporosis focuses on agents that reduce this risk by slowing down the activity of osteoclast cells (known as anti-resorptive drugs) or through the stimulation of osteoblasts (known as anabolic drugs); or a combination of both (see Table 4). Our current incomplete understanding of the mechanisms by which antiresorptive agents improve skeletal strength (at some but not necessarily all sites) deserves and demands further investigation. However, it would appear that the majority of antiresorptive treatments induce a 2-10% increase in spinal BMD, while in a recent study Geusens *et al.* (2008) reported that the identification of osteoporosis in menopausal women and its subsequent treatment using medication can reduce fracture risk by 40-60%. The choice of pharmacologic treatment, or combination of treatments, is a clinical decision which should be made by the patient and the referring physician; based on an assessment of the individual's risk of fracture and on the efficacy and side-effects of those drugs likely to be prescribed. While individual drugs can have complications, there is now a greater choice of therapy available with potentially fewer side effects (Body *et al.*, 2010).

Table 4 :

Pharmacological interventions for the treatment of osteoporosis

Classification of treatment	Generic name	Method of administration	Annual cost	Generalised treatment results
Bisphosphonates Slows down the process of remodelling by inhibiting osteoclasts and allowing osteoblasts to work more effectively	Alendronate	Daily or weekly tablet	£15.08	Increases BMD at all skeletal sites. Reduces fracture risk by ~50% at hip/spine
	Risedronate	Daily or weekly tablet	£253.63	Increase bone mass in post-menopausal women. Reduces rate of vertebral and non-vertebral fractures. Reduces hip fractures in elderly women with low BMD
	Ibandronate	Monthly tablet/ 3-monthly intravenous injection (IV)	£220.84/ £274.56	Improved hip and spine BMD in women with osteoporosis or osteopenia/Significant increases in lumbar spine BMD
	Zoledronate	Annual IV infusion	£263.74	Reduction in the rate of new clinical fractures and with improved survival following a hip fracture
Dual-acting bone agent Decreases bone resorption and increases bone formation	Strontium ranelate	Daily soluble sachet	£332.80	Associated with significant increases in BMD at lumbar spine, femoral neck and total spine
Monoclonal antibody Blocks RANK ligand which stimulates the production and activity of osteoclasts.	Denosumab	6-monthly subcutaneous injection	£366	Reduces the incidence of new vertebral and hip fractures in postmenopausal women with osteoporosis at higher risk for fracture
Selective (O)Estrogen Receptor Modulators (SERM) mimics the actions of oestrogen	Raloxifene	Daily tablet	£221.78	Reduces the incidence of new spinal fractures by 30–50%

(data from Anderson and Delmas, 2002; Elliot 2011; NOS, 2010; NOGG, 2010; NICE, 2010a,b,c; BNF, 2009; Black et al, 2000; Cummings et al, 2009; Miller et al, 2005; Meunier et al., 2004; Reginster et al., 2005 Boonen et al., 2011; Miller et al., 2011; Stakkestad et al., 2003; Lewiecki et al., 2009; Lyles et al., 2007)

Antiresorptive treatments

Hormone Replacement Therapy (HRT) is a sex hormone treatment, which has long been the method of choice for the prevention of osteoporosis in postmenopausal women (Anderson and Delmas, 2002). If the body stops producing hormones (oestrogen in women and testosterone in men), particularly due to surgery, illness or, in the case of women, early menopause, replacement is often considered. Like HRT, Selective (O)Estrogen Receptor Modulators (SERM) mimic the action of the hormone oestrogen. Currently, the only SERM in regular use as a treatment for osteoporosis is raloxifene (Evista), which mimics the positive effects of oestrogen on bone tissue helping to keep bone strong, without affecting breast or womb tissue (NICE, 2010a; 2010b; NOS, 2010). Subsequently, long-term use of raloxifene does not appear to carry the increased risk of cancer of the lining of the womb (endometrial cancer) or breast cancer that has been associated with long-term use of oestrogen-based HRT. Bisphosphonates slow down the process of remodelling by inhibiting osteoclasts; thus allowing osteoblasts to work more effectively. This medication is taken in either a tablet form or, for those with digestive tract issues, administered via an injection or infusion (NICE, 2010a; 2010b; NOS, 2010; Black *et al.*, 2000). While older bisphosphonates, such as etidronate (Didronel PMO), are still sometimes administered, newer versions like alendronate (Fosamax) and risedronate (Actonel) are now more commonly used (NOS, 2010). Bisphosphonates reduce the risk of vertebral, hip and other types of fracture, and appear to be the first choice for women at the highest risk of non-vertebral fracture, including older women as, according to Anderson and Delmas (2002), the risk of hip fracture increases exponentially with age. Intranasal or injectable Calcitonin regulates the amount of calcium in the blood and is an alternative to HRT or bisphosphonates. Four-year results from the PROOF study show that salmon calcitonin nasal spray reduces the incidence of vertebral fractures by 25-30% at a daily dose of 200 IU (Anderson and Delmas, 2002). Calcitriol is an active form of vitamin D, which works by increasing how much calcium we can absorb from food and decreasing how much calcium we excrete. Calcitonin and Calcitriol are often prescribed to produce a positive calcium balance in the body (NOS, 2010).

Anabolic treatments

Denosumab belongs to a group of treatments called monoclonal human antibodies and works by blocking a substance involved in bone development known as RANK ligand; responsible for stimulating the production and activity of osteoclasts (Cummings *et al.*, 2009; NICE, 2010c; NOS, 2010). Parathyroid hormone (PTH), naturally produced by the body to help in the regulation of calcium, is the first treatment method that attempts to renew the skeleton by stimulating osteoblasts. When used as a daily subcutaneous injection, this treatment acts as a bone forming agent, which is used to strengthen bones and reduce the risk of fractures (NOS, 2010). Some studies have reported that PTH can reduce the risk of vertebral fracture by 70% within an 18 month period, with non-vertebral fracture risk reduced by 50% (Neer *et al.*, 2001). Strontium ranelate (Protelos) is a Dual-acting bone agent, which is reported to impact on both osteoblasts and osteoclasts, although it is currently unclear how this works to reduce the risk of fracture (NICE, 2010a; 2010b; NOS, 2010).

Criteria for Treatment

Although knowledge of the degree of BMD is not always necessary to make a treatment decision, it is advisable and is usually measured. Individuals with a fragility vertebral fracture should always be treated, since their risk of further vertebral fractures is very high; approximately 20% in the 12 months following fracture (Anderson and Delmas, 2002). Men and women with BMD values greater than 2.5 standard deviations below the mean for young females (i.e. osteoporosis) should be offered appropriate information, support and treatment. Those individuals with osteopenia who have high-risk factors that add to the risk of fracture should also be offered the same options. For individuals with other low-trauma fractures, the existence of skeletal fragility underlying the fracture needs to be assessed by BMD measurement. In instances of a low BMD (T-score < -1) treatment should be considered on the basis of the type of fracture (all hip fractures should be treated, whereas toe and finger fractures are often non-osteoporotic). The age of the patient, additional risk factors, and current BMD (as fracture risk doubles for every 1 SD decrease in BMD) should also be taken into consideration. Primarily due to its low cost and success in clinical trials, NICE state that generic bisphosphonates are usually the

first choice of therapy (NICE, 2010a; 2010b), and based on scientific evidence, alendronate, risedronate, and raloxifene appear to be the best treatment options. However, Elliot (2011) does state that some patients (such as those with abnormalities of the oesophagus and those who develop swallowing problems or pain behind the sternum) are advised to seek other treatment options. Medications such as denoumab or strontium ranelate may have to be prescribed if first-line treatments in postmenopausal osteoporosis are not considered suitable or effective (NICE, 2010a; 2010b; Elliot, 2011). A worrying statistic is that in the majority of countries around the world, the percentage of people suffering from osteoporosis, who are actually receiving pharmacological treatment, is estimated to be fewer than 30% (Anderson and Delmas, 2002). Regardless of the treatment option adopted though, there is increasing evidence that many patients are not taking their medication following the first year of treatment (Weycker *et al*., 2006), with Lekkerkerker *et al*., (2007) stating that adherence to anti-osteoporosis medications is currently low and is associated with poor anti-fracture efficacy. In addition to increasing the risk of fracture, non-adherence also decreases the cost effectiveness of the drugs (Elliot, 2011).

Conclusions

While genetic pre-dispositions and lifestyle factors predispose some people to osteoporosis, the problem is widespread, particularly among women. The lifetime risk of a woman suffering from osteoporosis is approximately 1 in 2, whereas for men the risk falls to 1 in 5 due to their generally higher bone mass. Fracture risk also appears to be reduced for those of black origin when assessed against Caucasian, Hispanic and Asian populations; potentially due to increased bone mass levels. Individuals with a low body weight, those who smoke and drink excessively, and those who are relatively inactive are also generally more susceptible to osteoporosis. Ideally, the aim should be the achievement of optimum bone health throughout life by age-specific non-pharmacological intervention, following the age-old adage of prevention being better than cure. Unfortunately for some though, medical treatment for osteoporosis is necessary. There are currently a number of treatment options available, and choice of pharmacologic treatment, or combination of treatments, should be based on an assessment of the individual's risk of fracture and on the efficacy and side-effects of those drugs likely to be prescribed. Whatever treatment is used though, it should be coupled with exercise and fall precautions to achieve the ultimate goal of preventing osteoporotic fractures. Early detection of the disease using the latest technological advances is therefore crucial for effective treatment. However, to date, osteoporosis remains relatively under-diagnosed and under-treated. It is therefore imperative that campaigns, which effectively increase osteoporosis awareness, the appropriate use of diagnostic tools, and the availability of therapy, are maximised. Identifying patients at high risk of fracture enables the patient/client to be provided with education and support regarding fracture risk. Therapists can also assist with the identification of spinal fractures. This can easily be incorporated into a programme of treatment with an assessment of height loss, back pain, and visible stoop and having the patient/client complete an osteoporosis risk test; directing them to appropriate specialist osteoporosis organisations then facilitates a more effective and efficient patient referral system (Figures 2-5).

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Original research

The occurrence of compassion fatigue amongst sports therapists

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KEY WORDS

Sports therapy
Vicarious trauma
Compassion fatigue
Compassion satisfaction
Burnout

ABSTRACT

Context: Sports therapy has been described as a care profession, and yet little research exists regarding the factors which promote or hinder the caring/working relationship between practitioner and client/patient. Compassion fatigue occurs when individuals are unable to continue bearing the trauma of others, and might lead to a significant reduction in well-being and work capacity in a care profession. Yet whilst compassion fatigue has been studied in many healthcare professions, no research to date has focussed on its prevalence in sport therapy.

Objective: The purpose of this exploratory study was to determine the prevalence of compassion fatigue amongst a group of UK-based sports therapists.

Method: Self-reported measures of compassion fatigue, compassion satisfaction, and burnout were obtained.

Participants: UK-based members of The Society of Sports Therapists (SST) working in both employed
and self-employed settings participated (n = 32).

Results: The results illustrated that 73.9% of participants were classified as being at high risk for experiencing compassion fatigue, and 26.1% as being at high risk for experiencing burnout (emotional exhaustion, depersonalisation, and reduced sense of accomplishment). Further, when conditions were considered in combination, 9.4% of participants were classified as being at risk for experiencing compassion fatigue, burnout, and low compassion satisfaction (fulfilment from helping others).

Conclusion: Sports therapy may be considered as a care profession, where the practitioner-client/patient relationship is an important determinant in outcomes. However, it appears that the development of this relationship may present risks for the therapist. Therefore, this study has highlighted implications for therapists' self-care, and for ongoing research on this topic.

Introduction

Many professions involving client/patient care have placed an increasing emphasis upon the practitioner-client/patient relationship (i.e. the therapeutic/professional alliance). For example, within a nursing context, Sabo (2006) stated that the ability to be both empathetic and compassionate, and to understand a client's/patient's needs, is vital to developing the therapeutic alliance. However, being empathetic and compassionate might serve as a 'double-edged sword' in that, whilst these qualities facilitate care work, they might also render the care-provider vulnerable to negative consequences. One such consequence has been described as 'the cost of caring for others'; i.e. compassion fatigue (CF) (Figley, 1995). To date CF has been observed in many caring professions such as nursing (Maytum *et al*., 2004; Abendroth and Flannery, 2006), child welfare (Conrad and Kellar-Guenther, 2006), and social work (Leon *et al*., 1999; Badger *et al*., 2008; Radey and Figley, 2007; Bride *et al*., 2007; Negash, and Sahin, 2011). Compassion is commonly understood as an emotion, in which a person undergoes an experience of feeling with another whilst recognising that their feelings are not the same (Sabo, 2006). Oakley (1992) suggested that compassion can affect a person's "mental tone", influencing an individual's perceptions, desires and actions, regardless of whether the individual is aware of it. Sabo (2006) suggested that this indicates that compassion affects our lives over a long period of time and exists in the absence of feeling.

CF is a natural consequence of working with traumatised clients, and develops due to repeated vicarious empathic 'suffering' (Benoit *et al*., 2007; Coetzee and Klopper, 2010), and is a gradual response to work stress and negative triggers in the work environment (Pines and Maslach, 1978). However, CF might also result from a single exposure to trauma (Conrad and Kellar-Guenther, 2006). Many negative consequences have been associated with CF, such as; feelings of frustration, emotional exhaustion and depersonalisation (Rosenberg and Pace, 2006; Sabo, 2006), a reduced capacity or interest in bearing the trauma of others and a persistent state of tension or arousal (e.g. anxiety) (Figley, 2002), preoccupation with traumatised patients, declines in professional performance such as poor treatment planning, misdiagnoses, patient abuse, and lower patient satisfaction ratings (Figley, 1995, 2002; Hilliard, 2006; Bride *et al*., 2007). Thus, practitioners experiencing CF might distance themselves from clients/patients, leading to a point where neither the practitioner's nor the client's/patient's needs are met (Coetzee and Klopper, 2010; Bride *et al*., 2007). Ironically, it appears that some of the personal qualities and skills that make for an effective and competent practitioner might well lead to vulnerability.

In contrast, compassion satisfaction (CS) is described as the sense of pleasure and fulfilment derived from a practitioner's use of self, their skills and resources in order to connect with the patient/client and share their trauma, and from working effectively and competently in a care setting (Figley, 1995; Yoder, 2010). Therefore, rather than being left traumatised, the practitioner has the opportunity to witness the recovery of clients/patients which may lead to them feeling inspired and rejuvenated (Coetzee and Klopper, 2010). As such, the carer is able to maintain meaningful and purposeful connection with clients/patients regardless of the circumstance. Thus, CS has been observed as providing protection against CF in social work settings and is associated with flourishing in the workplace, maintenance of morale and consistently meeting clients'/patient's needs (Conrad and Kellar-Guenther, 2006).

The SST positions sports therapy as an element of healthcare primarily concerned with injury prevention and rehabilitation of patients to optimum levels of functional, occupational and sport specific fitness (SST, 2012). As such, it can be inferred that sports therapists are employed in a caring profession. Furthermore, in the Society's 'Standards of Proficiency' document (SST, 2008), it is stated that sport therapists must: a) recognise the need for effective self-management of workload and resources; b) understand the importance of maintaining their own health; and c) understand the need to engage patients, carers and (if appropriate) coaches in planning and evaluating diagnostics, treatments and interventions to meet their needs and goals. Thus, to work effectively, sports therapists must also maintain their own health and self-manage their workload. To date, no formal research has been conducted which examines the presence, and impact, of CF (nor CS) amongst sports therapists. Therefore, the aim of this study was to conduct an exploratory study to determine the existence of CF and CS amongst sports therapists. Specifically, it was posited that indications of CF would be present, but would be counter-balanced by CS. It was also posited that indications of burnout would not be present.

Method

Participants

Participants were UK-based sports therapists, were all members of the SST and in total 32 (18.5% response rate) therapists participated. Work experience ranged from 5 to 25 years, and participants reported having worked within a variety of sports (e.g. rugby, football, swimming, athletics).

Procedures

Following receipt of institutional ethical approval members of the SST were contacted via email to ascertain their interest in participation. As a result 32 participants completed the Professional Quality of Life Compassion Satisfaction and Fatigue Subscales (ProQOL) (Stamm, 2010). In order to maximise efficiency of questionnaire distribution and response-rate a version of the ProQOL-5 was constructed via online 'surveygizmo' software (Surveygizmo, 2012). This software was used as it was the preferred choice of the Society. Participants completed the questionnaire by 'checking' their choice of answer per item, and on completion the survey results were automatically forwarded to a password protected folder accessible only by the research team. The ProQOL is a 30-item measure where the respondent indicates how frequently they have experienced each item in the past 30 days. Each item is anchored by a 5-item Likert scale (1 = never, 1 = rarely, 3 = sometimes, 4 = often, and 5 = very often), and were designed to measure CS, CF, or burnout. Respective examples of items are: a) 'I get satisfaction from being able to help people', b) 'I can't recall important parts of my work with trauma victims', and c) 'I feel overwhelmed because my case-work load seems endless'. Higher CF scores might suggest that the practitioner reflect upon how they feel about their work, whilst higher CS scores suggest satisfaction with their ability to provide care effectively, and higher scores on the burnout suggest the practitioner is at risk for burnout. Whilst the ProQOL-5 is not diagnostic (as there are no official diagnoses for CF in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR, 2000) it is the most commonly used measure of the impact of working with people who have experienced trau-

matic events (Stamm, 2010). The ProQOL subscales have good reliability (Figley and Stamm, 2010).

Statistical Analysis

All data analysis followed procedures detailed within the 'The Concise ProQOL Manual' (Stamm, 2010). The manual describes three steps to data analysis: a) reverse score items 1, 4, 15, 17 and 29, b) sum items by subscale, and c) convert raw scores to t-scores. This was enabled using a table contained within the manual. Stamm (2010) stated that the ProQOL-5 is best analysed in its continuous form. However, cut scores, based upon the bottom quartile (25th percentile; a t-score of <43) and top quartile (75th percentile; a t-score of >57) provide an indication of individuals at risk of experiencing CF and/or burnout. Furthermore, when the scales are used in combination, Stamm (2010) provided a description of certain conditions that individuals may be experiencing. However, the ProQOL is considered as a screening and planning tool only. Therefore, "it is probably less problematic to include someone who should not be included than to exclude someone that should be included so that supportive or corrective action is considered even if it is not needed" (Stamm, 2010, p. 18). During this analysis, descriptive statistics were conducted, and compared to the moments of the ProQOL 5 when used with general health workers (Stamm, 2010).

Results

There was a tendency for the participants in this study to report experiencing average ratings for CF, CS, and burnout (see Table1).

Table 1: Mean scores for sports therapists (ST) compared to mean scores for general health workers (GHW)

ProQOL component	ST	GHW
Compassion Satisfaction	51	50
Secondary Traumatic Stress	51	50
Burnout	50	50

At a group level the ProQOL results for sport therapists therefore failed to indicate potential risk. However, when exploring individual reports, and when applying the more advanced analysis procedures outlined by Stamm (2010) it was possible to categorise each participant within different levels of risk (see Table 2). Of particular note is that the ProQOL categorised nearly 75% of participants as experiencing CF.

Table 2: Compassion satisfaction, compassion fatigue, and burnout risk frequencies for UK-based sports therapists.

	Low Risk	Moderate to high risk	High Risk
Compassion Satisfaction	n = 2; (8.7%)	n = 13; (56.5%)	n = 8; (34.8%)
Compassion fatigue	n = 0	n = 6; (26.1%)	n = 17; (73.9%)
Burnout	n = 2; (8.7%)	n = 15; (65.22%)	n = 6; 26.1%)

As previously stated, Stamm (2010) highlighted that the ProQOL is not a diagnostic test, and neither is CF categorised within the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR, 2000). However, Stamm also highlighted that the ProQOL might be used to 'raise issues' related to pathological conditions, and so 'combination scores' (see Table 3) are provided within the ProQOL manual which might be used as part of clinical decision-making for potential intervention.

Table 3: Participants observed as experiencing 'at-risk' combinations of compassion satisfaction, compassion fatigue, and burnout as highlighted by Stamm (2010).

Combination	ST
a) High CS, moderate to low BO and CF	n = 8 (25%)
b) High BO, moderate to low CS and CF	n = 3 (9.4%)
c) High CF, low BO and CS	n = 1 (3.1%)
d) High CF and CS, low BO	n = 2 (6.3%)
e) High BO and CF, low CS	n = 3 (9.4%)

Discussion

Existing research has demonstrated that CF exists in many care-based professions, but to date no research has been conducted within a sports context. Therefore, this study set out to explore the prevalence of CF amongst sports therapists. Within the current study there was a clear indication that some participants had reported experiencing relatively high levels of CF and a detrimental combination of risk factors. It is especially noteworthy that 9.4% of participants reported experiencing characteristics of burnout (combination b). A potential consequence of such a combination is feelings of

ineffectiveness at work. Also, 3.1% of participants reported experiencing CF (combination c), and so would be considered as being afraid of their job, or situations pertaining to it. This finding was somewhat expected, as a main precursor to CF is the presence of a client/patient who has experienced a high degree of trauma (Figley, 2002). Combination d (6.3% of participants) is also noteworthy as it has been associated with warfare or civil violence situations wherein individuals experience high levels of fear but remain highly effective and confident in their job. Combination e (9.4% of participants) is considered as the most detrimental situation, and represents feelings of fear and inadequacy at work, together with a lack of work satisfaction. However, it was encouraging that the majority of sports therapists reported experiencing the most positive combination (combination a) of risk factors (25% of participants) suggesting that these individuals were satisfied in their work, felt that it was important, and had not experienced any particular situation in their work which had made them fearful (Stamm, 2010). It could be suggested that this is partly due to these individuals being aware of the need for self-care, and to having developed personal coping mechanisms and support networks to guard against any potential negative consequences of caring. Indeed, one experienced participant contacted the researchers independently and highlighted the need for self-care but pointed-out that this issue had been lacking in their training:

"When we were trained, I don't remember being taught to protect myself, when I was inexperienced I would have thought the person telling me such a thing was probably 'off their trolley'. Now, believe me, it does happen, when you have a day starting from 7.30am to 7pm fully booked with clients with highly charged energy, or displaced energy, chances are you will be affected if you're not careful".

This participant also highlighted that becoming overly immersed in a client's/patient's trauma could often result in common illnesses (e.g. "a rash, a chesty cough, feel rough or depressed"). Consequently, in order to minimise any potential negative effects of working with traumatised clients/patients this participant described manipulating their physical work environment (e.g. lighting and ventilation), and using psychological strategies (e.g. relaxation techniques) in order to remain 'grounded'. This participant's reflection positioned self-awareness as a crucial component in their daily working-life. As CF is said to result from helping or wanting to help a traumatised or suffering person, and can lead to distressing emotions, cognitive changes and functional impairment (Figley, 2002), immediate treatment would prove beneficial (Stamm, 2010) in order to prevent the potential decline into various stress-related illnesses (Slocum-Gori *et al*., 2011). Also, Gentry *et al*. (2002) suggested that, to reduce the chances of experiencing CF, resiliency must be developed further through the ongoing development of self-care strategies and social support. Therefore, practitioners might consider developing self-care strategies and enhancing their understanding and use of sport psychology as part of their CPD. Radey and Figley (2007) suggested that this process should begin when the practitioner is in training, and that regular debriefing sessions should be provided by agencies and teaching institutions. In particular, this process would provide opportunity for student/practitioner sports therapists to highlight their individual successes and difficulties, as well as sharing helpful techniques. Additionally, some researchers have reported time away from the stressful environment as a beneficial coping strategy (Figley, 2002; Yoder, 2010). Stoesen (2007) also suggested that potential treatments for CF might include maintaining regular sleep, exercise and dietary patterns. Furthermore, Bride *et al*. (2007) recommended maintaining a balance, managing stress, spending quality time with family and friends, participating in exercise, taking holidays and enjoying personal time and generally deriving pleasure and relaxation at an individual level as being key to preventing CF. However, Kanter (2007) argued that whilst such interventions are certainly helpful in reducing the stress and fatigue potentially experienced by practitioners, they fail to address differential causes. Also, Deighton *d*. (2007) concluded that it is not exposure to others' trauma per se that renders practitioners vulnerable to CF, instead it is the practitioners' response to such trauma that presents possible risk factors. Thus, Radey and Figley (2007) suggested an alternative approach is to increase felt CS and reduce CF by purposefully attempting to maintain a positive outlook on their work, their clients and their work environment.

Limitations

There were several limitations to this study. As stated previously, the ProQOL is not a diagnostic test (Stamm, 2010), nor is there is an official diagnosis for CF within the Diagnostic and Statistical Manual of Mental Disorders. Therefore, the findings should be read with caution, and only taken as highlighting potential risk areas. Moreover, the small sample size, and the 'snapshot' approach to data collection restricts possibilities for both understanding the causes and progression of CF, and also the generalisability of results. Furthermore, with respect to combination scores, Stamm (2010) stated that these are potentially over-inclusive therefore there is a tendency for Type 1 error, meaning that "there is a greater possibility of having a false positive than missing someone who actually belongs in a particular group" (p. 18).

Conclusion

The profession of sports therapy centres upon a client/patient care context, within which the trauma presented provides the initial and perhaps central 'driver' for the therapeutic/professional alliance. Within such an alliance it

has been demonstrated in many professions that the practitioner qualities of being empathetic and compassionate also significantly drive the progress of this relationship and the success of the work being done. However, this relationship might be developed at a cost to the practitioner; that is the experience of vicarious psychological trauma. Indeed, the current study indicated that the working context does present risk for sports therapy practitioners to experience such trauma, and so greater emphasis might be placed upon self-care and the use of sport psychology within educational programmes and CPD for sports therapists, and therefore introducing essential prevention and coping strategies (Schwam, 1998). Clearly there is a need for further research to explore the prevalence, possible causes and consequences of CF amongst sports therapists. In particular, qualitative research that explores practitioners' lived experiences of vicarious trauma and coping might provide a better understanding of CF, and provide the basis for the context specific development of self-care strategies and intervention. In turn, this knowledge might be used to better equip neophyte practitioners and graduates, as well as more experienced practitioners.

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Original Research

Electromyographical analysis of the rectus abdominis muscle in athletes performing 10 different abdominal exercises

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KEY WORDS

Abdominal training
Electromyography
Crunch
Swiss ball
Isometric
Vertebral compression forces

ABSTRACT

There is debate regarding the type of exercise that optimally benefits development of the rectus abdominis (RA) muscle. Currently, the abdominal crunch is the exercise of choice, although comparative research is limited. The current study compared the myoelectric action potential (MAP), using root mean square (RMS), of the RA musculature during execution of 10 different abdominal exercises (AE). Following institutional ethics approval, surface electrodes were placed on the RA musculature on a sample of 15 male athletes ((Mean ± SD) age 27.53± 6.8 yrs, height 1.77 ± 0.1 m, and mass 74.93± 8.8 kg) with flat abdominal walls. Participants performed 10 repetitions of each of 10 different AE. All exercises were performed to the pace of a digital metronome at the rate of 2 seconds per repetition, with a rest period of 10 minutes between each AE. The order of exercises was randomised to reduce the effects of muscular fatigue. Hip and knee angles were standardised throughout testing. Repeated measures One-way ANOVA with post-hoc Least Significant Difference (LSD) correction reported that MAP was significantly greater when performing the hanging knee-to-chest raise (HKCR) (4.04mV, P=0.008), and the decline bench (DB) (3.63mV, P=0.013) in comparison to the traditional abdominal crunch (TAC) (3.13mV). RMS was significantly reduced when performing the isometric abdominal exercise (IAE) (0.73mV, P<0.000) compared to the TAC (3.13mV). When compared against the TAC the IAE was the only AE found to be significantly different in RMS separately for the lower (P = 0.001) middle (P = 0.005) and upper (P = 0.006) RA. As the HKCR and DB elicit the highest RMS activity, they appear to be the best exercises to train the abdominal muscles. However, establishing vertebral compression forces during execution of these AE is warranted.

Abdominal muscle strength and endurance is deemed essential for maintenance of the proper alignment of the axial skeleton and enhancing the performance of athletes (Hildenbrand, and Noble, 2004). Additionally, strength of the abdominal musculature helps in the stabilisation of the trunk and helps to unload stress from the lumbar spine (Escamilla *et al*., 2005). According to Colston *et al*. (2005), strengthening of the abdominal musculature enables what is termed the 'bracing effect' and helps in the protection of the spine. The rectus abdominis (RA) and external oblique muscles play the role of secondary stabilisers of the vertebral column, thus enhancing the integrity of the spine (Bird *et al*, 2006). In particular, proper execution of abdominal exercises (AE) facilitates the maintenance of stability of the torso and enhances dynamic stability of the spine (Bird *et al*., 2006). Various traditional and non-traditional AE are performed to enhance abdominal strength and structure, yet inadequate information is available regarding the effectiveness of these exercises in recruitment of the maximum number of muscle fibres. Selection of the exercise technique by the athlete is often based on anecdotal information and their personal experience, which, according to Sternlicht *et al*. (2005), may be misleading. Subsequently, athletes often train their abdominals ineffectually or erroneously which may be time-consuming and, potentially, have detrimental effects (Colston *et al*., 2005).

Sternlicht *et al*. (2005) reported that 6 different devices (Ab-One, Perfect Abs Roller, Ab Scissor, Ab Swing, 6 Second Abs, and Torso Track) were not as effective as the traditional abdominal crunch (TAC) in recruiting the upper and lower RA musculature, while, in a similar study, Bird *et al*. (2006) demonstrated that the Ab-Slide device increased the eccentric activity of the abdominal musculature, but provided less concentric abdominal activity than the TAC; ultimately making it less effective. Research conducted by Escamilla *et al*. (2006), analysed the effectiveness of Power wheel, Ab-Revolutioner, hanging knee-up with straps, and reverse crunch (inclined at 30º) against the traditional crunch using surface electromyography. Increased abdominal activity was reported during all non-traditional AE when compared with the traditional crunch exercise. In a study by Beim *et al*. (1997) the AbFlex device was found to be more efficient in stimulating the upper part of rectus abdominis than a TAC but reported no difference in recruiting any other parts of the abdominal muscles. However, Beim *et al*. (1997) used unilateral placement of

the electrodes on only the middle and lower rectus abdominis; limiting the generalisation of the findings. Demont *et al*. (1999) compared the training effects of two abdominal training devices (Ab-Flex and Ab-Roller) with a traditional abdominal crunch using surface electromyography and found no significant difference caused by the training effects of the specific equipment. Vera-Garcia *et al*. (2000) compared the effect of 4 types of crunches on a stable surface and 3 others on a labile surface (Gymball or wobble board). The study's results produced maximum signal amplitude and co-activation of the muscles when the crunches were performed over labile surfaces and also demonstrated that when the crunch was executed over the Gymball the activity of the RA and the external oblique increased two-fold and four-fold, respectively. Participants in a study by Hildenbrand and Noble (2004) were required to perform 15 repetitions of each of Ab-Roller, Ab Slide and Fitball and a traditional crunch to compare the myoelectric signal of each exercise. Results indicated that none of the exercises increased RA activation compared to the traditional crunch, but did increase the activity of the external oblique musculature and the hip flexors; deemed an undesirable feature of AE by the authors. Also detrimental was the limited recovery period of 2 minutes between the different AE; which would not be viewed as sufficient for the complete recovery of the muscle and the residual effect of fatigue by Christova *et al*. (1998).

The lack of consensus demonstrated in previous research can be attributed to methodological differences, participant numbers, performance levels, and the AE techniques employed. Due to the equivocal evidence regarding the effectiveness of AE, which require minimal or no equipment, on eliciting increased myoelectric action potential (MAP), the aim of the current study is firstly to evaluate how a range of AE affects the RA musculature. Also, due to the paucity of research investigating how these AE interact with the lower, middle and upper RA musculature, the current study will investigate the effectiveness of the AE in targeting these specific areas of the RA.

Methodology

Participants

Following institutional ethics approval, 15 healthy male athletes (Mean ± SD) age 27.5 ± 7 years, height 1.77 ± 0.1 m, and mass 75 ± 9 kg) volunteered to participate in the current study. The selection of participants was restricted to active athletes with flat abdomen. Participants with excessive subcutaneous adipose tissue, previous history of chronic low back pain, heart disease or severe musculoskeletal complaints were excluded from the study to ensure the safety of the participant and credibility of the research (Nordander *et al*., 2003; Lariviere *et al*., 2000). All participants were required to complete a pre-test medical questionnaire and provide informed consent. An information sheet detailing the exercises to be performed was provided; supported by demonstrations of the required technique and a familiarisation session before commencing the study.

Instrumentation and Data Collection

A standard non-invasive portable surface EMG system with six channels (DelSys Myomonitor) was used for recording the myoelectric signals. Line interference was minimised by correct preparation of the electrode placement site, securing skin-electrode contact, turning off unused electrical equipment in the surrounding environment, and uncoiling the electrode cables in accordance with the manufacturers guidelines (Delsys Ltd, 2003). The site of electrode placement over the skin was cleansed with alcohol-wipes to reduce the skin impedance in accordance with Sternlicht *et al*. (2005) and Drysdale *et al*. (2004), while the surface electrodes themselves were placed parallel to the direction of the muscle fibres to ensure maximal signal detection (Ng *et al*., 1998). Electrode interfaces were used to provide a secure contact between the electrode and the surface of the skin to minimise the motion artefact and line interface (Delsys Ltd, 2003). The surface electrodes were placed symmetrically and bilaterally (on either side of the midline of linea alba) over the upper, middle and lower parts of the rectus abdominis musculature in accordance with Filho *et al*. (1997). The placement of the surface electrodes were as follows: First pair (lower RA): 3 cm lateral and 5 cm inferior to the umbilicus; Second pair (middle RA): 3 cm lateral and 5 cm superior to the umbilicus (Vera-Garcia *et al*., 2000); Third pair (upper RA): equidistant from the point 3 cm lateral to the xiphoid process and the second pair. A reference electrode was placed over the anterior superior iliac spine. The functioning of electrodes was inspected by checking the signal obtained with a voluntary contraction of the abdominal musculature. Crosstalk, perceived as the difference in the RMS values between the channels as some electrodes may be nearer than the other electrodes to the adjacent muscle, was minimised by exact placement of the electrodes through standardising the electrode placement sites by marking the sites in relation to the landmarks (Campanini, 2007).

Protocol

Prior to testing, participants performed a warm-up, which included 5 minutes on a Monark exercise bike with heart rate at between 120-140bpm, to reduce the possibility of the occurrence of any musculoskeletal injuries; recommended by both the American College of Sports Medicine (ACSM) and the British Association of Sport and Exercise Sciences (BASES).

Participants were required to perform a set of 10 repetitions of each of 10 abdominal exercises (McNeal 2002; Demont *et al*., 1999). A digital metronome was used to control the speed of the exercise during concentric and eccentric phases (Sternlict *et al*., 2005). Each exercise was performed at the rate of 2 seconds per repetition (1 second for the concentric, and 1 second for the eccentric movement) in accordance with Ross *et al*. (1993), as the speed of performance of the exercise may cause variation in the RMS values obtained (Gutin and Lipetz, 1971). The participants were given a rest period of 10 minutes between exercises (Finnoff *et al*., 2003) as prolonged activity of the muscle causes reduction in the force-generating capacity of the muscle (muscular fatigue), which has an effect on the amplitude of the signal (Christova *et al*., 1998). Participants were advised not to phonate during the exercise as the electromyographic potentials increase during speech production (Hoit *et al*., 1988). Participants were also discouraged to breath-hold during the exercise as voluntary breath holding can cause significant increase in the peak blood pressure elevations (Finnoff *et al*., 2003). Participants were advised to exhale during the concentric contraction and inhale during the eccentric movement. Participants performed traditional abdominal crunch (TAC: in accordance with Sternlicht *et al*., 2005; Sands, 2002; Sarti *et al*., 1996; Demont *et al*., 1999: Figure 1a), bicycle manoeuvre (Figure 1b), crossover crunch (Figure 1c), reverse crunch (Figure 1d), isometric abdominal exercise (IAE: Figure 1e), Swiss ball (in accordance with Vera-Garcia, F.J., 2000: Figure 1f), decline bench (DB: Figure 1g), Ab-roller (in accordance with Sternlicht *et al*., 2005 and Demont *et al*., 1999: Figure 1h), hanging knee-to-waist raise (HKWR: Figure 1i), and hanging knee-to-chest raise (HKCR: Figure 1j). Standardisation of the hip and knee angle was enforced, with the hip maintained at 45 degrees and knee at 90 degrees to restrict hip flexor activity (Sternlicht *et al*., 2005; Ayllón and Fernández, 2006). All the ten exercises were performed in the same session. The testing order for the exercises was randomised across the 15 participants using a Standardised Latin Square design.

FIGURE 1a-j :

EMG Data and Statistical Analysis

The electromyographical complex obtained from each exercise was analysed and the peak RMS value for each individual channel was recorded. The RMS value obtained from different channels corresponded to the various abdominal sites: Channel 1 (Right lower rectus abdominis); Channel 2 (Left lower rectus abdominis); Channel 3 (Right middle rectus abdominis); Channel 4 (Left middle rectus abdominis); Channel 5 (Right upper rectus abdominis) and Channel 6 (Left upper rectus abdominis). The amplitude of the RMS value reflected the intensity of the activation of the rectus abdominis musculature. Mean RMS values corresponded to the mean amplitude over all six channels for each individual exercise, while the values from the pairs of channels (1&2; 3&4; 5&6) indicated the RMS values from the lower, middle and upper RA musculature respectively. Statistical analysis of the electromyographic values was performed using SPSS version 19.0 (SPSS Inc., Chicago, IL). One-way repeated-measures analysis of variance with a Bonferroni correction and a pair-wise comparison was made to analyse the RMS values of various abdominal exercises (Sternlicht *et al*., 2005).

Results

Analysis of the overall means revealed that the HKCR elicited the highest abdominal muscle fibre recruitment; reflected in the intensity of the RMS voltage signal acquired (4.05mV). This was followed by the decline bench (3.65mV), hanging knee-waist (3.14mV) and the bicycle manoeuvre (3.09mV) (Figure 2). The IAE and the RC had the lowest overall mean values (0.7mV and 1.93 mV respectively: Figure 2). Repeated measures One-way ANOVA revealed that there was a statisti-

cally significant difference (P<0.05) in mean RMS value for the IAE, HKCR and DB manoeuvres when compared with a TAC (Table 1). Significantly higher RA activity was observed with HKCR (P = 0.012) and DB (P = 0.018) in comparison to the TAC. IAE showed a significantly lower RA activity when compared with the TAC (P = 0.001). With the TAC being used as the standard criterion measure, the mean RMS of each AE was calculated as a percentage of the TAC RMS by dividing the mean of the exercise by the mean of the TAC and multiplying by 100 in accordance with Sternlict *et al*. (2005), to better illustrate any differences (Table 1; Figure 3).

TABLE 1 :

Exercise	Mean (mV)	SD (mV)	% RMS of TAC	*P* value (TAC)
TAC	3.14	1.99	100	-
Bicycle	3.10	1.92	100.65	0.267
Crossover	2.92	1.87	94.79	0.978
Reverse	1.8	1.83	62.87	0.088
IAE	0.7	0.68	22.8	0.001*
Swissball	3.13	2.16	99.35	0.778
DB	3.62	2.40	118.89	0.013*
Ab-Roller	2.41	2.23	81.76	0.869
HKWR	3.16	2.23	102.28	0.626
HKCR	4.04	2.36	131.92	0.008*
* Indicates a significant difference from the TAC at the *P* = 0.05 level				

FIGURE 2

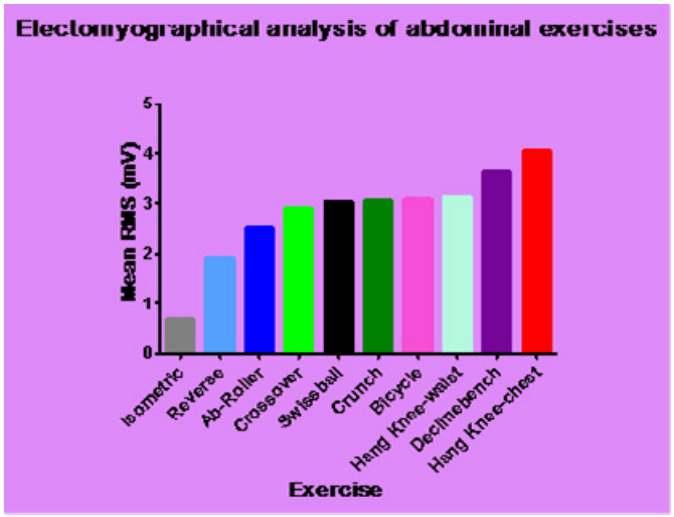
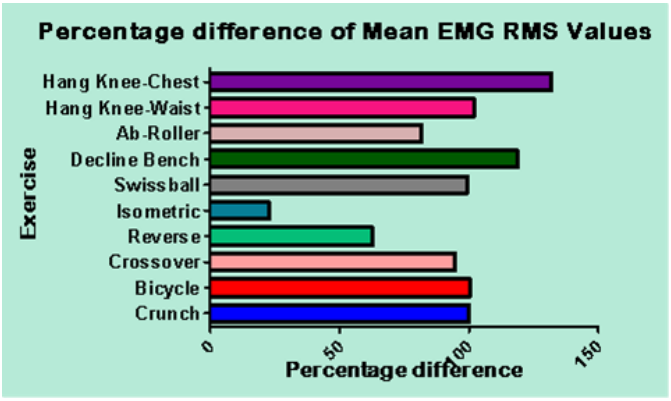


FIGURE 3



Lower, middle and upper Rectus Abdominis activation:

The sum of the MAP obtained from Channels 1 and 2 reveal the overall activation level for the lower RA muscle. While recruitment of the lower RA was highest during the HKCR and DB exercises and lowest in the IAC and reverse crunch (Figure 4), repeated measures one-way ANOVA with a pair-wise comparison performed with a Bonferroni correction revealed that none of these were found to be significantly different from the TAC (P = <0.05). The only significant difference in RMS values for the lower RA was found between the TAC and the IAE (P = 0.001). The combined action potential detected by Channels 3 and 4 comprised the MAP produced by the middle RA. As with the lower RA, the greatest muscle fibre recruitment was seen with the HKCR and DB exercises, with minimal activation observed with the IAC and reverse crunch (Figure 5). However, the only significant difference in RMS values for the middle RA was found between the TAC and the IAE (P = 0.005). The summation of the action potentials obtained from Channels 5 and 6 comprise the MAP produced by the upper part of the RA musculature. The greatest muscle fibre recruitment was again observed from the HKCR and DB exercises, with minimal activation observed with the IAC and reverse crunch (Figure 6). The only significant difference was again found between the TAC and the IAE (P = 0.006). The general pattern that emerged from the analysis was that the lower RA was less active across all the AE than the middle and upper components of the RA. However, there was disparity between which exercises elicited greater mean RMS in the middle or the upper RA musculature (Figure 7).

FIGURE 4

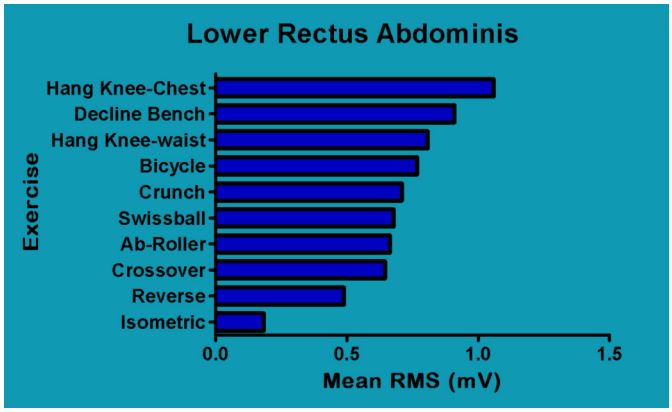


FIGURE 5

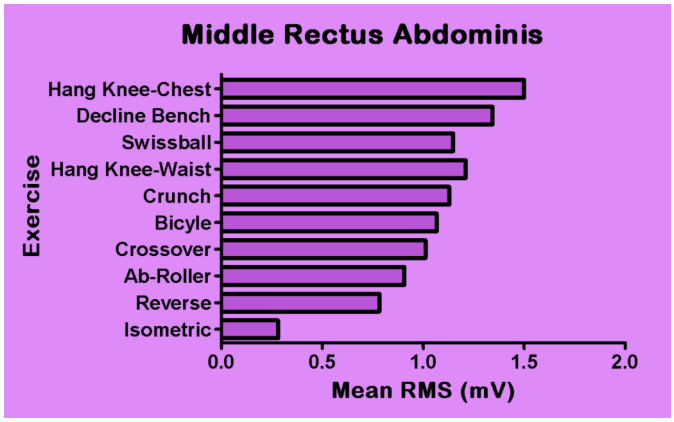


FIGURE 6

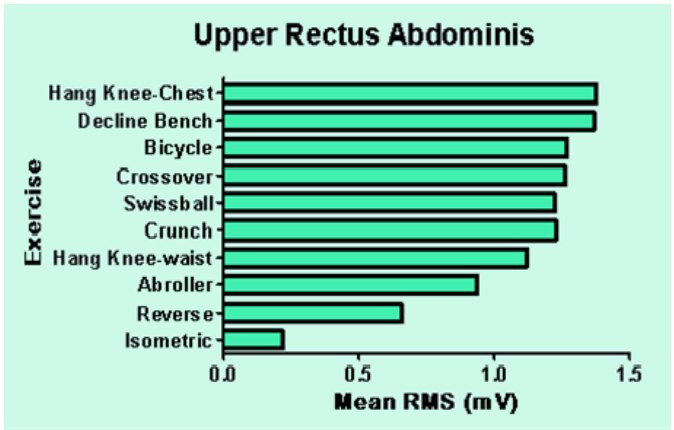
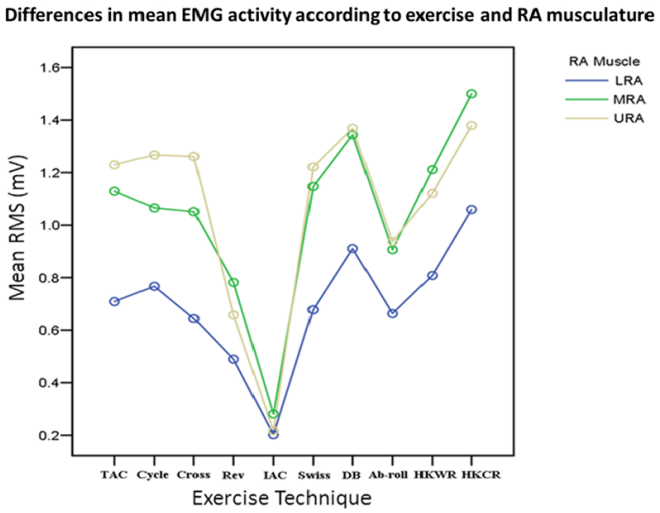


FIGURE 7



Discussion

The current study was designed to compare the electromyographic activity of a range of AE against the criterion measure of the TAC; considered as the standard for such exercises (Bird *et al*., 2006), due to it activating multiple lumbar flexors, which in turn contribute to the stability of the core musculature (Colston *et al*., 2005). Analyses of myoelectric signals in the majority of previous studies have not concentrated on the activity of all of the lower, middle and upper RA muscle. The current study included an additional pair of electrodes to include all three parts of the RA musculature to give a holistic interpretation about the occurrence of electromyographical changes in the muscle. Additional control measures employed included standardisation of knee and ankle angles and control of the speed of the exercise with a metronome; as the speed of performance of the exercise may cause variation in the RMS values obtained (Gutin and Lipetz, 1971).

Analysing the means of the RMS signals revealed significant variation in the MAP of the AE investigated. In the current study, 7 out of the 10 AE maintained a supine lying position (crunch, bicycle, crossover, reverse, IAE, Swissball, Ab-roller), while the decline bench necessitated a semi-reclined position, and the HKWR and HKCR required an upright posture. The results of the study revealed that the exercises which required an upright posture (HKCR and HKWR) and semi-reclined posture (DB) elicited the highest mean RMS values. This is supported by research conducted by Strohl *et al*. (1981) and Hoit *et al*. (1988), who reported that activity of the abdominal musculature depends on the starting position adapted; myoelectric activity detected by surface electrodes

was found to be minimal in the supine position and maximum with the upright standing posture (Strohl *et al*., 1981). Though the facilitation of the upper limb support and the execution of the hanging knee-up with strap exercise in Escamilla *et al*. (2006) study are slightly different than that employed with the HKCR in the current study there are obvious similarities. It is therefore not entirely surprising that the results obtained regarding the HKCR are similar to those of Escamilla *et al*. (2006), who found evidence of increased activation of the abdominal musculature with hanging knee-up exercises using straps. While no previous studies have analysed the efficiency of a DB, Escamilla *et al*., (2006) reported increased upper RA activity during an inclined reverse crunch; the possible rationale for the increased production of MAP in these exercises could be attributed to the participant having to overcome gravity and body weight.

Previous research, by Vera-Garcia *et al*. (2000), implied that increased abdominal muscle activation was produced while performing abdominal crunches over an unstable surface, such as a Swiss ball, as it poses a high demand on motor control. Results of the current study did not show any significant increase in RA activity during exercising on the Swiss ball compared to a TAC ($p > 0.05$). Vera-Garcia *et al*. (2000) acknowledged that external oblique muscle was increased in comparison to other muscles. Their findings, if attributed to the current study, may provide a possible rationale for not obtaining a statistical significant result with the Swiss ball when compared with a crunch; as the electrode placement was restricted to the RA musculature. Another study by Hildenbrand and Noble (2004) expounded that Swiss ball had an increased recruitment of the hip flexors, again supporting the lack of myoelectric activity of the RA in the current study. The only commercial device tested in the current study was the Ab-Roller, which enables performance of a TAC with additional head and arm support. The results obtained in the current study concur with those of Demont *et al*. (1999) and Beim *et al*. (1997), who also reported no statistically significant differences between the TAC and Ab-roller exercises. This is to be expected as the equipment focuses on producing less strain to the neck and back muscles, rather than actually increasing the intensity of the exercise itself (Sternlicht *et al*., 2005). While the IAE consistently elicited the lowest mean RMS values, it does have the advantage that it is device-free and it can be performed at any time (for example when sitting in front of a computer). Isometric exercise can also be practised by athletes who are recovering from a back injury as the isometric exercise maintains a neutral pelvis and spine and poses minimum compression load over the spine (Escamilla *et al*., 2005).

Previous research by Sarti *et al*. (1996) demonstrated that different exercises are required for activation of the upper and lower rectus abdominis. Sarti *et al*. (1996) reported TAC activated both the upper and lower RA musculature and that the reverse crunch activated more of the lower rectus RA. The current study demonstrated that the upper, middle and lower parts of the rectus abdominis have different levels of activation during a variety of AE. The HKCR and the DB exercises consistently elicited higher RMS values across the lower, middle and upper RA. However, the IAC was the only AE that was significantly different to the TAC in respect to RA activation. Comparison of the myoelectric activity of the left and right lower, middle, and upper rectus abdominis showed some minimal, but not significant, differences; potentially due to the postural or functional asymmetry originally described by Floyd and Silver (1950).

Conclusion

Various abdominal exercises are performed in fitness and rehabilitation centres for strengthening the abdominals. However, the current study's findings suggest that the hanging knee to chest raise (HKCR) and decline bench (DB) exercises exhibited significant increases in mean electromyographic activity when compared with a traditional abdominal crunch (TAC). Isometric exercise (IAC) was shown to have significantly lower electromyographic activity when compared with a TAC. Correspondingly, significant differences were found between the myoelectric activity of the lower, middle and upper parts of the rectus abdominis muscle during abdominal exercises, which has received limited coverage in the literature previously. For those wanting to maximise the muscle activation of the abdominal musculature it appears that the HKCR and DB are the most effective exercise techniques. However, future research should be conducted to establish the vertebral compression forces during the execution of these abdominal exercises.

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Table and Figures

FIGURES 1a-j : AE used in current study

TABLE 1 : Mean RMS values, percentage RMS values and statistical significance

FIGURE 2 : Mean RMS values and order of AE.

FIGURE 3 : Percentage RMS compared against TAC.

FIGURE 4 : Mean RMS values for the lower RA.

FIGURE 5 : Mean RMS values for the middle RA.

FIGURE 6 : Mean RMS values for the upper RA.

FIGURE 7 : Differences in mean EMG activity according to exercise and RA musculature .

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Reviews and invited commentary

Research Concepts and Methods (part 5) Quantitative inputs and qualitative outputs

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KEY WORDS

Weight loss.
Percentage.
Sweating rate.
Activity time.
Competition.

At the conclusion of the previous article in this series (Research Concepts and Methods part 4, Journal of Sports Therapy Vol. 5 Issue. 1), I referred to the potential for researchers to generate qualitative outputs from quantitative data inputs. This is one of four configurations possible once the notion of a full complimentarity of methods is adopted, rather than the dichotomous choice between objective and subjective analyses. The other three combinations are quantitative data inputs with quantitative analytical outputs; qualitative inputs with quantitative outputs; and qualitative inputs with qualitative outputs, the latter being broadly accepted as interpretivist analysis.

The quantitative data inputs and qualitative outputs under consideration here are based on ordinal raw data of the type often generated when using Likert scale responses to some form of ranking question. Ordinal data are one of four data types; the others being nominal, interval, and ratio data, but is the only type that is capable of being employed for quantitative and qualitative analysis because both discrete and continuous numbers can be taken from Likert scales, and so allows the researcher the luxury of potentially employing quantitative and qualitative analysis from the same dataset(s).

Effectively, this means that we are attempting to use a specialised method of association for categories of ordinal data, taking into account ordinal variables that range from high to low and *vice versa.* A popular ordinal measure of association is *Gamma*, and the most straightforward way of explaining how it works is by using a simple example.

Suppose the sports therapy researcher wishes to explore the satisfaction levels of a particular intervention he has been prescribing to a range of different levels of sportsmen and sportswomen all engaged in the same discipline. Let us also assume that there are three categories of participants and three levels of response to the survey carried out. The levels of sporting involvement could be 'professional', 'semi-professional', and 'amateur'; with the survey responses set out as 'very satisfied', 'moderately satisfied', and 'dissatisfied'. A contingency table for this configuration may look something like the one below for 104 sports therapy clients.

Table 1:

Level of sporting participation	Levels of satisfaction of treatment (percentages in parentheses)			
	Dissatisfied	Moderately satisfied	Very satisfied	Totals
Amateur	6 (27.3)	13 (59.1)	3 (13.6)	22 (100.0)
Semi-professional	9 (15.5)	37 (63.8)	12 (20.7)	58 (100.0)
Professional	3 (12.5)	13 (54.2)	8 (33.3)	24 (100.0)
Totals	18	63	23	104

Source: adapted from Agresti, A. and Finlay, B. (1997) *Statistical Methods for the Social Sciences*, 3rd edition New Jersey (US): Prentice-Hall

Ordinal data exhibit two primary types of association – *positive* and *negative*. Positive associations between the two variables exist when subjects on the high end of the scale X also tend to be on the high end of the scale Y. For example, a positive association may exist between in the above example between satisfaction and participation levels, with the professionals with high levels of activity tending to be more satisfied with their treatment (for whatever reason), and amateurs with lower levels of activity being less satisfied. Negative association occurs when subjects classified high on X tend to be classified low on Y, and where those rated low on X tend to be high on Y.

Most ordinal measures of association are based on information regarding all the pairs of associations. And, it is here that the main components of the gamma model come into play: concordant pairs and discordant pairs. A pair of observations is *concordant* if the subject is higher on one variable and also higher on the other variable; whereas a pair of observations is *discordant* if the subject is higher on one variable and lower on the other.

In the example above, 'Dissatisfied' would be seen as the low end of the Y scale, with 'Very satisfied' at the high end of Y. Similarly, 'Professionals' are on the high end of X, with 'Amateurs' at the low end of X. Now consider a pair of subjects, one of whom is classified as (amateur and dissatisfied), and the other who may be (semi-professional and moderately satis-

fied). The first subject then is one of the 6 shown in the above table (row three, column two), and the second subject is one of the 37 (row four, column three). This pair of subjects is concordant because the second subject is higher than the first in both in both level of sporting participation and also level of satisfaction. If we now pair each of the subjects from the above 6, with each of the other 37 subjects above, we would have 6 x 37 = 222 concordant pairs from these two cells in the above table. Following the same logic for all the other concordant cells in the table, we generate the following totals for concordant pairs from the original dataset with C denoting the total concordant value, which is 1165 (C=1165).

Table 2 :

	D	MS	VS	D	MS	VS	D	MS	VS	D	MS	VS
A	6				13							
S-P		37	12			12	9				37	
P		13	8			8		13	8			8
	C = 6 (37+12+13+8)			+13 (12+8)			+ 9 (13+8)			+37 (8) = 1165 in total		

A = Amateur
S-P = Semi-professional
P = Professional
D = Dissatisfied
MS = Moderately satisfied
VS = Very satisfied

By contrast, for discordant pairs we can take the example of the 13 subjects in the cell reference (amateur and moderately satisfied) and match them with the 9 subjects in the cell reference (semi-professional and dissatisfied). Here, we have discordant pairs because the 13 amateurs are moderately satisfied, but the 9 semi-professionals are dissatisfied. This means we have 9 x 13 = 117 discordant values from this pair, following the discordant logic across the whole table, we now have D denoting discordant pairs of 645 (D=645).

Table 3:

	D	MS	VS	D	MS	VS	D	MS	VS	D	MS	VS
A			3					13				
S-P	9	37				12	9				37	
P	3	13		3	13		3			3		
	D = 3 (9+37+3+13)			+12 (3+13)			+13 (9+3)			+37 (3) = 645 in total		

A = Amateur
S-P = Semi-professional
P = Professional
D = Dissatisfied
MS = Moderately satisfied
VS = Very satisfied

In our example, there are obviously more concordant pairs showing positive association than discordant pairs demonstrating negative association. The Gamma formula can now be used to generate a numerical value in order to reflect the level of qualitative association in the dataset contained in the example. Gamma is denoted by **ŷ**, so the formula is -

$$\hat{y} = \frac{C - D}{C + D}$$

Where:

- The value of Gamma falls between -1 and +1
- The mathematical sign of Gamma indicates whether the association is positive or negative
- The magnitude of the Gamma value represents the strength of the association.

The larger the absolute value of Gamma, the stronger the association. The value +1 represents the strongest positive association, and occurs where there are no discordant pairings (D= 0). Gamma equals -1 when C = 0, denoting there are no concordant pairings. So, for our example, we plug in the C and D values from the example above to achieve:

$$\hat{y} = \frac{1165-645}{1165-645} = 0.287$$

Our analysis would then be that there is a moderately positive relationship between levels of participation in the particular sport and the satisfaction regarding the treatment offered in this case. However, the Gamma value is closer to 0 than to 1, so the association is not particularly strong, and as in all statistical testing, should only form the basis of the beginning of an enquiry into cause and effect, and also the usefulness of the data generated and the method selected.

Being able to manipulate what are essentially qualitative data outputs using Gamma in this way obviously has advantages, but the additional facility of attaching a numerical value to the association also means that maximum statistical utility can be achieved from the raw data generated in the type of survey illustrated above. Other measures of association similar to Gamma are *Kendall's tau-b,* and *tau C; Spearman's rho-b* and *rho-c;* and *Somers' d.* All very similar in terms of output analysis opportunities, but with the Somers model also being able to distinguish between the dependent variable and the response variable as in regression modelling.

In the next instalment of this series, I will be looking at qualitative raw data inputs with qualitative output analysis, using levels of codification and categorisation, and again reinforcing the benefits of mixed complimentarity of research methods.

Book reviews

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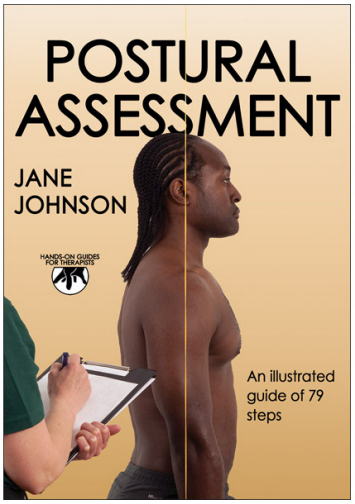


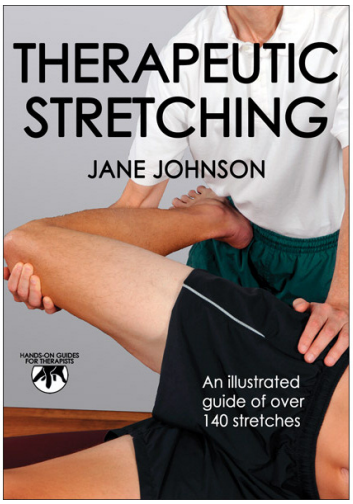
Title:
Postural Assessment
Author:
Jane Johnson
Year:
2012
Publisher:
Human Kinetics
ISBN-13:
978-1-4504-0096-1

Postural assessment can, at times become a time consuming, complicated process, however this latest edition in Jane Johnson's *Hands-on Guides for Therapists* series, creates a condensed and simplified reference text that is ideal for a variety of practitioners.

Postural Assessment provides a detailed discussion of ideal posture and the common factors affecting posture as well as how to provide the correct environment for postural assessment, necessary equipment and the importance of documenting assessment findings. It also provides a comprehensive step-by-step guide to completing postural assessments with the patient in a standing and seated position.

The upper and lower body are both considered in isolation and this allows the practitioner to gain an overall view of a patient's entire body posture whilst being able to gain further information on regional problems such as pelvic tilt and scapula positioning and movement.

Information in the text is presented in a concise, logical manner and supported with a surplus of colourful labelled photographs and detailed illustrations offering visual prompts for developing an accurate assessment. In addition, the appendix contains a useful resource for readers containing postural assessment charts which match the order of steps throughout the book.



Title:
Therapeutic Stretching
Author:
Jane Johnson
Year:
2012
Publisher:
Human Kinetics
ISBN-13:
978-1-4504-1275-9

This next text from Jane Johnson provides a comprehensive resource of stretches for musculoskeletal conditions and injuries of the upper and lower body.
The book is organised into three parts. In part one, the therapist learns how to get started and prepare for therapeutic stretching, the rationale for stretching and the 10 steps to follow when preparing a stretching programme. In part two, therapists are introduced to passive, active and advanced forms of stretching including muscle energy technique (MET) and soft tissue release (STR).

Part three focuses on specific stretching for each region of the body and the concept of rehabilitative stretching. This section also includes additional useful stretches for specific pathologies and these are given in table format to condense the information and guide the practitioner in their recommendations.

Therapeutic Stretching will help therapists to develop their confidence to apply specific passive stretches; it also presents a range of useable examples of how to best position patients, and which handholds to use, when applying stretches to patients with musculoskeletal problems.

Overview

There are minimal references to support either T*herapeutic Stretching* or *Postural Assessment,* a fact which will not endear itself to many practitioners or lecturers keen to utilise evidence-based methodologies; however the simplified terminology, presence of 'quick questions' and 'top tips' work to effectively summarise key learning objectives and make both books reader friendly. Both the quality and quantity of photographs throughout Jane Johnson's *Hands-on Guides for Therapists* are a strong feature and make these texts unique and extremely accessible. Johnson is a chartered physiotherapist with a history in teaching massage therapy, and with this series of books she is able to call upon her years of experience in the teaching environment.

Compared to other established texts such as Ylinen (2007) or Kendall *et al*. (2010), Johnson's guides fall significantly short in terms of supportive evidence, anatomical detail, pathological discussion, and perhaps most importantly, clinical reasoning strategies. However, these simple and easy to read handbooks are obviously targeted at an audience who, with these books in particular, will not be looking for comprehensive and contemporaneous academic underpinning.

Both reference guides would be an ideal and affordable purchase for students new to these topic areas – perhaps those undertaking sports massage or undergraduate sports therapy courses; however they also contain adequate technical knowledge and practical examples of technique delivery to serve as a resource for any practitioner wanting to revisit and review their postural analysis skills or therapeutic stretching techniques.

Book Review Summary Box	
Title	**Postural Assessment**
Author	Jane Johnson
Target audience	Sports and remedial massage therapy students; sports therapy students; physiotherapy students; practitioners.
Number of pages	157
B&W/Tri-colour/Full colour	Full colour
Evidence-based/fully referenced	Limited supportive evidence and references
User-friendliness/innovation	Easy to use. Clear and descriptive photographs and illustrations. Simplification of topic.
Multimedia functions	Kindle version available
Price	£16.99

Book Review Summary Box	
Title	**Therapeutic Stretching**
Author	Jane Johnson
Target audience	Sports and remedial massage therapy students; sports therapy students; physiotherapy students; practitioners.
Number of pages	167
B&W/Tri-colour/Full colour	Full colour
Evidence-based/fully referenced	Limited supportive evidence and references
User-friendliness/innovations	Easy to use. Clear and descriptive photographs and illustrations. Simplification of topic.
Multimedia functions	Kindle version available
Price	£18.99

References

Kendall, F.P., Kendall McCreary, E., Provance, P.G., Rodgers, M.M. and Romani, W.A. (2010) *Muscle Testing and Function: Posture and Pain 5th edition revised*. Philadelphia: Lippincott, Williams and Wilkins.

Ylinen, J.J. (2007) *Stretching Therapy for Sports and Manual Therapies*. Oxford: Churchill Livingstone.