

Preface

In the last decade there has been considerable growth in the knowledge base that serves as the foundation for neuromusculoskeletal rehabilitation. In particular, extensive focus has been placed upon identifying the neuromuscular mechanisms consistent with health, and the specific alterations that underlie dysfunction, such as low-back and pelvic girdle pain. Alongside this work, a valuable tool, ***ultrasound imaging***, has emerged to assist clinicians in the detection and treatment of these neuromuscular or motor control impairments. However, what has not materialized are the resources needed to educate rehabilitation professionals in its use and clinical application.

When I began using ultrasound imaging to augment the management of patients with lumbopelvic dysfunction (lumbopelvic pain with associated continence and respiratory dysfunction), resources (both in the form of literature and clinical expertise) were limited. They consisted of a small section in a text, several research papers containing vague descriptions of methodology, and a handful of clinicians spread out around the globe. Over the last five years the popularity of the tool has increased, as has the scientific literature employing it. However, the information remains dispersed and disconnected. The aim of this text is to draw together published evidence with practical expertise, and present the first comprehensive resource for the rehabilitation clinician interested in integrating ultrasound imaging into their practice.

From a historical perspective, investigation into the nature and possible uses of ultrasound waves began in the 1920s, with initial medical applications introduced in the late 1930s. The focus of this early work centred on heating tissue for therapeutic purposes, with diagnostic applications following in the 1950s. Since that time, diagnostic imaging has been primarily concerned with traditional radiological goals, which consider morphological characteristics and structural integrity. However, as the technology has been embraced

as a safe, portable, objective and relatively inexpensive means of examination, the ingenuity and diversity of applications has exploded.

Ultrasound imaging related to musculoskeletal rehabilitation has been ongoing since the 1980s. Current applications include assessment of muscle morphology (length, depth, diameter, cross-sectional area, volume), architectural changes in muscles and associated structures (fascia and organs such as the bladder) with muscle contraction, integrity of fascia, and motion of neurological tissue. Clinically, ultrasound imaging is a powerful tool as its dynamic, real-time nature allows clinicians to gather previously unavailable information about the status of the myofascial system, provide unparalleled visual feedback to their patients, and monitor the effectiveness of their treatment more objectively. Furthermore, it serves to refine the accuracy of a clinician's palpatory and observational skills in detecting subtle contractions in muscles that are deep and difficult to directly access.

Ultrasound imaging and in particular, real-time ultrasound imaging (the rapid sequential display of ultrasound images resulting in a moving presentation) is highly operator dependent. Clinicians embarking upon a journey to incorporate it into their daily practice require theoretical knowledge, as well as practical skill. Specifically, ultrasound imaging presents three major challenges:

- **Image generation** – the ability to use ultrasound technology to generate an image of the structure(s) of interest.
- **Image recognition** – the ability to orientate to the plane and anatomical structure(s) seen within the two-dimensional image.
- **Image interpretation** – the ability to interpret the still and dynamic images that are generated.

This text addresses these issues as they pertain to rehabilitation of neuromuscular dysfunction in the lumbopelvic region. It begins with a review of the basic principles of sound wave propagation, as well as a discussion of instrumentation, prudent use and safety topics (Chapter 1). Chapter 2 outlines, in a step-by-step fashion, the practicalities involved in generating images of the deep muscles and structures (fascia) that play a role in respiration, continence and postural control of the lumbopelvic region. This is followed by an in-depth discussion of the fundamentals of interpretation from both a qualitative (Chapter 3) and quantitative perspective (Chapter 4). The last chapter provides clinical guidance for the use of real-time ultrasound in the treatment of individuals with lumbopelvic dysfunction and addresses the value that it holds for both the therapist and the patient. The text concludes with appendices containing resources that facilitate the implementation of the technology into clinical practice, guidelines for accreditation, and a case study that

provides a practical illustration of the way in which ultrasound imaging can enhance patient management. For those new to the technology it is critical to realize that it takes time to accumulate the knowledge, and perfect the skills, required for accurate interpretation and measurement. Hence the information contained here is only a beginning.

Although ultrasound imaging is currently used both in clinical and research settings, I believe that its full significance with regard to the rehabilitation process has yet to be revealed. The goal of this text is to give a comprehensive description of the current applications of ultrasound imaging in the rehabilitation of neuromusculoskeletal dysfunction in the lumbopelvic region based upon published evidence and clinical expertise. In doing so it is my hope to inspire further debate and research, as well as facilitate a greater understanding of the complementary role that ultrasound imaging can play in the rehabilitation of this region.

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White Rock, Canada
2007