REFERENCES

Akuthota V, Nadler SF. **Core strengthening**. Arch Phys Med Rehabil. 2004;85:S86-92.

Allison GT, Godfrey P, Robinson G. **EMG signal amplitude assessment during abdominal bracing and hollowing**. J Electromyogr Kinesiol. 1998;8:51-7.

Astrand P-O, Rodahl K, Dahl HA, Stromme SB. T**extbook of work physiology: physiology bases of exercise. 4th ed.** Champaign: Human Kinetics; 2003.

Baechle TR, Earle RW. **Essentials of strength training and conditioning**. 2nd ed. Champaign: Human Kinetics; 2000.

Baechle TR, Earle RW. **Essentials of strength training and conditioning 2nd ed**. Champaign: Human Kinetics; 2000.

Barile A, Limbucci N, Splendiani A, Gallucci M, Masciocchi C. **Spinal injury in sport**. Eur J Radiol. 2007;62:68-78.

Barker KL, Shamley DR, Jackson D. **Changes in the cross-sectional area of multifidus and psoas in patients with unilateral back pain: the relationship to pain and disability**. Spine. 2004;29:E515-9.

Barker PJ, Guggenheimer KT, Grkovic I, Briggs CA, Jones DC, Thomas CDL, et al. **Effects of tensioning the lumbar fasciae on segmental stiffness during flexion and extension:Young Investigator Award winner**. Spine. 2006;31:397-405.

Barr KP, Griggs M, Cadby T. **Lumbar stabilization: Core concepts and current literature, part 1**. Am J Phys Med Rehabil. 2005;84:473-80.

Bergmark A. **Stability of the lumbar spine**. A study in mechanical engineering. Acta Orthop Scand 1989;60:1-54.

Bland JM, Altman DG. **Measuring agreement in method comparison studies**. Stat Methods Med Res. 1999;8:135-60.

Brumagne S, Cordo P, Lysens R, Verschueren S, Swinnen S. **The role of paraspinal muscle spindles in lumbosacral position sense in individuals with and without low back pain**. Spine. 2000;25:989-94.

Bunce SM, Hough AD, Moore AP. **Measurement of abdominal muscle thickness using M-mode ultrasound imaging during functional activities.** Man Ther. 2004;9:41-4.

Bunce SM, Moore AP, Hough AD. **M-mode ultrasound: a reliable measure of transversus abdominis thickness?.** Clin Biomech (Bristol, Avon). 2002;17:315-7.

Calhoon G, Fry AC. **Injury rates and profiles of elite competitive weightlifters.** J Athl Train. 1999;34:232-8.

Cholewicki J, Juluru K, McGill SM. **Intra-abdominal pressure mechanism for stabilizing the lumbar spine**. J Biomech. 1999;32:13-7.

Cholewicki J, McGill SM, Norman RW. **Lumbar spine loads during the lifting of extremely heavy weights**. Med Sci Sports Exerc. 1991;23:1179-86.

Cholewicki J, McGill SM. **Lumbar posterior ligament involvement during extremely heavy lifts estimated from fluoroscopic measurements**. J Biomech. 1992;25:17-28.

Cholewicki J, Panjabi MM, Khachatryan A. **Stabilizing function of trunk flexor-extensor muscles around a neutral spine posture**. Spine. 1997;22:2207-12.

Critchley DJ, Coutts FJ. **Abdominal muscle function in chronic low back pain patients: measurements with real- time ultrasound scanning**. Physiotherapy. 2002;88:322-32.

Danneels LA, Vanderstraeten GG, Cambier DC, Witvrouw EE, Bourgois J, Dankaerts W, et al. **Effects of three different training modalities on the cross sectional area of the lumbar multifidus muscle in patients with chronic low back pain**. Br J Sports Med. 2001;35:186-91.

Danneels LA, Vanderstraeten GG, Cambier DC, Witvrouw EE, De Cuyper HJ. **CT imaging of trunk muscles in chronic low back pain patients and healthy control subjects**. Eur Spine J. 2000;9:266-72.

Essendrop M, Andersen TB, Schibye B. **Increase in spinal stability obtained at levels of intra-abdominal pressure and back muscle activity realistic to work situations**. Appl Ergon. 2002;33:471-6.

Ferreira PH, Ferreira ML, Hodges PW. **Changes in recruitment of abdominal muscles in people with low back pain; ultrasound measurement of muscle activity**. Spine. 2004;29:2560-6.

Gill NW, Springer BA. **Use of rehbilitative ultrasound imaging to characterize abdominal muscle structure and function in lower extremity amputees**. J Orthop Sports Phys Ther. 2007;37:A18.

Goertzen M, Lamge G, Schoppe K, Schulitz KP. **Injuries and damage caused by excess strains in body building and power lifting**. Sportverlet Sportschaden. 1989;3:32-6.

Granhed H, Morelli B. **Low back pain among retired wrestlers and heavyweight lifters**. Am J Sports Med. 1988;16:530-3.

Hayden JA, van Tulder MW, Malmivaara AV, Koes BW. **Meta-Analysis: Exercise Therapy for Nonspecific Low Back Pain**. Ann Intern Med. 2005;142:765-75.

Haynes W. **Rolling exercises designed to train the deep spinal muscles**. J Bodyw Mov Ther 2003;7:153-64.

Henry SM, Westervelt KC. **The use of real-time ultrasound feedback in teaching abdominal hollowing exercises to healthy subjects**. J Orthop Sports Phys Ther. 2005;35:338-45.

Hides JA, Cooper DH, Stokes MJ. **Diagnostic ultrasound imaging for measurement of the lumbar multifidus muscle in normal young adults**. Physiother Theory Pract. 1992;8:19-26.

Hides JA, Fan T, Stanton WR, Stanton P, McMahon K, Wilson S. **Psoas and Quadratus Lumborum Muscle Asymmetry among Elite Australian Football League Players**. Br J Sports Med. 2008:Published Online First: 18 September 2008. doi: 10.1136/bjsm.2008.048751.

Hides JA, Gilmore C, Stanton WR, Bohlscheid E. **Multifidus size and symmetry among chronic low back pain and healthy asymtomatic subjects**. Man Ther. 2008;13:43-9.

Hides JA, Jull GA, Richardson CA. **Long-term effects of specific stabilizing exercises for first-episode low back pain**. Spine. 2001;26:E243-8.

Hides JA, Miokovic T, Belavy DL, Stanton WR, Richardson CA. **Ultrasound imaging assessment of abdominal muscle function during drawing-in of the abdominal wall: an intrarater reliability study**. J Orthop Sports Phys Ther. 2007;37:480-6.

Hides JA, Richardson CA, Jull GA, Davies SE. **Ultrasound imaging in rehabilitation**. Aust J Physiother. 1995;41:187-93.

Hides JA, Richardson CA, Jull GA. **Magetic resonance imaging and ultrasonography of the lumbar multifidus muscle**. Spine. 1995;20:54-8.

Hides JA, Richardson CA, Jull GA. **Magnetic resonance imaging and ultrasonography of the lumbar multifidus muscle**. Spine. 1995;20:54-8.

Hides JA, Richardson CA, Jull GA. **Multifidus muscle recovery is not automatic after resolution of acute, first-episode low back pain**. Spine. 1996;21: 2763-9.

Hides JA, Richardson CA, Jull GA. **Use of real-time ultrasound imaging for feedback in rehabilitation**. Man Ther. 1998;3:125-31.

Hides JA, Stanton WR, Freke M, Wilson S, McManon S, Richardson CA. **MRI study of the size, symmetry and function of the trunk muscles among elite cricketers with and without low back pain**. Br J Sports Med. 2007 10.1136/bjsm.2007.044024;December 7:[Epub ahead of print].

Hides JA, Stanton WR, McMahon S, Sim K, Richardson CA. **Effect of stabilization training on multifidus muscle cross-sectional area among young elite cricketers with low back pain**. J Orthop Sports Phys Ther. 2008;38:101-8.

Hides JA, Stokes MJ, Saide M, Jull GA, Cooper DH. **Evidence of lumbar multifidus muscle wasting ipsilateral to symptoms in patients with acute/subacute low back pain**. Spine. 1994;19:165-72.

Hides JA, Wilson S, Stanton W, McMahon S, Keto H, McMahon K, et al. **An MRI investigation into the function of the transversus abdominis muscle during "drawing-in" of the abdominal wall**. Spine. 2006;31:E175-E8.

Hides JA, Wong I, Wilson SJ, Belavy´ DL, Richardson CA. **Assessment of abdominal muscle function during a simulated unilateral weight-bearing task using ultrasound imaging**. J Orthop Sports Phys Ther 2007;37:467-71.

Hodges PW, Erikssond AEM, Debra S, Gandevia SC. **Intra-abdominal pressure increases stiffness of the lumbar spine**. J Biomech 2005;38:1873-80.

Hodges PW, Gandevia SC. **Changes in intra-abdominal pressure during postural and respiratory activation of the human diaphragm**. J Appl Physiol. 2000;89:967-76.

Hodges PW, Holm AK, Holm S, Ekstrom L, Cresswell A, Hansson T, et al. **Intervertebral stiffness of the spine is increaseed by evoked contraction of tranversus abdominis and the diaphragm: in vivo porcine studies**. Spine. 2003;28:2594-601.

Hodges PW, Pengel LHM, Herbert RD, Gandevia S. **Measurement of muscle contraction with ultrasound imaging.** Muscle Nerve. 2003;27:682-92.

Hodges PW, Richardson CA. **Altered trunk muscle recruitment in people with low back pain with upper limb movement at different speeds**. Arch Phys Med Rehabil. 1999;80:1005-12.

Hodges PW, Richardson CA. **Contraction of the abdominal muscles associated with movement of the lower limb**. Phys Ther. 1997;77:132-44.

Hodges PW, Richardson CA. **Insufficient muscular stabilization of the lumbar spine associated with low back pain: a motor control evaluation of transversus abdominus**. Spine. 1996;21:2640-50.

Hodges PW. **Core stability exercise in chronic low back pain**. Orthop Clin N Am. 2003;34:245-54.

Hodges PW. **Is there a role for transversus abdominis in lumbo-pelvic stabilitty?**. Man Ther. 1999;4:74-86.

Hodges PW. **Ultrasound Imaging in rehabilitation: just a fad?**. J Orthop Sports Phys Ther 2005;35:333-7.

Hoskins PR, Thrush A, Martin K, Whittingham T. **Diagnostic Ultrasound Physics and Equipment**. London: Greenwich Medical Media Limited; 2003.

Hungerford B, Gilleard W, Hodges PW. **Evidence of altered lumbopelvic muscle recruitment in the presence of sarcoiliac joint pain**. Spine. 2003;28:1593-600.

Kanehisa H, Ikegawa S, Fukunaga T. **Comparison of muscle cross-sectional area and strength between untrained women and men**. Eur J Appl Physiol Occup Physiol 1994;68:148-54.

Kanthason J. **Incidence of injuries in Thai national weightlifters team [IS]**. Sports Science. Thailand: Chiang Mai university; 2005.

Karder DF, Wardlaw D, Smith FW. **Correlation between the MRI changes in the lumbar multifidus muscles and leg pain**. Clin Radiol. 2000;55:145-9.

Keifer A, Shirazi-Adl A, Parnianpour M. **Stability of the human spine in neutral postures**. Eur Spine J. 1997;6:45-53.

Keifer A, Shirazi-Adl A, Parnianpour M. **Synergy of the human spine in neutral postures**. Eur Spine J. 1988;7:471-9.

Kennellly KP, Stokes MJ. **Pattern of asymmetry of paravertebral muscle size in adolescent idiopathic scoliosis examined by real-time ultrasound imaging**. Spine. 1993;18:913-7.

Kermode F. **Benefits of utilising real-time ultrasound imaging in the rehabilitation of the lumbar spine stabilising muscles following low back injury in the elite athlete: a single case study**. Phys Ther Sport. 2004;5:13-6.

Kidd AW, Magee S, Richardson CA. **Reliability of real-time ultrasound for the assessment of transversus abdominis function**. J Gravit Physiol. 2002;9:P-131-2.

Kiesel KB, Uhl T, Underwood FB, Nitz AJ. **Rehabilitative ultrasound measurement of select trunk muscle activation during induced pain**. Man Ther. 2008;13:132-8.

Kiesel KB, Uhl T, Underwood FB, Rodd DW, Nitz AJ. **Measurement of lumbar multifidus muscle contraction with rehabilitative ultrasound imaging**. Man Ther. 2007;12:161-6.

Kiesel KB, Underwood FB, Matacolla C, Nitz AJ, Malone TR. **A comparison of select trunk muscle thickness change between subjects with low back pain classified in the treatment-based classification system and asymptomatic controls**. J Orthop Sports Phys Ther. 2007;37:596-607.

Koppenhaver SL, Hebert JJ, Fritz JM, Parent EC, Teyhen DS, Magel JS. **Reliability of rehabilitative ultrasound imaging of the transversus abdominis and lumbar multifidus muscles**. Arch Phys Med Rehabil. 2009;90:87-94.

Koppenhaver SL, Parent EC, Teyhen DS, Hebert JJ, Fritz JM. **The effect of averaging multiple trials on measurement error during ultrasound imaging of transversus abdominis and lumbar multifidus muscles in individuals with low back pain**. J Orthop Sports Phys Ther. 2009;39:604-11.

Kremkau FW. **Diagnostic Ultrasound Physics and Equipment**. 6th ed. Philadelphia: WB Saunders Company; 1998.

Kremkau FW. **Diagnostic Ultrasound: Principles and Instruments**. 6th ed. Philadelphia: WB Saunders Company; 1998.

Lee SW, Chan CK, Lam TS, Lam C, Lau NC, Lau RW, et al. **Relationship between low back pain and lumbar multifidus size at different postures**. Spine. 2006;31.

Lewin T, Moffett B, Vilidik A. **The morphology of the lumbar synovial joints.** Acta Morphologica Neerlanco Scandinav. 1962;4:299-319.

MacDonald DA, Moseley GL, Hodges PW. **The lumbar multifidus: Does the evidence support clinical beliefs?**. Man Ther. 2006;11:254-63.

Macintosh JE, Bogduk N. **The detailed biomechanics of the lumbar multifidus**. Clin Biomech (Bristol, Avon). 1986;1:205-31.

Maher CG, Latimer J, Hodges PW, Refshauge KM, Moseley GL, Herbert RD, et al. **The effect of motor control exercise versus placebo in patients with chronic low back pain**. BMC Musculoskelet Disord. 2005;6:54.

Mannion AF, N. P, Toma V, Sprott H. **Abdominal muscle size and symmetry at rest and during abdominal hollowing exercises in healthy control subjects**. J Anat. 2008;213:173-82.

Maughan RJ, Watson JS, Weir J. **Strength and cross-sectional area of human skeletal muscle**. J Physiol (London). 1983;338:37-49.

Mazanec D. **Non operative treatment of low back pain**. In: Frymoyer J, Wiesel S, editors. The adult and pediatric spine. 3rd ed. Philadelphia: Lippincott Williams&Wilkins; 2004. p. 883-98.

McGill S. **Low Back disorders**. Champaign, Illinois: Human Kinetics; 2002.

McGregor AH, Anderton L, Gedroyc WM. **The trunk muscles of elite oarsmen**. Br J Sports Med. 2002;36:214-21.

McMeeken JM, Beith ID, Newham DJ, Milligan P, Critchley DJ. **The relationship between EMG and change in thickness of transversus abdominis**. Clin Biomech (Bristol, Avon). 2004;19:337-42.

Mengiardi B, Schmid MR, Boos N, Pfirrmann CWA, Brunner F, Elfering A, et al. **Fat content of lumbar paraspinal muscles in patients with chronic low back pain and in asymptomatic volunteers: quantification with MR spectroscopy**. Radiology. 2006;240:786-92.

Mills JD, Taunton JE, Mills WA. **The effect of a 10-week training regimen on lumbo-pelvic stability and athletic performance in female athletes; a randomized-controlled trial**. Phys Ther Sport. 2005;6:60-6.

Moseley GL, Hodges PW, Gandevia SC. **Deep and superficial fibers of the lumbar multifidus muscle are differentially active during voluntary arm movements**. Spine. 2002;27:E29-E36.

Mundt DJ, Kelsey JL, Golden AL, Panjabi MM, Pastides H, Berg AT, et al. **An epidemiologic study of sports and weight lifting as possible risk factors for herniated lumbar and cervical discs**. Am J Sports Med. 1993;21:854-60.

Myer GD, wall EJ. **Resistance training in the young athlete**. Oper Tech Sports Med. 2006;14:218-30.

Neumann DA. **Kinesiology of the musculoskeletal system: foundations for rehabilitation**. London: Mosby; 2010.

Neumann DA. **Kinesiology of the musculoskeletal system: foundations for rehabilitation**. London: Mosby; 2010.

Norasteh A, Ebrahimi E, Salavati M, Rafiei J, Abbasnejad E. **Reliability of B-mode ultrasonography for abdominal muscles in asymptomatic and patients with acute low back pain**. J Bodyw Mov Ther. 2007;11:17-20.

Panjabi MM, Abumi K, Duranceau J, Oxland T. **Spinal stability and intersegmental muscle forces**. A biomechanic model. Spine. 1989;14:194-200.

Panjabi MM. **The stabilizing system of the spine**. Part I. Function, dysfunction, adaptation, and enhancement. J Spinal Disord. 1992;5:383-9.

Panjabi MM. **The stabilizing system of the spine. Part II.** Neutral zone and instability hypothesis. J Spinal Disord. 1992;5:390-6.

Parkkola R, Rytokoski U, Kormano M. **Magnetic resonance imaging of the discs and trunk muscles in patients with chronic low back pain and healthy control subjects**. Spine. 1993;18:830-6.

Paungmali A, Pirunsan U, Chamnongkich S, Sitilertpisan P, Pothongsunun P, Khamwong P, et al. **Analysis of injuries and rehabilitation for excellence of Thai national weightlifters Thailand**. Department of Physical Therapy, Faculty of Associated Medical Sciences, ChiangMai University 2007.

Pool-Goudzwaard AL, Vleeming A, Stoeckart R, Snijders CJ, Mens JMA. I**nsufficient lumbopelvic stability: a clinical and biomechanical approach to 'a-specific' low back pain**. Man Ther. 1998;3:12-20.

Portney LG, Watkins MP. **Foundations of clinical research: applications to practice**. 3 ed. Upper Saddle River: Prentice Hall; 2008.

Pressler JF, Heiss DG, Buford JA, Chidley JV. **Between-day repeatability and symmetry of multifidus cross-sectional area measured using ultrasound imaging.** J Orthop Sports Phys Ther. 2006;36:10-8.

Rankin G, Stokes M, Newham DJ. **Abdominal muscle size and symmetry in normal subjects**. Muscle Nerve. 2006;34:320-6.

Rankin G, Stokes M, Newham DJ. **Size and shape of the posterior neck muscles measured by ultrasound imaging: normal values in males and females of different ages**. Man Ther. 2005;10:108-15.

Richardson CA, Hodges PW, Hides JA. **Therapeutic Exercise for Lumbopelvic Stabilization.** A Motor Control Approach for the Treatment and Prevention of Low Back Pain. 2nd ed. London: Churchill Livingstone; 2004.

Richardson CA, Jull GA, Hodges PW, Hides JA. **Therapeutic Exercise for Spinal Segmental Stabilization in Low Back Pain**. Scientific Basis and Clinical Approach. London: Churchill Livingstone; 1999.

Richardson CA, Jull GA, Toppenberg R, Comerford M. **Techniques for active lumbar stabilisation for spinal protection: a pilot study**. Aust J Physiother. 1992;38:105-12.

Richardson CA, Snijders CJ, Hides JA, Damen L, Pas MS, Storm J. **The relation between the transversus abdominis muscles, sacroiliac joint mechanics, and low back pain**. Spine. 2002;27:399-405.

Rossi F. **Spondylolysis, spondylolithesis and sports**. J Sports Med Phys Fitness. 1978;18:317-40.

Roy SH, Deluca CJ, Snyder-Mackler L, Emley MS, Crenshaw RL, Lyons JP. **Fatigue, recovery and low back pain in varsity rowers**. Med Sci Sports Exerc. 1990;22:463-9.

Sitilertpisan P, Pirunsan U, Paungmali A, Ratanapinuanchai J, Kiatwattanacharoen S, Neamin H. **Comparision of lateral abdominal muscles size between weightlifters and sedentary subjects**. Chiang Mai Medical Bulletin. 2007;46:10.

Sofka CM. **Ultrasound in Sports Medicine**. Seminars in Musculoskeletal Radiology Sports Injuries 2004;8:17-27.

Springer BA, Mielcarek BJ, Nesfield TK, Teyhen DS. **Relationships among lateral abdominal muscles, gender, body mass index, and hand dominance**. J Orthop Sports Phys Ther. 2006;36:289-97.

Stokes M, Hides J, Elliot J, Kiesel K, Hodges P. **Rehabilitative ultrasound imaging of the posterior paraspinal muscles**. J Orthop Sports Phys Ther. 2007;37:581-95.

Stokes M, Rankin G, Newham DJ. **Ultrasound imaging of lumbar multifidus muscle: normal reference ranges for measurements and practical guidance on the technique**. Man Ther. 2005;10:116-26.

Stuge B, Mørkved S, Dahl HH, Vøllestadb N. **Abdominal and pelvic floor muscle function in women with and without long lasting pelvic girdle pain. Man Ther**. 2006;11:289-96.

Teyhen DS, Gill NW, Whittaker JL, Henry SM, Hides JA, Hodges PW. **Rehabilitative ultrasound imaging of the abdominal muscles**. J Orthop Sports Phys Ther. 2007;37:450-66.

Teyhen DS, Miltenberger CE, Deiters HM, Del Toro YM, Pulliam JN, Childs JD, et al. **The use of ultrasound imaging of the abdominal drawing-in maneuver in subjects with low back pain**. J Orthop Sports Phys Ther. 2005;35:346-55.

Teyhen DS, Rieger JL, Westrick RB, Miller AC, Molloy JM, Childs JD. **Changes in deep abdominal muscle thickness during common trunk-strengthening exercises using ultrasound imaging**. J Orthop Sports Phys Ther. 2008;38:596-605.

Urquhart DM, Barker PJ, Hodges PW, Story IH, Briggs CA. **Regional morphology of the transversus abdominis and obliquus internus and externus abdominis muscles**. Clin Biomech (Bristol, Avon). 2005;20:233-41.

Van K, Hides JA, Richardson CA. **The use of real-time ultrasound imaging for biofeedback of lumbar multifidus muscle contraction in healthy subjects**. J Orthop Sports Phys Ther. 2006;36:920-5.

Vasseljen O, Fladmark AM. **Abdominal muscle contraction thickness and function after specific and general exercises: a randomized controlled trial in chronic low back pain patients**. Man Ther. 2010;15:482-9.

Videman T, Sama S, Battie MC, Koskinen S, Gill K, Paananen H, et al. **The long-term effects of physical loading and exercise life-styles on back-related** symptoms, disability, and spinal pathology among men. Spine. 1995;20:699-709.

Wallwork TL, Hides JA, Stanton WR. **Intrarater and interrater reliability of assessment of lumbar multifidus muscle thickness using rehabilitative ultrasound imaging**. J Orthop Sports Phys Ther. 2007;37:608-12.

Wallwork TL, Stanton WR, Freke M, Hides JA. **The effect of chronic low back pain on size and contraction of the lumbar multifidus muscle**. Man Ther. 2009;14:496-500.

Whittaker JL, Teyhen DS, Elliott JM, Cook K, Langevin H, Dahl HH, et al. **Rehabilitative Ultrasound Imaging: Understanding the Technology and Its Applications**. J Orthop Sports Phys Ther. 2007;37:434-49.

Wilke HJ, Wolf S, Claes LE, Arand M, Wiesend A. **Stability increase of the lumbar spine with different muscle groups: A biomechanical in vitro study**. Spine. 1995;20:192-8.

[Online]. Available. http://www.getbodysmart.com/ap/muscularsystem/abdominalmuscles/menu/menu.html. [cited 20 December 2010].