Diastasis Rectus Abdominis and the Implications for Returning to Sport after Pregnancy

Diane Lee BSR FCAMT

Diane last appeared at our Annual Conference in 2009. She returned to present at our 2012 Diamond Jubilee Conference her lecture based on the *Integrated Systems Model,* co-developed with LJ Lee and about which she has supplied the following article.

Introduction

Increasingly, scientific evidence suggests that function of the pelvis is essential for the performance of almost every task. "When the pelvis gives way, it's tough to play" is a statement that can be applied to both genders of all age groups pertaining to a wide spectrum of activity levels from the need to transfer from wheelchair to bed, to those competing in elite level sports. However, how do we know if the pelvis is the cause of the patient's primary complaint (the criminal) or merely the victim of an impairment elsewhere? The restoration of function and performance depends on being able to identify and treat the underlying source of the problem and it is common to find that the pelvis is, in some cases the criminal and the victim in others. The *Integrated Systems Model for Pain & Disability* (ISM) (Lee & Lee 2007, Lee 2011) helps clinicians to determine the primary driver when there are multiple sites of impairment, i.e. to know where to direct treatment first when there is failure to control movement of multiple joints such as the sacroiliac joint, subtalar joint and hip joint during a single leg loading task. The ISM approach uses sound clinical reasoning integrated with the available research evidence to develop prescriptive treatment programmes unique to each individual's story.

This article is compiled in part from excerpts reproduced from the following text chapters and articles and briefly describes the key components that highlight the principles of the *Integrated Systems Model for Pain & Disability* and demonstrates how the model is applied to those with diastasis rectus abdominis. (Lee LJ, Lee D 2011, Lee D et al 2008, Lee D 2011)

It's about more than pain: integrated systems for optimal health

From Lee LJ, Lee D 2011 Chapter 7 Clinical practice – the reality for clinicians. In: Lee D 2011 The Pelvic Girdle – An integration of clinical expertise and research. Elsevierpp163-165

It has been long recognised that simply relieving a patient's pain does not necessarily result in a full return to all functional activities. Furthermore there are subgroups of patients such as high-level athletes whose functional goals and measures, e.g. race time, power delivery in a stroke etc. are just as, if not more meaningful to them than the relief of pain. Indeed, there is an increasing market in helping people without pain to optimise performance and prevent injury by facilitating strategies for better posture and movement. Pain is not a problem for these people but an inability to meet their functional goals is. Non-painful impairments are also recognised as a potential contributor to the development of pain both in sites distal to the impaired area and in the area itself. If we take the broader view that pain is an opinion on the organism's state of health rather than a

mere reflexive response to injury (Ramachandran in Doidge 2007), we then need to alter our focus and consider not only what it means to be "in pain" but also what it means to be "in health". The World Health Assembly has defined health as *"a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."* Speaking at the 1985 annual conference of the American Medical Association in Seattle, USA, Dr Paul Brenner defined health even more broadly as "*the full acceptance and appreciation of life.*" Restoring health is about more than removing disease and creating optimal strategies for function and performance is about more than removing pain.

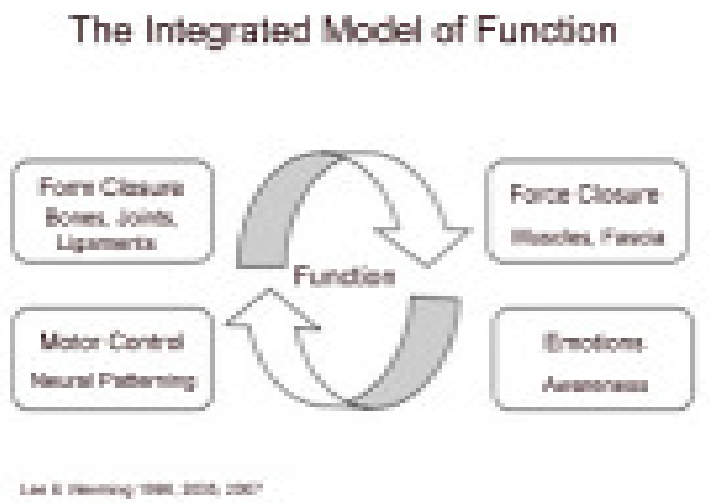
What it means to be "in health" is individually defined, therefore changing our focus from removing pain to restoring optimal health and optimal strategies for function and performance is intrinsically linked to the patient's values and goals. Our role as clinicians is to best facilitate and empower patients on their journey to achieve their personal optimal health and function. To do this effectively we need to not only understand their pain (problem), but also understand them as a person. As Jones & Rivett (2004) state:

> *"To understand and manage patients and their problems successfully, manual therapists must consider not only the physical diagnostic possibilities (including the structures involved and the associated pathobiology) but also the full range of factors that can contribute to a person's health, particularly the effects these problems may have on patients' lives, and the understanding patients (and significant others) have of these problems and their management."*

This paradigm requires that clinicians broaden their perspectives and skill sets and opens up a wider range of potential and possibility for effecting change.

The *Integrated Model of Function* (Figure 1) was developed from anatomical and biomechanical studies of the pelvis as well as from the clinical experience of treating patients with lumbopelvic pain (Lee & Vleeming 1998, 2004, 2007). From its inception, the *Integrated Model of Function* focused on the evaluation of the function of the pelvis and how it effectively transfers loads across tasks with varying characteristics. The model addresses the reason why the pelvis is painful by identifying the underlying impairments in four specific components: form closure, force closure, motor control and emotions. This is in opposition to pathoanatomical models that seek to only identify pain-generating structures. The model has continued to evolve with the publication of anatomical, biomechanical and neurophysiological research as well as the clinical expertise gained through collaborative efforts worldwide and remains a useful framework to understand the pelvis in function and in dysfunction.

Figure 1.



The *Integrated Systems Model for Disability and Pain* evolved from working with the *Integrated Model of Function* and was first introduced in 2007 as the *System-Based Classification for Failed Load Transfer* (Lee & Lee 2007, Lee et al 2008, Lee & Lee 2008a,b). We have since recognised that the word "classification" is limiting for this model because its primary purpose is not to place patients into homogeneous subgroups, rather it is a framework to understand and interpret the unique picture of each individual patient in the clinical context in order to facilitate decision-making and treatment planning. The model provides a context to organise all the different types of knowledge needed; scientific, theoretical, professional craft, procedural and personal and provides for the development and testing of multiple hypotheses as the multidimensional picture of the patient emerges. A multimodal treatment plan can then be designed based on the complete picture of the person and their presenting problem(s).

The *Integrated Systems Model for Disability and Pain* allows clinicians to characterise all the components that contribute to what Melzack (2005) terms the message

that represents the whole body as a flow of awareness. It is an integrated, evidence-based model that considers disability and pain as defined and directed by the patient's values and goals and relates impairments found in systems, underlying pain mechanisms and the impact of these impairments on their current whole body strategies for function and performance. It, therefore analyses the patient's current whole body strategies, determines the underlying reasons for those strategies and relates these to current knowledge about the necessary state required in all systems to provide optimal strategies for function and performance and ultimately for health. As a systems-based model it has inherent flexibility to evaluate and integrate new evidence from research and innovative clinical approaches as they emerge. As a patient-centered model it can continually adapt to changing goals and values of the patient and as it applies to the whole person rather than to a specific type of pain presentation or body region the model can be used across pain and disease populations rather than applied only to patients with lumbopelvic or pelvic girdle pain. In the context of the lumbopelvic-hip complex the *Integrated Model of Function* fits within, and is encompassed by *the Integrated Systems Model for Disability and Pain.* The *Integrated Model of Function* provides a way to subgroup patients with failed load transfer (FLT) in the LPH complex; those with a primary form closure, force closure, motor control or emotional deficit.

The broader *Integrated Systems Model for Disability and Pain* also considers both how a patient could be subgrouped according to the primary system impairment and considering the role of the rest of the body and mind to the observed failed load transfer (FLT) in the LPH complex. For example, is the primary impairment causing the FLT intrinsic to the pelvic girdle itself (pelvic-driven pelvic girdle pain), extrinsic to the pelvic girdle (thorax-driven or foot-driven pelvic girdle pain) or due to a negative cognitive / emotional state? The online version of the 4th edition of The Pelvic Girdle (Lee D 2011) includes 4 case reports that reflect each of these drivers of pelvic girdle pain.

The *Integrated Systems Model for Disability and Pain* also considers the interaction and contribution of multiple systems such as articular, myofascial, neural, visceral, hormonal, neuroendocrine etc. Therefore, while The *Integrated Systems Model for Pain & Disability* is based on the identification of the multi-system impairments that are the key drivers behind the problems facing the whole person which could then be used to subgroup patients, the primary purpose of the model is to provide a framework for building a unique tapestry that tells the patient's story and facilitates instinctive clinical reasoning as the story unfolds and the clinician begins to understand the significant pieces of their tapestry. It is our goal that when the *Integrated Systems Model for Pain & Disability* is used reflectively it will facilitate, foster and promote the development of clinical expertise. The *Clinical Puzzle* (Figure 2) is a graphic that conceptualises the *Integrated Systems Model for Disability and Pain*, representing the person, their problem(s) and the systems that support optimal strategies for function and performance.

Figure 2.

The puzzle is used clinically and in teaching as a tool for clinical reasoning and decision-making (Lee & Lee 2007).

Diastasis rectus abdominis and the implications for returning to sport after pregnancy

Modified from Lee D, Lee LJ, McLaughlin L 2008 Stability, continence and breathing: the role of fascia following pregnancy and delivery. JBMT 12(4):333-348

Lee D 2011 Chapter 6 Pregnancy and its potential complications. In: Lee D 2011 The Pelvic Girdle – An integration of clinical expertise and research, Elsevier pp131-133

It is well established that transversus abdominis plays a crucial role in optimal function of the lumbopelvis and that one mechanism by which this muscle contributes to intersegmental (Hodges et al 2003) and intrapelvic (Richardson et al 2002) stiffness is through fascial tension. Diastasis rectus abdominis (DRA) has the potential to disrupt this mechanism and is a common postpartum occurrence (Boissonnault & Blaschak 1988, Spitznagle et al 2007). Universally, the most obvious visible change during pregnancy is the expansion of the abdominal wall and while most abdomens accommodate this stretch very well, others are damaged extensively (Figure 3).

Figure 3.

One structure particularly affected by the expansion of the abdomen is the linea alba, the complex connective tissue (Axer et al 2001) connecting the left and right abdominal muscles. The width of the linea alba is known as the inter-recti distance and normally varies along its length from the xyphoid to the pubic symphysis. Beer et al (2009) measured the width of the linea alba with ultrasound imaging in 150 nulliparous women aged between 20 – 45 years and found the mean width to be highly variable reporting 7mm ± 5 at the xyphoid, 13mm ± 7 3cm above the umbilicus and 8mm ± 6 2cm below the umbilicus.

Mendes et al (2007) showed that ultrasound imaging is an accurate method for measuring inter-recti distance and others have used this tool to measure the behaviour of the linea alba during a variety of tasks (Coldron et al 2007, Lee et al (unpublished data)). A DRA is commonly diagnosed when the inter-recti distance exceeds what is thought to be normal although there is no standardised agreement as to what is normal.

There is little scientific literature on this condition; Boissonnault & Blaschak (1988) found that 27% of women have a DRA in the second trimester and 66% in the third trimester of pregnancy. 53% of these women continued to have a DRA immediately postpartum and 36% remained abnormally wide at 5-7 weeks postpartum. Coldron et al (2007) measured the inter-recti distance from day one to one year postpartum and noted that the distance decreased markedly from day one to eight weeks and that without intervention such as core training there was no further closure at the end of the first year. In the urogynecological population 52% of patients were found to have a DRA (Spitznagle et al 2007) and that 66% of these women had at least one support-related pelvic floor dysfunction, i.e. stress urinary incontinence (SUI), fecal incontinence and / or pelvic organ prolapse. There are no studies to guide clinicians on what is the best treatment for postpartum women with DRA.

Clinically, it appears that there are two subgroups of postpartum women with DRA;

1. Those who through a multi-modal treatment programme are able to restore optimal strategies for transferring loads through the abdominal canister with or without achieving closure of the DRA

2. Those who despite apparently being able to restore optimal function of the deep muscles (optimal neural system) and who do not have loss of articular integrity of the SIJs or pubic symphysis (optimal articular system) and in whom the inter-recti distance remains greater than normal (non-optimal myofascial system) fail to achieve optimal strategies for transferring loads through the abdominal canister. In multiple vertical loading tasks such as single leg standing, squatting, walking, moving from sit to stand and climbing stairs failed load transfer through the joints of the lower thorax, lumbar spine and / or pelvic girdle is consistently found.

This second subgroup of postpartum women appear to have sustained significant damage to the midline fascial structures and sufficient tension can no longer be generated through the abdominal wall for resolution of function (Figure 4). A surgical repair of the midline abdominal fascia (the linea alba) should, therefore be considered (Toranto 1988).

Two case reports, complete with video clips in the online version of The Pelvic Girdle, 4th edn (Lee 2011) describe

Figure 4.

the clinical findings and treatment of two women, one of whom has a non-surgical DRA and the other who, eventually undergoes surgical repair of her abdominal wall. We now understand that there are several subgroups of this condition (DRA) and recognise that both further research and clinical expertise are needed to properly investigate and thus inform individuals with this very significant postpartum complication.

Summary

Loss of motion control of the lumbopelvic-hip complex is a common finding in patients / athletes presenting with single or recurrent hamstring injuries and / or posterior thigh pain. As a functional platform is essential for optimal performance of not only the lower extremity but the body in general whenever impairments that can be shown to relate to non-optimal strategies during meaningful tasks are found, whether painful or not, they must be addressed. The *Integrated Systems Model for Pain & Disability* is an integrated, evidence-based approach that considers both pain and disability, i.e. it relates impairments found in systems, pain and the impact of these impairments on the synergistic function required for optimal strategies for function and performance and, ultimately for health. It is a model that applies to the whole person rather than to a specific type of pain presentation and so it can be used across pain and disease populations rather than only being used for patients with lumbopelvic pain. This approach is an evidence-based (Sackett et al 2000), patient centred model that considers the best available research evidence in combination with clinical expertise, defined as the ability "to do the right thing at the right time" and requiring the ability to think critically and be critical about your thinking (reflection and metacognition) (Jones & Rivett 2004). A diastasis of the rectus abdominis is a myofascial system impairment and has the potential to disrupt mechanisms for transferring load between the thorax, lumbar spine and pelvis. The ability to generate tension in this structure appears more significant to function as opposed to the inter-recti distance. This clinical theory is supported by the scientific evidence pertaining to force closure mechanisms of the lumbopelvis yet remains to be validated by further studies.

To learn more about the *Integrated Systems Model for Pain & Disability*, please join us for The Discover Physio Series (more information at www.discoverphysio.ca).

Acknowledgements

The author would like to acknowledge the contribution of Linda-Joy (LJ) Lee both for our collaboration that has led to the *Integrated Systems Model for Pain & Disability* as well as for her major contribution to the writing of the 4th edition of The Pelvic Girdle (2011) first published in 1989. This article contains excerpts of LJ's writings from The Pelvic Girdle and her contributions are highlighted in the relevant section. Her knowledge of research as well as her novel clinical ideas and expertise are an on-going

inspiration for me and I am extremely grateful to be part of our company Discover Physio.

I would also like to thank Prof. Paul Hodges for his support and guidance during our initial research pertaining to women with diastasis rectus abdominis and thank the Clinical Center of Research Excellence for providing me with a grant to further the investigation of this condition.

Finally, it is the patients who bring us their stories that I am indebted to and offer my acknowledgement since these individuals challenge us to find better ways to help them restore the quality of their lives. The clinic and my patients remain my ultimate research lab, one patient at a time.

References

Axer H, von Keyserlingk D G, Prescher A 2001 Collagen fibers in linea alba and rectus sheaths. I. General scheme and morphological aspects. Journal of Surgical Research 96:127-134

Beer, G M, Schuster A, Seifert B et al 2009 The normal width of the linea alba in nulliparous women. Clinical Anat. 22(6):706-711

Boissonault J S, Blaschak MJ 1988 Incidence of diastasis recti abdominis during the childbearing year. Physical Therapy 68(7):1082

Coldron Y, Stokes M J, Newham D J et al 2008 Postpartum characteristics of rectus abdominis on ultrasound imaging. Manual Therapy 13: 112

Doidge N 2007 The brain that changes itself. Stories of personal triumph from the frontiers of brain science. Penguin Books, New York

Hodges P W, Kaigle Holm A et al 2003a Intervertebral stiffness of the spine is increased by evoked contraction of transversus abdominis and the diaphragm: in vivo porcine studies. Spine 28(23):2594

Jones M A, Rivett D 2004 Introduction to clinical reasoning. Ch 1 In: Clinical reasoning for manual therapists. Eds Jones M A, Rivett D A, Elsevier, Edinburgh

Lee D G 2011 The Pelvic Girdle, 4th edn. Elsevier, Edinburgh

Lee D G, Lee L J 2007 Bridging the Gap: The role of the pelvic floor in musculoskeletal and urogynecological function. Proceedings of the World Physical Therapy Conference, Vancouver, Canada http://www.wcpt.org/abstracts2007/Abstracts/448.htm

Lee D G, Lee L J 2008a Integrated, multimodal approach to the treatment of pelvic girdle pain and dysfunction. In: Magee D J, Zachazewski J E, Quillen W S (eds) Pathology and intervention in musculoskeletal rehabilitation Saunders, Elsevier p473

Lee L J, Lee D L 2008b Integrated, multimodal approach to the thoracic spine and ribs. In: Magee D J, Zachazewski J E, Quillen W S (eds) Pathology and intervention in musculoskeletal rehabilitation Saunders, Elsevier p306

Lee D, Lee LJ, McLaughlin L 2008 Stability, continence and breathing: the role of fascia following pregnancy and delivery. JBMT 12(4):333-348

Lee D G, Vleeming A 1998 Impaired load transfer through the pelvic girdle – a new model of altered neutral zone function. In: Proceedings from the 3rd interdisciplinary world congress on low back and pelvic pain. Vienna, Austria

Lee D G, Vleeming A 2004 The management of pelvic joint pain and dysfunction. In: Boyling J D, Jull G (eds) Grieve's modern manual therapy. The vertebral column, 3rd edn. Churchill Livingstone, Elsevier p495

Lee D G, Vleeming A 2007 An integrated therapeutic approach to the treatment of pelvic girdle pain. In: Vleeming A, Mooney V, Stoeckart R (eds) Movement, stability & lumbopelvic pain, 2nd edn. Elsevier p621

Melzack R 2005 Evolution of the neuromatrix theory of pain. The Prithvi Raj Lecture: Presented at the third World Congress of World Institute of Pain, Barcelona 2004. Pain practice: the official journal of World Institute of Pain 5(2):85

Mendes D, de A, Nahas FX, Veiga DF, Mendes FV, Figueiras RG, Gomes HC, Ely PB et al 2007 Ultrasonography for measuring rectus abdominis muscles diastasis Acta cirúrgica brasileira / Sociedade Brasileira para Desenvolvimento Pesquisa em Cirurgia 22(3):182–186

Richardson C A, Snijders C J, Hides J A et al 2002 The relationship between the transversely oriented abdominal muscles, sacroiliac joint mechanics and low back pain. Spine 27(4):399

Sackett DL, Straus S, Richardson WS, Rosenberg WMC, Haynes B 2000 Evidence-based medicine: how to practice and teach EBM. Churchill Livingstone, Edinburgh

Spitznagle TM, Leong FC, Van Dillen 2007 Prevalence of diastasis recti abdominis in a urogynecological patient population. International Urogynecology Journal Pelvic Floor Dysfunction 18(3):321

Toranto I R 1988 Resolution of back pain with the wide abdominal rectus plication abdominoplasty. Plastic Reconstruction Surgery 81(5):777

Diane Lee is Owner/Director of Diane Lee & Associates – Consultants in Physiotherapy and Co-Founder of Discover Physio.

Address for correspondence:
Diane Lee
www.discoverphysio.ca