Characterising Therapist Perception of Tissue Response during Soft Tissue Palpation of Lymphoedema

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Introduction

Secondary lymphoedema is an incurable condition in which there is a decreased capacity of the lymphatic system to clear fluid from the interstitium (Warren, Brorson, Borud, & Slavin, 2007); and without appropriate treatment can potentially cause debilitating, permanent pathological changes to the subcutaneous tissue (Lawenda, Mondry, & Johnstone, 2009). In Australia approximately 8000 people will develop secondary lymphoedema annually almost exclusively following cancer or genitourinary related treatment (National Breast & Ovarian Cancer Centre, 2008). It is therefore important that accurate and reliable measures are available to monitor the efficacy of treatment (Myburgh, Larsen, & Hartzigsen, 2008). Currently there is no gold standard assessment method available to clinicians, so combinations of methods that complement each other are employed including volumetric, tissue compliance, fluid dynamics and fibrosis measures as well as manual assessment (palpation).

Manual assessment has long been regarded as an important element of the physical examination of a patient with lymphoedema (Simmonds & Kumar, 1993). During manual assessment clinicians use their knowledge of condition-specific pathological processes as well as palpatory skills developed through extensive practice and experience, to make qualitative evaluations based on their perceptions of the soft tissue (Zheng, Mak, & Lue, 1999). Currently these qualitative evaluations are subject to interpretation, bias and nomenclature confusion.

Background

The literature reports that clinicians who are proficient in palpating lymphoedematous tissue assess skin qualities that include: texture, thickness, turgor ("*an abnormality in the skin's ability to change shape and return to normal (elasticity)*" (University of Maryland Medical Centre, 2008)) and temperature; as well as the soft tissue characteristics that include pitting status, presence of fibrosis, depth of skin folds, and stiffness or compliance of the soft tissue (Bagheri et al., 2005; Gary, 2007; Piller & Eaton, 2004). This information aids the therapist in grading the oedema, and planning and monitoring treatment (Zuther, 2005).

Currently there are no universally accepted criteria for assessing or classifying lymphoedema by manual assessment. Some authors suggest the use of a positive Stemmer sign (the inability to pinch the skin on the dorsum of the fingers or toes) as evidence of the presence of lymphoedema (Harwood & Mortimer, 1995; Lawenda et al., 2009). Others such as Sussman and Bates-Jensen (cited in Lawenda et al., 2009) describe a zero to three point scale for grading tissue 'pitting', in which "firm pressure" is applied to the skin for more than five seconds, and the depth of any indentation of the skin is classified using subjective terms. The severity and reversibility of lymphoedema has also been classified using a zero to three point scale in which clinical signs such as reversibility of oedema with elevation, and volume measures are combined with palpatory assessments (Lawenda et al., 2009). Miller et al. (1999), suggests the adoption of a simple classification of lymphoedema "*based solely on*

clinical observations", which includes elements of inspection, palpation, gravitational effects and extremity function. Thus far there are few reports of the use of the Miller classification system in the literature.

Despite the range of skin and soft tissue qualities being assessed by manual palpation, little information appears in the literature which adequately either describes or characterizes tissue qualities found during the manual assessment of lymphoedema. Where descriptions of tissue characteristics are provided, they are subjectively rather than objectively defined (e.g., "*The skin may also be thin and fragile or thick and "woody""* (Zuther, 2005, p67)). Such subjective terminology is used extensively throughout the literature, and due to a lack of standardised definitions, the resulting assessments lack clarity and objectivity. Studies measuring reliability of palpation in other types of physical examination (such as detecting myofascial trigger points, or particular structures in the vertebral column) have shown greater intra-rater reliability than inter-rater reliability, suggesting variation between examiner's perceptions or assessment criteria (Simmonds & Kumar, 1993). Such assessment and reporting difficulties also result in imprecision in educating and training future clinicians (Zheng et al., 1999). It is evident that there is more to palpation than just applying pressure. Palpation is a complex process involving many factors we are yet to fully understand that influence therapist perceptions (Myburgh et al., 2008).

Anecdotally, there appear to be a number of factors that the clinician thinks are important as part of the manual assessment of soft tissue and which have not currently been evaluated. Although researchers are beginning to measure the physical characteristics of oedematous tissues when compressive forces are applied *in vivo*, no linkages as yet seem to be made between tactile force application and therapist perception. The literature is largely silent about which tissue characteristics are considered important by therapists.

Most information regarding palpation involves the assessment of other pathologies such as detecting lumps in breast tissue, and assessing the size of the liver and spleen (Simmonds & Kumar, 1993). One technique called layer palpation has been described for the assessment of myofascial structures. The technique involves the "skilful" application of a load either perpendicular (for compression), or obliquely (for shear forces) to the tissue, starting with the most superficial structures and progressing to the deeper ones (Hertling & Kessler, 2006). The descriptions used could be interpreted as either a force of increasing magnitude or as a constant force applied over time to allow deeper structures to be assessed, the latter allowing for the 'creep' response of tissues to occur. When considering the excess fluid present in the soft tissue in lymphoedema, a question is raised of whether constant pressure or increasing pressure is being applied during palpation. Presently, we do not know how therapists perform or interpret their palpation, or indeed if their findings are clinically relevant.

A poroelastic model has been proposed in an attempt to describe the mechanical behaviour of lymphoedematous soft tissue. The model comprises a solid elastic matrix interacting with a watery gel-like substance. Berry et al., (2008) describes the poroelastic model's response to a compressive force: *"When compressed, fluid flows down the compression induced pore-pressure gradient and away from the compression site. This causes a time-dependent decrease in the stress-strain ratio of the sample. This decrease in apparent stiffness is accompanied by a time-dependent spatially varying volumetric strain in the solid matrix."* In other words, the stiffness, shape and further time-dependent response of the tissue alters with fluid movement in response to applied pressure.

The strain ratio and its rate of change with time can be mapped with acoustic elastography *in vivo* (Konofagou, Harrigan, Ophir, & Krouskop, 2001), and has been used to image and quantify the response of oedematous soft tissue response to compressive force. Using this technique, oedematous forearms have been shown to have a larger time-dependent strain distribution than non-oedematous forearms (Berry et al., 2008). It is expected that issues of time-dependency and compression are likely to be amongst the primary factors for quantitatively defining tissue characteristics. To confirm this, it is important to understand firstly what it is that the therapist is doing and what they perceive when manually assessing soft tissue.

Myburgh et al., (2008) suggests the fundamental concept of manual assessment is the ability to distinguish the "*normal from the abnormal*"; and Beal (as cited in Comeaux, Eland, Chila, Pheley, & Tate, 2001) suggests manual assessment involves knowledge, detection and perception of tissue characteristics. Attempts have been made to comprehend what therapists think they perceive during palpation through psychophysics, which attempts to understand the relationship between tactile force applied and the sensation perceived (Nicholson, Adams, & Maher, 2003). Others have determined manual discrimination thresholds of stiffness and viscosity using various non-biological spring and viscoelastic models (Nicholson et al., 2003; Nicholson, Maher, & Adams, 1998) with good repeatability being shown in discrimination tasks using these models. However, repeatability has been shown to be poorer for manual discrimination tasks conducted *in vivo*, possibly due to the complexity of the composition and mechanical properties of soft tissue compared with non-biological models (Nicholson et al., 1998). Myburgh et al., (2008) reported that previous investigations into the reproducibility of palpation generally exhibited poor methodologies that resulted in conflicting conclusions. The highly subjective nature of manual assessment coupled with the complexity of pathological changes occurring in lymphoedema make it difficult to know how therapists gather and interpret the information from their palpation.

Aims and Objectives

We propose that: (i) a new approach to the matter of describing tissue characteristics and tissue palpation is needed; and (ii) that only once this is understood, can we develop physical measures of these characteristics. Although the development of a standardised and reliable method for assessing soft tissue is important, prior to developing such a method we need to first understand: (a) what the therapist is doing when palpating lymphoedema; (b) the response (mechanical behaviour) of the soft tissues to palpation; and (c) how therapist perception and interpretation relates to the physical tissue responses.

It is for this reason that we set out to qualitatively investigate, through semi-structured interviews with physiotherapists experienced in the manual assessment of lymphoedema: 1) the techniques physiotherapists use to palpate lymphoedematous soft tissue; and 2) how physiotherapists perceive and interpret their palpation findings. These interviews are designed to identify and explore factors considered by physiotherapists to be relevant when manually assessing unilateral upper limb secondary lymphoedema. In the future a mixed methods approach will be used (both qualitative and quantitative) to further elucidate these factors. We will only be reporting the qualitative component in this report, specifically a phenomenological approach to describe how physiotherapists experience the phenomenon of palpation. In-depth interviews are being utilised to search for commonalities and themes in expression across individuals' descriptions of their palpation assessments. At the time of writing, these interviews are in the process of being completed. Preliminary findings and

indications, based on clinical observations and completed interviews for this pilot study, are described below.

Findings

In our preliminary findings, physiotherapists describe that, at the beginning of their manual assessment of patients with unilateral upper limb lymphoedema, they palpate both of the patient's upper limbs simultaneously using gentle squeezing and sliding palpatory techniques. Comparisons are made between the patient's two arms and then palpation techniques are focussed on areas where tactile differences have been perceived by the physiotherapist. During this focussed assessment, physiotherapists continue to use two hands with the physiotherapist's dominant hand performing more of the probing/exploratory palpation techniques.

When asked to describe the specific methods used, the physiotherapists have difficulty describing their palpation technique and, at several times during the interviews are observed to perform palpation on their own limbs to guide psychoevaluative aspects of the interview process. A common thematic expression is emerging in the interviews where physiotherapists comment that they "*really have to think hard*" about what they do during palpation indicating that the usual act of palpation is performed in an automatic sequence by experienced clinicians. Physiotherapists seem able to clearly describe their interpretations (outcome), but are less able to clearly describe the processes whereby the perceived characteristics lead them to these interpretations.

It appears that experienced physiotherapists have the ability to subconsciously filter information perceived through palpation, (i.e., the texture of the skin, soft tissue compliance, temperature, skinfold thickness and turgor) and integrate this into an interpretation of lymphoedematous soft tissue characteristics. These characteristics include the presence and extent of soft tissue fibrosis, thickening, and pitting. Therapists have difficulty in describing their perceptions of these characteristics (i.e., what these characteristics felt like), and give subjective definitions (e.g., describing tissue in which pitting will occur as feeling 'gluggy' or 'boggy') that are difficult to quantify.

During the interviews, physiotherapists also demonstrate and describe using different hand movements to assess different soft tissue qualities. Fibrosis and thickening are demonstrated and described as being assessed using gentle squeezing; while pitting is assessed through applying pressure using the pads of the distal phalanges of fingers two through to four, or the thumb.

As part of the mixed-method approach being utilised in this pilot study, the authors are attempting to quantify which parts of the physiotherapists' hands are utilised in the palpation examination of lymphoedema. As data is collated we will determine from which areas of the hands physiotherapists believe they perceive most information regarding different soft tissue qualities. Physiotherapist perceptions combined with preliminary measurements of patterns of force application will be used to develop a method of measuring both the magnitude and pattern of forces that physiotherapists use during palpation assessment of lymphoedema. In turn, the resulting data will be used to develop more effective methods for teaching palpation assessment techniques.

Summary

Manual palpation assessment of soft tissues is one method of evaluating the severity of lymphoedema. Palpation of soft tissues is a highly subjective process that, coupled with the various pathological changes occurring in lymphoedema, makes it difficult to confirm the reliability and repeatability of the assessment. To comprehend what it is that a therapist perceives when manually assessing soft tissue, we have set out to understand the techniques that physiotherapists use to palpate lymphoedematous tissue and how they perceive and interpret the palpation findings. The results from this pilot study will aid in identifying objective characteristics of manual assessment of lymphoedema that can be explored further and quantified during further studies. These investigations will contribute to knowledge in the field of manual palpation examination which may aid in further development of diagnostic as well as educational tools and methods.

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