Clinician's Commentary on Armijo-Olivo et al.¹

The use of electrophysical agents in health care settings has been evaluated extensively, and none more so than therapeutic ultrasound (US).² The study by Armijo-Olivo and colleagues¹ explores the patterns, frequency, usage, and beliefs about therapeutic US among a sample of 19% of practising physiotherapists in the province of Alberta, adding to the growing literature. Armijo-Olivo and colleagues highlight that practising physiotherapists in Alberta believe that there is a lack of evidence to demonstrate US effectiveness. Nonetheless, the usage of therapeutic US by physiotherapists in Alberta remains high (85%), despite a decrease in usage over the past 15 years.

Therapeutic US is applied along a continuum of patient care from acute to chronic phases of inflammation and is used for a multitude of conditions. US can be considered as two separate modalities, depending on the parameters used for treatment (pulsed vs. continuous modes). Delivered in pulsed mode, US is used to facilitate cellular processes, enhance the resolution of inflammation,^{3–6} and facilitate wound healing.^{7,8} A recently published study showed that pulsed US increased cartilage thickness in people with knee osteoarthritis;⁹ in other studies, therapeutic US has been shown to increase fracture healing rates when delivered at low intensity in pulsed mode.^{10–12} US has also been used to enhance drug delivery into tissues.^{13–15} Delivered in continuous mode, US has been shown to heat high-protein-content soft tissue, thereby improving extensibility of scar tissue and soft tissue.^{16,17}

There is a misconception among physiotherapists that US is used to reduce pain, which is highlighted in Armijo-Olivo and colleagues' article.¹ Approximately 25% of physiotherapist respondents reported believing that US modulates acute and chronic pain, a lower percentage than previously reported.¹⁸ While therapeutic US does not directly reduce pain, its cellular and thermal effects do so indirectly. Confusion about the use of US as a "pro-inflammatory" or "anti-inflammatory" modality continues in clinical practice, as Armijo-Olivo and colleagues highlight. Athermal US lead to increased cell-membrane permeability, lysosomal activity, fibroblast proliferation, mast cell degranulation, collagen and protein synthesis, and vasodilation of arterioles – all activities that are consistent with healing. It has been suggested that the application of athermal US results in cell injury followed by a cell-recovery response,¹⁹ thereby enhancing the inflammatory process.

Surprisingly, Armijo-Olivo and colleagues' study highlights a belief among physical therapists that there is a lack of evidence for the effectiveness of US. The therapeutic benefits of US have long been established, and the parameters of treatment have been ascertained and supported in animal and human models. Unfortunately, studies examining cellular benefits of therapeutic US have mostly been confined to animal models, because of the logistical challenges of using human research participants. Diagnostic US can be used to evaluate edema, assess areas of calcification, and evaluate effects of disuse. However, diagnostic US use requires training for the operator. Training and use of diagnostic US imaging may make clinicians more apt to use therapeutic US when cellular outcomes can be objectively evaluated. At present, clinicians must rely on improvement in surrogate measures based on therapeutic objectives. The fact that

evidence for the effectiveness of US based on cellular-level indices in humans is lacking does not mean that therapeutic US treatment is ineffective. Until such time as therapeutic gains can be measured at the cellular level, clinicians will have to rely on the cellular evidence from animal models and on surrogate clinical measures.

When physiotherapy practice is constrained by time and resource limitations, it is important to evaluate the most effective interventions to address our clients' impairments. While there are many therapeutic approaches to patient management, treatment should be guided by the best available evidence. US, like many other treatment modalities, should be used in conjunction with other interventions, including manual therapy, education, and exercise prescription. The use of a particular modality may be limited not by the therapist's lack of knowledge of the available evidence but by clinician preference. Electrophysical agents should be used to achieve a desired therapeutic outcome, rather than to fulfil client requests or to achieve a placebo effect.

Sharon Gabison, BSc, BScPT, MSc

Physical Therapist, Lecturer, Department of Physical Therapy, University of Toronto

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