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Rehabilitation of lumbar multifidus dysfunction in low back pain: strengthening versus a motor re-education model

Regarding the article “Effects of three different training modalities on the cross sectional area of the lumbar multifidus in patients with chronic low back pain!” I would like to extend my appreciation to Dr Danneels and his colleagues for their interest in contributing to the literature on this important and clinically relevant topic. Unfortunately, there are important design and methodological flaws inherent in this study which call into question its results and primary conclusions. I respectfully submit this review of the study, its findings, and the authors’ clinical recommendations.

The objective of the investigation of Danneels et al was to determine the potential for different exercise models to reverse the pathology related atrophy of the lumbar multifidus muscle in people with low back pain. As described by various researchers, the lumbar multifidus experiences a number of morphological and neurophysiological changes following low back injury. One of these changes is a segmental atrophy which develops at the level of pathology, on the symptomatic side and as quickly as 24 hours after the injury. Further, these changes have been shown to persist beyond the resolution of symptoms, and for at least five years after surgical intervention for intervertebral disc herniation. There is evidence that such findings are indicative of a neurologically mediated process rather than a simple disuse or weakness phenomenon. In their study, Danneels and colleagues compared the motor re-education model, originally developed by Richardson et al and as studied by O’Sullivan and colleagues, against two variations of a traditional strengthening model. The first of these strength training variations utilised typical concentric and eccentric lumbar extensor loading motions. The other added a static or isometric component which was to be maintained between the concentric and eccentric phases of the exercise.

The authors concluded that, in order to correct the atrophy observed in the lumbar multifidus, patients should perform strengthening exercises targeting the lumbar extensors, ideally incorporating an isometric “pause” into these exercises. Danneels et al reported that this was the only exercise model tested that developed sufficient hypertrophy to correct the multifidus atrophy seen in their experimental population. These findings conflict with those of Hides and colleagues, who have published data showing correction of the pathology-induced lumbar multifidus atrophy using a considerably more specific and subtle activation of the multifidus muscle.

Unfortunately, the method by which the authors measured the cross sectional area (CSA) of the multifidus muscle introduced a large degree of methodological error, calling into question the study’s results and therefore its clinical recommendations. Using computed tomography scanning, Danneels et al took measurements from three arbitrary levels of the lumbar spine (the L3 superior end plate, the L4 superior end plate, and the L4 inferior end plate) recording the CSA of the multifidus muscle at each of these levels bilaterally. They then summed the right and left multifidus CSA at each of these segments resulting in a single multifidus score for each level.

In preselecting the levels from which CSA measurements would be taken, it is possible, indeed likely, that the pathological level would have been missed entirely in at least some of the subjects. This is important because previous studies have shown that the multifidus muscle experiences its greatest loss of CSA at the primary level of pathology. Also problematic was the decision to sum the CSA scores at each of the preselected levels. A number of studies have shown that the lumbar multifidus, ipsilateral to the pathological side, experiences a cascade of neuro-morphological changes, including atrophy, in the presence of both acute and chronic pathology, whereas the multifidus contralateral to the pathological side experiences no such changes.

Taken together, the preselection of measurement levels and the summation of the bilateral multifidus CSA would have had the effect of attenuating any side to side differences in multifidus CSA even if a subject’s level of pathology happened to coincide with one of the levels from which measurements were obtained. Through either of these mechanisms, this measurement scheme would have introduced a substantial mass of healthy, non-motor dysfunctional muscle into each of the multifidus CSA measurements. The net effect of the measurement approach employed by Danneels et al, although probably intended to more discretely reflect the pathological side multifidus, was to introduce a bias to the outcome. The experimental intention toward an exercise model with the ability to cause hypertrophy in healthy muscle—that is, a strengthening exercise—is likely to be biased and ineffective for correcting the pathological atrophy of the multifidus instead caused hypertrophy of the non-pathological, non-atrophied multifidus muscle segments included in the three measurement scores. Ultimately, the study’s recommendations are unsupportable given this flaw in methodology.

The low load multifidus activation exercise, developed by Richardson et al and used by O’Sullivan and colleagues, is to be performed as a co-contraction with the transversus abdominis muscle, and is intended to correct a neurologically mediated loss of normal multifidus muscle volume, not unlike that seen in the vastus medialis following trauma or surgery involving the knee joint. In studies in which the CSA of a pathological multifidus muscle has been compared with its contra-lateral and “healthy” segmental partner, this form of motor re-education exercise has been shown to normalise the CSA of the pathological multifidus in as little as four weeks.

It is critical that both researchers and clinicians appreciate that a significant body of research now shows that the lumbar multifidus muscle, ipsilateral to the pathological side, experiences a cascade of neuro-morphological changes, including atrophy, in the presence of both acute and chronic pathology, whereas the multifidus contralateral to the pathological side experiences no such changes. This is important because previous studies have shown that the lumbar multifidus muscle experiences its greatest loss of CSA at the primary level of pathology.

References


R S Jemmott

598 Tower Rd, Halifax, Nova Scotia B3H 2X7, Canada; rmj@free.net@compuserve.com
The event side doctor: the role of the orthopaedic surgeon

Orthopaedic surgeons have long had a close association with sport. International sports players have similarly gone on to careers in orthopaedic surgery, examples being Jonathan Webb and JPR Williams. Without finding appropriate medical personnel to care for the needs of spectators and athletes at major sporting events is a challenge. Event organisers have required the skills of volunteer orthopaedic surgeons. I volunteered as a competitors’ doctor for the Olympic and Paralympic Games.

Increased endothelin-1 levels in athletes

Endothelin-1 (ET-1), a potent vasoconstrictor peptide, may contribute to the exercise induced redistribution of blood flow in muscles. On the other hand, the latter parameter in athletes may be expanded secondarily to muscle volume as a consequence of increased ET-1 production. In this study, we found a difference in basal serum ET-1 levels between trained male athletes and normal matched control males.

We studied 13 male professional football players (mean (SEM) age 26.0 (1.02) years, body mass index (BMI) 26.1 (1.3) kg/m² and an equal number of sedentary or moderately physically active men (age 26 (1.3) years; body mass index 24.4 (1.8) kg/m²). All subjects gave written consent and had a negative family history of diabetes and hypertension. Blood samples were collected at 8 am after an overnight fast; all subjects remained at rest for 20 minutes in a supine position, before collection of the blood specimen. ET-1 concentration in serum was measured by radioimmunoassay (Peninsula Lab Inc, Belmont, California, USA). Data were analysed by Student’s t test for independent samples.

The concentration of ET-1 in the serum was significantly higher in the athletes than in the control subjects (22.16 (0.87) v 7.74 (0.29) pg/ml, p<0.001; values are mean (SEM)). Serum creatine kinase was also found to be significantly higher in athletes than controls (331.84 (43.3) v 110.5 (17.3) U/l, p<0.001; values are mean (SEM)).

The increased creatine kinase levels may be attributed to the increased muscle mass in athletes, and the increased serum ET-1 levels can be explained as being a consequence of a widening of the vascular bed resulting from the increased muscle weight and size.

I N Legakis
Er Dyman Hospital, Athens, Greece; nlegakis@med.uoa.gr

T Mantzouridis
Department of Biology, University of Athens

T Mountokalakis
Sotiria Hospital, Athens

References

BOOK REVIEW

Reckoning with risk: learning to live with uncertainty


Gerd Gigerenzer has a passion for improving statistical numerical which is rarely encountered in the normally dry statistics texts. He has researched and published extensively on how doctors and other professionals interpret risks and convey that information to their patients. He has also shown how clinicians’ understanding of risk can be improved dramatically by changing how they process information about risk.

The early chapters of the book look at Gigerenzer’s research into clinicians’ understanding of statistics and Bayes’s rule, and shows just how poor senior clinicians’ understanding of risk is. He shows that similar problems exist in other professions as well. He indicates how confusing it can be for our patients when we try to convey our understanding of risks to them.

This book has been written for the general public, but if you find risk statistics difficult to interpret and convey, then this book is definitely for you. It is written in a very instructive and well thought out style, and covers a diverse range of problems encountered in everyday as well as clinical life. I think it should be on the curriculum for all postgraduate medical courses.

Analysis
Presentation 14/20
Comprehensiveness 12/20
Readability 17/20
Relevance 18/20
Evidence basis 17/20
Total 78/100


D Humphries
Sports Medicine, St Helen’s Hospital, 186 Macquarie Street, Hobart, Tasmania 7000, Australia; drdavie@ozemail.com.au

Skills Course in Musculoskeletal Ultrasound

6–8 January 2003, Oxford, UK

Further details: Alison Davies, Department of Radiology, Nuffield Orthopaedic Centre, Headington, Oxford, OX3 7LD, UK; tel: +44 (0)1865 227765; fax: +44(0)1865 227347; email: alison.davies@nrc.anglox.nhs.uk

BASICS Refresher course

28–29 November 2002, Madingly Hall, Cambridge, UK

This two day course is directed at previous participants on the pre-hospital emergency care and immediate care courses. The aim is to maintain and update skills, incorporating the latest developments in pre-hospital care.

www.bjsportmed.com
3rd Québec International Symposium on Cardiopulmonary Rehabilitation Evidence Based Interventions: Science to the Art of Cardiopulmonary Rehabilitation
11–13 May 2003, Québec City Convention Center, Québec, Canada
Call for abstracts deadline is 1 November 2002. The abstract submission form and complete programme can be printed from the web site.
Further details: email: Jean.Jobin@med.ulaval.ca
Web site: www.ulaval.ca/symp-rehab

The 6th STMS World Congress on Medicine and Science in Tennis in conjunction with the LTA 2004 Sports Science, Sports Medicine and Performance Coaching Conference
Keynote speakers include Professor Per Renstrom (SWE), Professor Peter Jokl (USA), Professor Savio Woo (USA), Dr Carol Otis (USA), Dr Mark Saffran (USA), Dr Ben Kibler (USA), Prof Bruce Elliott (AUS), and Professor Ron Maughan (UK).
Further details: Dr Michael Turner, The Lawn Tennis Association, The Queen’s Club, London W14 9EG, UK; email: michael.turner@lta.org.uk

International XVII Pujo Symposium
25–28 June 2003, Kuopio, Finland
This symposium “Physical activity and Health—Gender Differences Across the Lifespan.”
Further details: Ms Auli Korhonen, Project Secretary, Pujo Research Institute of Exercise Medicine, Pujo Symposium Secretariat, Haapaniementie 16, 70100 Kuopio, Finland; tel: +358 17 288 4422; fax: +358 17 288 4488; email: pujo.symposium@uku.fi

Further details:
- Basics Education Ltd; tel: +44 (0) 870 165 4999; fax: +44 (0) 870 165 4949; email: educ@basics.org.uk
- Victoria Sports Medicine in Sport, Homerton University Hospital, London E9 6SR, UK; email: ahysym@btinternet.com
- SMX 2003
- Victoria, Australia
- Sports Medicine Seminar at the Hong Kong Sevens
- Australia
- 2003 SMA Queensland State Conference
- Australia
- 3rd Quebec International Symposium on Cardiopulmonary Rehabilitation Evidence Based Interventions: Science to the Art of Cardiopulmonary Rehabilitation
- London, UK
- The 6th STMS World Congress on Medicine and Science in Tennis in conjunction with the LTA 2004 Sports Science, Sports Medicine and Performance Coaching Conference
- London, UK
- International XVII Pujo Symposium
- Finland

NOTES AND NEWS

Winners of the annual BASEM Prizes
Dr Eileen Mackie (Clopidogrel inhibits platelet activation and exercise induced ischaemia in stable coronary artery disease) and Mrs Eleanor Curry (Role of exercise in multiple sclerosis) (joint winners). The poster prize was won by Dr Stuart Reid (Injury patterns and injury prevention strategies in the winter sports population attending the English medical centre in Val d’Isere).

Diploma in Sport and Exercise Medicine for Great Britain and Ireland
Details for the above exam can be found on the Royal College of Surgeons of Edinburgh Web site at www.rcsed.ac.uk. Alternatively applicants can write to: The Royal College of Surgeons of Edinburgh, Eligibilities Section, Careers Information Services, 3 Hill Place, Edinburgh; tel: +44 (0) 131 668 9222 or Mrs Yvonne Gilbert, Intercollegiate Academic Board for Sport and Exercise Medicine, Royal College of Surgeons of Edinburgh, Nicolson Street, Edinburgh EH8 9DW; tel: +44 (0) 131 527 3409; email: ygillibert@rcsed.ac.uk

Intercollegiate Academic Board of Sport and Exercise Medicine Diploma Exam
The following were successful diplomates in the Intercollegiate Academic Board of Sport and Exercise Medicine Diploma Exam: 7 July 2000
- Dr Prabodh C Agarwal
- Dr Robert Bleakney
- Dr Trevor W Fleet
8 November 2000
- Dr James P Robson
- Dr Samantha L Fee
- Dr David C Watkins
- Dr RS Prabhu
For further information contact: Donald AD Macleod, Chairman, Intercollegiate Academic Board of Sport and Exercise Medicine.

Interested in Sports Medicine? Gain a higher degree from Australia’s leading university
The Centre for Sports Medicine Research and Education is a multidisciplinary Centre located in the Faculty of Medicine, Dentistry and Health Sciences at the University of Melbourne, Australia. It combines world-class researchers and clinicians working in the area of sports medicine.

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The Centre offers Doctor of Philosophy (PhD), Master of Sports Medicine, Master of Physiotherapy, Master of Science, and Doctor of Medicine degrees. These are available to graduates of health and medical science courses such as physical therapy, medicine, and human movement.

Educational programme
The Centre offers a one month full time postgraduate Certificate in Sports Physiotherapy: spine, pelvis, and lower limb. Instructors are leading clinical experts and researchers in the multidisciplinary approach to sports medicine. The Centre will run from Nov 4–29 in 2002.
Please contact: Professor Peter Brukner: p.brukner@unimelb.edu.au (Research Degrees), Professor Kim Bennell: k.bennell@unimelb.edu.au (Research Degrees), Mr Henry Wajsuelner: h.wajsuelner@unimelb.edu.au (Certificate Courses), www.physio.unimelb.edu.au/cmsre
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Web site: www.med.unsw.edu.au/sportsmed

NCPAD NEWS
A monthly publication of the National Center on Physical Activity and Disability. NCPAD is the leading source for information about organisations, programmes, and facilities nationwide providing accessible physical activity and recreation. NCPAD also has a large and growing online library of fact sheets, monographs, and contact information on physical activity and recreation for people with disabilities.

Sign up for this free monthly electronic newsletter by sending an email to: Listserv@listserv.uic.edu, with this message in the body of the email: SUBSCRIBE NCPAD-NEWS yourfirstname yourlastname. If you have any difficulty, you can also sign up for the newsletter by going to www.ncpad.org/signup

Study Sports Physiotherapy in Australia’s sporting capital at The University of Melbourne
Qualified physiotherapists may now apply for the Master of Physiotherapy by Coursework (Sports Physiotherapy), the Postgraduate Certificate in Physiotherapy (Sports Physiotherapy of the Spine, Pelvis and Lower Limb) or the Postgraduate Certificate in Physiotherapy (Sports Physiotherapy of the Spine, Shoulder and Upper Limb).
The School of Physiotherapy at the University of Melbourne now has approval for these courses and applications are open to international students for full time study.

• Applications for the Master of Physiotherapy by Coursework (Sports Physiotherapy) close 1 October 2002.
• Applications for the Postgraduate Certificate in Physiotherapy (Sports Physiotherapy of the Spine, Pelvis and Lower Limb) close 1 November 2002.
• Applications for the Postgraduate Certificate in Physiotherapy (Sports Physiotherapy of the Spine, Shoulder and Upper Limb) close 1 April 2003.

Please check the website for updates and information about the courses: www.physioth.unimelb.edu.au/postgrad.html