THE ROUTINE MAINSTREAM MEDICAL USE OF LLLT
WHY HAVE WE NOT ARRIVED YET?

Dr Roberta Chow MB BS (Hons) FRACGP PhD
CLINICAL USE OF LLLT – FOCUS ON PAIN
Disclosure / Credentials

• GP – Medical Grad 1972 (Hons 2)

• FRACGP (1992) – Winner of Monty Kent-Hughes Medal

• Other qualifications: Fellowship of the Medical Acupuncture College, Masters Applied Science in Medical Acupuncture, Graduate Certificate of Pain Management (U Syd)

• Member Therapeutic Goods Association – Adverse Drug Reactions Advisory Committee, Complementary Medicines Evaluation Committee, Member AMA Council, Examiner with the College of GPs, Member of the Steering Committee for the National Pain Strategy, President of the Australian Medical Laser Association.

• Using laser in practice since 1988 – 15mW, 830nm

• PhD – 2006 University of Sydney, Faculty of Medicine – Laser treatment of neck pain

• National Health and Medical Research Foundation – 3 yr grant to study the effects of laser on nerves

• Published 14 papers including a systematic review on neck pain published in the Lancet and four book chapters

• Have worked in a large general practice for 25 yrs and now my own practice for 1 yr
• I have no financial interest or other potential conflict of interest

..........why am I doing this??
In the US chronic suffering due to pain costs the country $560 to $635 billion each year in medical bills, lost productivity and missed work.

52.5 million Americans are currently living with arthritis, the nation's leading cause of disability and the second most frequently reported chronic condition in the United States.

Serious, chronic pain affects at least 116 million Americans each year, many of whom are inadequately treated by the health-care system, according to a new report by the Institute of Medicine (IOM).

By 2030, an estimated 67 million Americans will have arthritis unless the trend is reversed. CDC estimates 8 million new cases of arthritis will be diagnosed in the next decade.

CDC: annual cost of arthritis to the economy was $128 billion in 2003 and increased by $20 billion between 1997 and 2003

Arthritis Foundation
• PERSISTENT PAIN - EPIDEMIC PROPORTIONS

• GLOBAL BURDEN OF DISEASE (2010) – Musculoskeletal disorders make up 21.3% of 777 million disability-adjusted life years (DALYS)

• DALYS for low back pain have increased from 58.2 million in 1990 to 83 million in 2010

• In 25 European countries and beyond 100 million Europeans suffer from musculoskeletal disorders accounting for 49% of workplace absence and 60% of permanent work incapacity in the EU. Cost: €240 billion Fit for Work? Musculoskeletal Disorders in the European Workforce Report September 2009

High-risk NSAIDs remain popular worldwide

Diclofenac should be removed from essential medicine lists (EMLs) worldwide, according to the authors of a report published in *PLOS Medicine*. Using data from published meta-analyses, the authors correlated the relative risk of cardiovascular events associated with specific non-steroidal anti-inflammatory drugs (NSAIDs) with the EMLs of 100 countries and sales information for NSAIDs in 15 countries. Apart from diclofenac, which was removed from EMLs worldwide 8 years ago, diclofenac was the NSAID most associated with an increased risk of cardiovascular events (40%-60% higher relative risk compared with non-users). Yet it remains on the EMLs of 71 countries, including Australia. In contrast, naproxen, rated the safest of the NSAIDs, features on only 27 EMLs. An accompanying editorial said that “emerging evidence about NSAID risk is poorly translated into practice and sales in countries around the world, raising questions about the use and promotion of potentially harmful drugs”.

PlosMed 2013; 10 (1): e1001388
doi: 10.1371/journal.pmed.1001388
PlosMed 2013; 10 (1): e1001389
doi: 10.1371/journal.pmed.1001389

**NSAIDS AND SIDE EFFECTS**

Non-steroidal anti-inflammatory drugs (NSAIDs) are among the most widely used drugs in the world.

**Study links low-dose NSAIDs to stroke risk in healthy population**

their long-term use is limited by serious gastrointestinal side-effects.

**Miscarriage risk prompts warning on NSAID use in pregnancy**

Anna Evangelou

A *study* finding an increased risk of miscarriage in women taking NSAIDs has been reported in *The Lancet*.

**NSAIDs: study suggests no safe dose post-MI**

There is no safe dose of anti-inflammatories for people with a history of myocardial infarction, research finds, rekindling debate on the risks of over-the-counter NSAIDs.

**Risks associated with NSAID use**

The Dutten study of almost 85,000 patients with prior MI found both short- and long-term use of NSAIDs increased the risk of a further MI and death.

Those taking any NSAIDs over the eight-year study period faced a 45% increased risk of death or MI at the beginning of treatment, and the risk persisted throughout the treatment duration.

The authors called for limits on NSAID use, noting the increase in risk with diclofenac (Voltaren) was higher than for rofecoxib (Vioxx), which was withdrawn in 2004.

“The present results indicate that there is no apparent safe therapeutic window for NSAIDs in patients with prior MI,” they wrote in *The Lancet*. Professor Len Killander, head of cardiology at Concord Hospital in Sydney, said the study added to mounting evidence that NSAIDs increased cardiovascular risk, but said he did not support an outright ban for CV patients.

“The advice would be to avoid the drugs where possible, to take them for the shortest period of time possible and to take them under supervision of a family doctor,” he said.

“The most important thing is that there’s a warning to patients and ideally that patient information, verbal and written, acknowledges this risk so that patients know what they’re doing.”

The study adds to growing evidence
Opioids may promote tumours

Lynnette Hoffman

OPIOIDS given to reduce pain in cancer patients may actually promote tumour growth and metastasis, two studies suggest.

In one study, based at the University of Chicago, overexpression of opioid receptors in a lung cancer cell line increased in vitro and in vivo measures of tumour growth and metastasis.

In another study, based at the University of North Carolina at Chapel Hill, naturally occurring genetic differences in opioid receptor biology correlated to breast cancer survival in a cohort of more than 2000 women.

Breast cancer mortality was significantly reduced (at least halved) in patients with a genetic variant in the opioid receptor that reduces opioid response.

Several studies have shown a reduced incidence of cancer recurrence after reduced doses of opioids post-surgery for breast, prostate and colon cancer and melanoma, although others have not detected any significant differences, the authors of the lung cancer study noted. They said their results indicated opioids in these epidemiological findings.

But Melbourne Health anaesthetist Dr Malcolm Hogg, president elect of the Australian Pain Society, called that “a big jump”.

He said that while it was important to be aware of the link, other factors likely contributed to the outcomes.

“Whilst opioids themselves appear to inhibit immune cell function in the laboratory, we also know that poorly controlled pain impairs immune function,” Dr Hogg said. “So removing opioids and having poorly controlled pain could potentially be just as detrimental.

“When you’ve got less pain, you’ve got less stress reaction, and so we believe the immune system functions better.”

He said patients should be given a combination of simple analgesics such as paracetamol and anti-inflammatories — along with nerve-modulating medication to improve pain control.

“This can have the effect of limiting reliance and dosage levels of opioids, but opioids should not be excluded.”

*Anaesthesia 2012; 116:857-61;866-902*
Opioid epidemic in the United States.


• One in 6 or 17.3% of users of non-therapeutic opioids indicated that they received the drugs through a prescription from one doctor.

• The escalating use of therapeutic opioids shows hydrocodone topping all prescriptions with 136.7 million prescriptions in 2011, with all narcotic analgesics exceeding 238 million prescriptions.

• opioid analgesics are now responsible for more deaths than the number of deaths from both suicide and motor vehicle crashes, or deaths from cocaine and heroin combined.
• Despite low-quality evidence supporting practice change, use of chronic opioid therapy (COT) for chronic non-cancer pain increased dramatically over the past two decades.

• Concurrently, opioid analgesic overdose deaths, addiction, misuse and diversion have increased markedly. COT may provide modest, variable short-term pain relief for some patients with chronic pain. Long-term benefits of COT for chronic pain have not been established. Potential medical and behavioral harms of opioids are an important concern...

• Escalating the prescribing of opioids has been repeatedly linked to a myriad of individual and public harms, including overdose deaths. Many patients on long-term opioids may never be able to taper off them, despite their associated toxicities and lack of efficacy.
• Long term opioid therapy may cause adverse effects on the respiratory, gastrointestinal, musculoskeletal, cardiovascular, immune, endocrine and central nervous systems. (Hayes 2013)

• A US healthcare data study of those prescribed opioids continuously over 90 days and then followed up for up to half a decade, showed about two-thirds remained on them. 37
Despite low-quality evidence supporting practice change, use of chronic opioid therapy (COT) for chronic non-cancer pain increased dramatically over the past two decades. Concurrently, opioid analgesic overdose deaths, addiction, misuse and diversion have increased markedly. COT may provide modest, variable short-term pain relief for some patients with chronic pain. Long-term benefits of COT for chronic pain have not been established. Potential medical and behavioral harms of opioids are an important concern...

Escalating the prescribing of opioids has been repeatedly linked to a myriad of individual and public harms, including overdose deaths. Many patients on long-term opioids may never be able to taper off them, despite their associated toxicities and lack of efficacy.
OVERVIEW OF THE USE OF LLLT
Physiological effects of LLLT

• Tissue Repair
• Inflammation
• Oedema
• Analgesia
• Protective (muscle fatigue, oral mucositis)
Applications for LLLT with moderate-strong evidence

- Tendinopathies (Achilles, lateral epicondylitis)
- Chronic joint disorders (OA, RA)
- Back and neck pain (sciatic pain, whiplash)
- Neuropathic pain (PHN, trigeminal neuralgia)
- Non healing wounds (diabetic, venous, pressure)
- Cancer therapy side-effects (Oral Mucositis, lymphoedema, Radiation dermatitis,)
- Dental (post-extraction, TMJ, HSV, orthodontic pain and accelerated tooth movement)
My research

- Most other doctors did not believe in what I was doing…..so I thought I would put it to the test
- I believed in evidence-based medicine
- My observation: some patients reported numbness during treatment – was it a direct effect on nerves?
- Clinically based studies: Review of the literature, a pilot study, an RCT on neck pain
- Lab studies: investigation of effects of laser on nerves
Effects of laser on nerves

- Immunohistochemistry
  - Cultured, neonatal rat dorsal root ganglion neurons
  - Immunohistochemistry - anti-β tubulin antibodies
- Live cell imaging - JC 1
  - Measured Mitochondrial Membrane potential
  - Fast axonal flow
- 650nm, 808nm & 830nm LI

LASER-IRRADIATED AXON SHOWING VARICOSITY IN REAL TIME OVER 10 MINUTES OF OBSERVATION - LI
CONTROL AXON SHOWING NORMAL FAST AXONAL FLOW
FAST AXONAL FLOW - TRANSPORT OF MITOCHONDRIA – LASER DISRUPTS THE CYTOSKELETON

Before LI

AFTER LI

*diagram not to scale*
Compound Muscle Action Potential (CMAP)

- is the electrical recording of the combined action potential of all muscle fibres
- measures latency of the action potential (time from stimulus to positive n wave) and amplitude (height of the positive wave)
- is a measure of motor nerve function
- reflects conduction velocity

Somatosensory Evoked Potential (SSEP)

- is an electrical recording of the maximal response of sensory nerves at the spinal cord (L1/T12) to supramaximal stimulation of the sensory nerves in the skin at the ankle
- stimulation: in skin at ankle and recording in skin proximally at L1/T12
- is measured orthodromically - i.e. in the direction of normal nerve conduction
- is a measure of function of sensory fibers

Laser Suppressed nerve conduction in both sensory & motor nerves
Laser blocks nerves and this has been demonstrated in lots of nerve models.

It is selective for pain fibres.

Once pain fibres are blocked, inflammation is also reduced.

The cascade of pain is inhibited.

……but doctors still don’t accept it.
• 50yr old female with an extremely painful frozen shoulder for 6 months - to have an arthroscopic biopsy of the shoulder joint lining

• No health insurance

• Cost $6,000

• Had treatment – no need for biopsy – dx severe frozen shoulder
Systematic reviews and guidelines

- BMJ sports medicine journal 2010, frozen shoulder "strong evidence"
- IASP 2010 "strong evidence" myofascial pain syndrome.
- American Physical Therapy Association guidelines for Achilles tendonitis
- The Lancet 2009 acute and chronic neck pain
- WHO 2008 Neck Pain
- MASCC Oral Mucositis
Systematic reviews and guidelines

• Over 400 RCTs

• Over 4,000 laboratory studies

• USA, European, Canadian and Australian regulatory approvals for LLLT

• But no reimbursement by any insurance company or government healthcare system (except Norway)
SO HOW FAR HAVE WE GOT?
YOUR THOUGHTS ON WHY LLLT IS STUCK AND WHAT NEEDS TO BE DONE
Why LLLT is still a fringe therapy and what is missing?

- Mechanism of action?
- Clinical evidence?
- Regulatory approval?
- Reimbursement?
- Key opinion leaders?
- Lack of guidelines?
- Return on investment for doctors and therapists?
- Lack of marketing by manufacturers?
- No industry standard?
- Too good to be true?
- Doctors refuse to believe that light can heal?