

**These projects will be supervised primarily by Steve Tumilty, Lecturer, with an appropriate co-supervisor for each of the varying topics.**

**To discuss any of the projects further, please contact: [steve.tumilty@otago.ac.nz](mailto:steve.tumilty@otago.ac.nz)**

**To apply, please contact: [nicola.clarke@otago.ac.nz](mailto:nicola.clarke@otago.ac.nz)**

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### **Therapeutic application of Low Level Laser Therapy (LLLT):**

**Musculoskeletal:** Tendon injuries are becoming an ever increasing burden on the health system. For example in New Zealand in 2003, 412 Achilles tendon ruptures cost the Accident Compensation Corporation (ACC) approximately NZ\$2 million; furthermore, the incidence is rising. Low level laser therapy (LLLT) is the term used to describe the use of low power laser and superluminous diodes for the treatment of a variety of medical conditions and has emerged as a possible treatment modality for tendon injuries. Accepted effects of LLLT are enhanced ATP production, enhanced cell function and increased protein synthesis. It has also been shown to have positive effects on reduction of inflammation, increase of collagen synthesis and angiogenesis. However, the effectiveness of LLLT for the treatment of Tendinopathy in the clinical setting has not been adequately established. As with any electrotherapy device, LLLT is a dose dependant modality and there is a need for further well conducted randomized controlled trials to find the most efficacious dose.

#### **Refs:**

Tumilty S. (2007). Achilles Tendon Rupture: Rising Incidence in New Zealand Follows International. *Physical Therapy Reviews* 12, 59-65.

Tumilty S, Munn J, Abbott JH, McDonough S, Hurley DA, & Baxter GD. (2008) Laser Therapy in the Treatment of Achilles Tendinopathy: a Pilot Study. *Photomedicine and Laser Surgery*. 26(1); 25-30.

Tumilty S, Munn J, McDonough S, Hurley DA, Basford JR, 7 Baxter GD. Low Level Laser Treatment of Tendinopathy: A systematic Review with Meta-Analysis. *Photomedicine and Laser Surgery*. (in press).

**Laser Acupuncture:** Laser acupuncture is promoted as safer than needle acupuncture due to it's non-invasive nature of application. It has been recommended as an effective alternative to metal needles for the stimulation of acupuncture and musculoskeletal trigger points. As with traditional acupuncture, it's effectiveness has been claimed for a variety of soft tissue injuries, acute and chronic pain conditions and some systemic illnesses. To date the studies investigating laser acupuncture have been of variable quality and there is a need to support the use of this modality with a well conducted high quality RCT.

#### **Ref:**

Baxter G.D., Bleakley C., & McDonough S. (2008). Clinical Effectiveness of Laser Acupuncture: A Systematic Review. *J Acupunct Meridian Stud*. 1(2):65-82.

**Neurological:** In recent times there have been many animal studies exploring the effect of LLLT on damage to the central nervous system. Transcutaneous application of LLLT has been shown to penetrate to the depths of the spinal cord and also through the skull to brain tissue and therefore can show an effect in spinal cord injuries and stroke. As well as stimulating axonal growth it significantly decreases the invasion of cells that are involved in secondary damage such as macrophages. Emerging areas of interest is in the use of LLLT for neurodegenerative disorders such as Parkinson's, Motor Neuron Disease and Alzheimers. Much more research is needed to establish LLLT as an effective therapy for CNS injuries and to find the optimum parameters as well as the time in the healing process for application. A systematic review is required to evaluate the evidence from animal studies to justify the next stage; which would be to conduct an RCT on human subjects.

Ref:

Anders J.J. (2009). The Potential of Light Therapy for Central Nervous System Injury and Disease. *Photomedicine and Laser Surgery*. 27(3); 379-380.

**Diabetes:** The use of laser phototherapy to treat diabetes is in it's infancy, but gaining popularity in Europe. Here in New Zealand diabetes is a major public health concern affecting 10% of Europeans and 20% of Maori and Pacific Islanders by the age of 70. The effects claimed with this modality are reduced glycemia and the progressive reduction of insulin and anti-diabetic drugs during the course of treatment. In addition to exercise and dietary changes the use of LLLT to treat this condition may well bring added benefit to the patient. More research is needed to refine the treatment application and explore the mechanisms of action.

Ref:

Longo L. (2008) Laser Therapy of Diabetes: Update. *Lasers in Medical Science*; 23, supp 1. p.34.

### **Clinical Studies of Musculoskeletal interventions:**

**Diagnostic ultrasound:** Diagnostic ultrasound or musculoskeletal ultrasound as it is sometimes referred to, is becoming an accepted tool for physiotherapists when used as a sophisticated biofeedback mechanism in the retraining of core stability. However, its role in assisting with therapeutic interventions in the musculoskeletal & sports injury settings has been to date underused. If properly used, musculoskeletal ultrasound can aid in the accuracy of diagnosis and treatment, improve time to treatment intervention, and improve patient satisfaction. Work is needed to explore the different applications of this tool to increase efficiency and outcomes of physiotherapeutic interventions.

**Interactive Computer play for Musculoskeletal injuries:** Interactive computer games have been used to rehabilitate children with sensorimotor disorders. Interactive software has also been used to aid the rehabilitation of adults with neurological deficits suffered after incidence of stroke. However, the potential application of such technology in the area of musculoskeletal injury has not been extensively explored. Rehabilitation exercises are often

mundane leading to lack of patient motivation and little independent patient exercise taking place between sessions with the therapist. Retraining of balance and proprioception, hand-eye coordination, and to a certain extent, strength and flexibility may all be possible through the utilisation of modern computer software. Research into the efficacy and effectiveness of such an approach is warranted.

Refs:

Sandlund, M., S. McDonough, et al. (2009). "Interactive computer play in rehabilitation of children with sensorimotor disorders: A systematic review." *Developmental Medicine and Child Neurology* **51**(3): 173-179.

M. Ma, et al. (2007). Adaptive virtual reality games for rehabilitation of motor disorders. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*. **4555 LNCS**: 681-690.