Current Perspectives: The Clinical Application of Ultrasound Imaging by Physical Therapists

In the last decade, there has been considerable growth in the knowledge base that is the foundation of neuromusculoskeletal rehabilitation. In particular, extensive focus has been placed upon identifying the neuromuscular mechanisms consistent with health and the specific alterations that underlie dysfunction. From this work, it has become evident that a primary impairment seen in dysfunctions such as chronic cervical, low back, and pelvic girdle pain is one of altered neuromuscular control as opposed to decreased strength or functional capacity[1-5]. Specifically, there appears to be a trend of evidence consistent with augmented activity of the superficial and diminished activity of the deep muscles of these regions[1-8]. Alongside the evidence, ultrasound imaging (UI) has emerged as a clinical tool to aid physical therapists in the detection and treatment of altered motor control[9,10]. However, as with all new tools, debate arises on issues of scope of practice, the specific role the new tool can play in the rehabilitation process, and its limitations.

The scope of practice of physical therapy varies from jurisdiction to jurisdiction. The World Confederation of Physical Therapy[11] has defined physical therapy as "…the assessment and treatment of neuromusculoskeletal and cardiorespiratory systems of the body by physical or mechanical means, for the purpose of maintenance or restoration of function, that has been impaired by injury or disease, for pain management and for the promotion of mobility and health…" This statement clearly verifies that the rehabilitation of movement dysfunction and specifically dysfunction of the neuromusculoskeletal system is within the scope of the physical therapy profession. It also confirms that a physical therapist is qualified to establish a physical therapy diagnosis, determine an individual's movement potential, and plan and implement programs, using specialized knowledge, skills, and tools, for the prevention or treatment of movement dysfunction. UI is simply one potential tool and should be viewed as such in the same light as, say, a stethoscope. A variety of health care providers employ a stethoscope during their daily practice. Depending on the information sought, their unique area of training, and their level of knowledge, the tool is used differently. The uses of UI by physical therapists may vary depending on the jurisdiction, its specific licensing guidelines, and professional regulation. In a recent report to the College of Physical Therapists of British Columbia, Canada[12], a generic definition regarding the use of UI by physical therapists that encompasses current clinical uses has been proposed. It includes "…applications that result in a physical diagnosis of the structure or movement characteristics of muscles and/or nerves in relation to adjacent structures…" At present, it is not within the scope of practice of North American physical therapists to make a medical diagnosis of altered tissue morphology based on the interpretation of imaging studies.

Ultrasound imaging related to musculoskeletal rehabilitation has been ongoing since the 1980's[13], and investigation has established that it has a role as a safe, cost-effective (as opposed to the alternative of magnetic resonance imaging), and accessible method for visualizing and measuring the deep muscles of the trunk[14-22]. The value of UI from a rehabilitative perspective is that it allows for dynamic study (real-time images) of muscle groups as they contract. Consequently, the complementary use of UI can enhance the clinical analysis of the musculature system and has been advocated by various authors[5,9,10,23-27]. In addition to its clinical utility, numerous studies[17,20-22,28-34] have shown that UI withstands scientific rigor when applied in a thoughtful manner and that it is both a valid and reliable

method to ascertain muscle size (through static quantitative measurements of muscle width, length, depth, cross-sectional area, or volume) and hence can be used as an indicator of muscle activity.

Ultimately the matter of using real-time ultrasound imaging (RTUS) to describe a muscle contraction is a complex issue. Although changes in static architectural measures tell a portion of the story, considered alone they primarily reflect muscle capacity. As the clinical and scientific interest in the musculature system is related to altered motor control, it is imperative that more encompassing methods of describing what is being seen on the ultrasound display are developed. Considering only the increase in an architectural measure of a muscle during a task is analogous to considering the maximal amount of EMG activity without taking into account timing or impact on other structures. Furthermore, the interpretation process is complicated by the fact that the amount of change seen in a muscle's architecture (depth, width, and length) during a contraction does not necessarily represent the intensity or amount of actual muscle activity[20,35]. The potential for a discrepancy exists due to specific characteristics of the muscle under investigation, the nature and limitations of two-dimensional imaging (e.g., muscle contraction produces architectural changes in three dimensions as opposed to the two dimensions visible on an ultrasound display) as well as the potential for a change in muscle architecture due to the presence of a competing force on the muscle (e.g., protrusion and retraction of the abdominal contents during respiration may impact the architecture of the abdominal wall muscles[28,35]). Hence, it is critical for those who are new to the technology to realize that it takes time to accumulate the knowledge, and perfect the skills required for accurate interpretation and measurement.

In the current environment of evidence-based practice and fiscal accountability, it is imperative that physical therapists be allowed access to the tools that will optimize the effectiveness of their interventions. However, as this opportunity arises, it is critical that we not only rise to defend the logical inclusion of UI in our scope of practice if challenged, but that we determine how this tool can best benefit our patients. Contiguous to this task is the responsibility associated with quality control, accreditation, and development of policies to ensure the safe and appropriate use of the technology by the members of our profession. Although the evidence supporting the clinical use of RTUS is only beginning to emerge, there is little doubt that it contributes previously unavailable and unrivaled information. Thus, it is my opinion that by incorporating the information available from RTUS with our existing diagnostic and management skills, thoughtful patient selection and as a component of a multi-modal treatment program, rehabilitation aimed at restoration of neuromuscular function is likely to be enhanced.

Jackie Whittaker BSc PT, FCAMT, CGIMS, CAFCI
Whittaker Physiotherapy Consulting
#101, 12761-16th Ave
Surrey, British Columbia V4A 1N2
Canada
www.RTUSPT.com

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