Commentary on J. Kennedy Elliott's paper entitled: The cause of disability following limb injuries

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ABSTRACT

Over 70 years ago, J. Kennedy Elliott, an orthopaedic surgeon, wrote a paper for the Society journal that provided important information for physiotherapists concerning the treatment of fractures and other similar injuries. Many of his thoughts remain part of current orthopaedic practice, and continue to influence our rehabilitation of such injuries. Although notable advancements have occurred in clinical practice, the major changes since Elliott's time reflect developments in knowledge in the basic sciences that are associated with orthopaedics and rehabilitation. These include physiology, biochemistry and biomechanics. Such advances have led to more efficacious programs that have limited the degree of disability associated with these musculoskeletal injuries.

McNair P (2013) Commentary on J Kennedy Elliott's paper entitled: The cause of disability following limb injuries. New Zealand Journal of Physiotherapy 41(1): 20-21.

In 1938, physiotherapists were far from being the practitioners that they are today. They were not able to make diagnoses, and develop and implement treatment programs independently. It was a time where therapists were primarily masseuses who could also utilise electricity to induce currents within the body to heat and stimulate various tissues with the ultimate aim of enhancing the healing process (Tidy 1932). Some had also training in "remedial exercises" which had proved to be of notable value in the treatment of patients with polio in the early 1900s.

Elliott, an orthopaedic surgeon, provides a commentary on aims and methods for the treatment of fractures particularly, but also refers to some conditions that involve joints. It is interesting that the principles of fracture treatment have not changed dramatically in the past 70 years. The emphasis today remains upon achieving good alignment, and healing and the subsequent restoration of function (Al-Rashid et al 2010). The implants, procedures and tools that can be utilised to achieve these aims are what have changed dramatically.

In Elliott's time, the use of implants was at an early developmental stage with limited choice of materials that might be utilised to support a fracture site prior to union. Today, there are numerous wires, nails, screws and plates that the surgeon can choose from depending upon the type of fracture and the loading required at the fracture site. For instance, there are currently five main plate designs that include buttress, compression, protection and bridge plates (Ruedi et al 2007). These different designs are made of specific materials and are melded to control unwanted bending, torsional and shearing loads. Furthermore, the likelihood of tissue rejection is much reduced by the use of materials such as stainless steels and alloys of chromium and titanium (Gotman 1997), which were not available when Elliott was practising.

Surgical techniques have also developed notably. Most recently, minimally invasive surgical techniques allow the insertion of such plates percutaneously or through limited incisions, thus limiting the subsequent number and extent of impairments and hence enhance function, as well as reducing the chances of infection (Krettek et al 1997). Today, surgeons also have greater access to scanning procedures (e.g. fluoroscopy and portable radiography) to check their work immediately following the reduction of fractures, hence ensuring good alignment of fractures in the early period following an injury. Interestingly, it is apparent that many tools that would have been utilised by Elliott have survived the test of time. Phillips and Biant (Phillips and Biant 2011) note Plaster of Paris is still utilised regularly, and the design of the Thomas splint and a number of instruments such as saws, bone nibblers and osteotomes have changed little since their inception.

Furthermore, new adjunctive techniques such as bone grafting (Cabraja and Kroppenstedt 2012) and chemical agents (natural and synthetic) (Virk and Lieberman 2012) have been developed to promote fracture healing. These include hydroxyapatite, tricalcium phosphate, and calcium sulfate, as well as other biologic agents such as bone morphogenic protein, -transforming growth factor, and platelet-derived growth factor (Brandi 2012).

In respect to infection, there is now a greater emphasis on its prevention. In 1938, there was limited knowledge of the different kinds of infective organisms that could proliferate after an injury, and there were few drugs to combat their presence. Penicillin for instance, was in its final stage of development. Today, the early administration of specific antibiotics following fracture has been shown to substantially reduce the chance of infection (Patzakis and Wilkins 1989)

Clinical procedures in orthopaedics have developed in parallel with advances in knowledge in the basic sciences associated with the musculoskeletal system. There has been a dramatic increase in our understanding of physiology, biochemistry and the biomechanics associated with the stages of healing following fracture (Taljanovic et al 2003). We better appreciate the presence of particular cells, how they act and interact with others, and how we might influence their actions at the different stages through chemical and physical agents. As such, surgeons can plan their treatment strategy more effectively and physiotherapists can implement more efficient rehabilitation programs, ultimately leading to a more expedient return to work and recreation.

Elliott highlights disuse atrophy as the commonest cause of disability following a notable injury. At this time (1920-30s), research was providing early evidence of mechanisms for atrophy following injury. These included thoughts that not only a structural change was evident in the muscle fibres as a result of disuse, but also a neural mechanism might be operating that contributed to the muscle weakness observed (Harding 1929). These pathways continue to be examined today (Rice and McNair 2010) and even now we do not have a regime that adequately addresses neural inhibition. The position in which a limb is immobilised is also emphasised by Elliott as a mechanism that might potentiate greater disability. Today, we recognise not only the effects of oedema in causing adhesions that limit motion, but also the effect of such immobilisation on muscle fibre length, with muscles immobilised in a shortened position the most affected, and the need to apply periodic stretching activities to limit such changes (Williams 1990).

Elliott suggests the need to immobilise the limb for only a limited period and to exercise all joints that do not affect the stability of the injury site. These principles remain fundamental to rehabilitation today. However, in 1938, knowledge of muscle physiology, and how muscle and other tissues reacted to exercise and training was very limited. At the time, exercise principles for rehabilitation were largely based upon those associated with athletic training. Specific training regimes to remedy muscle atrophy were yet to be developed. For instance, it was not until the second world war, shortly after Elliott's paper was published, that Delorme and Watkins (Delorme and Watkins 1948) developed a systematic training regime for muscle strength deficits. Notably, this regime is still used today in exercise rehabilitation.

There is also now a greater appreciation of the social and psychological factors that can influence rehabilitation after notable trauma. It is well known that certain personality states (e.g. anxiety) and traits (e.g. self-efficacy) can affect rehabilitation progress, and that specific programs tailored to these problems can be extremely beneficial in improving outcomes related to disability (Geisser et al 2003). Similarly, we can assess genetic variants that might increase the chances or risks of chronic pain syndromes emerging in certain patients (Lee and Tracey 2012). Such abilities allow us to target specific patients and alter their rehabilitation to prevent such problems from emerging.

As Elliott writes, in the 1930s practices in surgery and rehabilitation were based on "dogma", that is, unsupported opinion usually by an authority figure and often presented in a manner that induced belief in listeners/readers. Research in orthopaedics was in its infancy and since Elliott's time the number of journals related to orthopaedics has increased 10 fold (Smith 2006). Additionally, in the past 20 years, evidence based medicine's emergence accelerated, with a focus upon utilising research evidence for making clinical decisions, and as such clinical decision making has become grounded in assessment based on science (Guyatt et al 2000). Clinical research is now also evaluated in a systematic manner, and we have established levels of evidence to ultimately appreciate and assess the quality of research available in answering a particular clinical question (McNair and Lewis 2012).

As I reflect upon the words of Elliott written some 70 years ago, I think that if I had had to work as a physiotherapist at that time, encumbered by a lack of freedom to act independently, (and perhaps rightly so given the amount of training and thus knowledge I might have had at the time), I would have liked to work with this man. He thought critically about his practice, and hence displayed open mindedness, and a willingness to appreciate how little was known, and what was known to be largely empirically based. He was also game to take on new concepts and embraced the importance of mobilisation and exercise therapy, two principles that remain cornerstones of our profession today.

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