AN IMPACT OF OSTEOPATHIC MANIPULATIVE TECHNIQUE WITH SPECIALREFERENCE TO MUSCULOSKELETON DISORDERS

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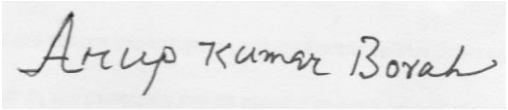
DECLARATION

I hereby declare that this thesis is the result of investigation which has been carried out by me under the supervision of thesis guide Dr.(Professor) Shawn Pourgol as supervisor as well as mentor of National University of Medical Sciences, Spain.

I would like to acknowledge the Registrar of National University of Medical Sciences, Spain for various communications and provide me details up to date information as well as inspiration in due course of time in a prompt way.

I declare that this thesis as a whole or may part thereof has not been submitted by me for any research degree, to this university or may other university / Institution.

Finally, I wish to thank my wife Dr. Pori and our children Dr. Roktutpal and Pratyushpal for their love, inspiration and unconditional support throughout the year of studying.



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ABSTRACT

Recent evidence has undermined much of the biomechanical based reasoning of osteopathy. This has led to considerable discussion of the future of the distinctiveness of osteopathy and proposals for new models of osteopathic approaches. Current research on pain processes, aetiology and clinical effectiveness supports a biopsychosocial perspective in clinical reasoning for musculoskeletal pain. New clinical reasoning models proposed by osteopaths Fryer and Lederman are considered alongside models from other professions. Process based models are based on a biopsychosocial approach and involve changes to diagnostic reasoning and treatment rationale. Evidence shows the need for multi-dimension, multimodal approaches in treatment of musculoskeletal pain. These models may provide a means of applying evidence to practice and a rationale for hands-on manual therapy. Adoption of new models of osteopathic care require change to practice incorporating education and more active approaches alongside hands-on care. Consideration is given to how osteopaths need to adapt and the future of osteopathy in musculoskeletal medicine.

LIST OF ABBREVIATIONS

AACOM	American Association of Colleges of Osteopathic Medicines
ACC	Anterior cingulated cortex
ANS	Automatic nervous system
BA 6	Brodmann area 6(pre-motor cortex and supplementary motor area)
BA 2	Brodmann area 2 (somatosensory cortex)
BMI	Body mass index
BSO	British school of osteopathy
BCOM	British college of osteopathic medicines
CBL	Case base learning
CI	Confidence interval
CNS	Central nervous system
DLPFC	Dorolateral prefrontal contex
EEG	Electrocephalography
fMRI	Functional magnetic resonance imaging
GOsC	General osteopathic council
H-D	Hypothetico deductive
IPS	Intraparietal sulcus
LTM	Long term memory
LOC	Lateral occipital complex cortex
MOC	Medial occipital cortex
MRI	Magnetic resonance imaging

MSK	Musculoskeletal
M1	Primary motor cortex
OFC	Orbitofrontal cortex
PCS	Post central sulcus
PET	Positron emission tomography
PFC	Prefrontal cortex
PNS	Peripheral nervous system
PPC	Posterior parietal cortex
PSIS	Posterior superior illiac spine
PBL	Problem based learning
TMS	Transcranial magnetic stimulator
UV	Ultraviolet
VAS	Visual analogue scale
VHB	Virtual haptic back
V1	Primary visual cortex
V2, V3,V4	Secondary visual cortex
WM	Working memory
WHO	World Health Organization

The Global Year about Back Pain aims to guide and support clinicians, scientists, and the public in understanding the global challenges of preventing and treating back pain.

We certainly hope this campaign leads to better patient outcomes and contributes towards IASP's (International Association for the Study of Pain) vision of global-pain relief.


IASP 2022
GLOBAL YEAR
Translating Pain Knowledge to Practice
#globalyear2022

INTRODUCTION

Osteopaths commonly treat back problems which represent a prevalent and costly cause of pain and disability (Andersson et al., 1999; Maniadakis and Gray, 2000). Founded in 1874 by Andrew Taylor Still, an American physician, osteopathic medicine (or osteopathy) is a system of manual diagnosis and treatment for a range of musculoskeletal and nonmusculoskeletal clinical conditions. It is distinguished from other health care professions by the fact that it is practised according to an articulated philosophy (Seffinger, 1997). It claimed unique philosophy of health care is supported by current medical practice with an emphasis on the unity of the body, interrelationship between structure and function, and an appreciation of the body's self-healing mechanisms (Seffinger, 1997; Mc Partland and Pruit, 1999). One of its defining characteristics is the emphasis placed on the musculoskeletal system as an integral part of patient care (Rogers et al., 2002). Osteopaths utilize a wide range of therapeutic techniques to improve function and support homeostasis that has been altered by somatic dysfunction (WHO, 2010). Somatic dysfunction is described as the altered or impaired function of skeletal, arthrodial, and myofascial components of the somatic (body) framework and their related vascular, lymphatic, and neural elements (DiGiovanna, 2005c).

Since its inception, in 1874, osteopathic medicine has developed into two distinct forms of clinical practice. Whereas in the USA, osteopaths have full medical practice rights; in the UK and in Australia, osteopaths have a limited scope of practice with an emphasis on the provision of manual therapy (Hartup et al., 2010). Notwithstanding this, in the UK osteopaths operate as primary contact practitioners and follow a four or five-year academic programme of study. At the point of graduation, students are required to possess a clinical competence profile which enables them to effectively operate as autonomous health care practitioners. This competence profile is reflected on a well developed clinical reasoning (GOsC, 1999). Clinical reasoning is widely recognised as the essential element for competent autonomous health care practice (e.g., Higgs and Jones, 2000; Jones and Rivett, 2004). Although osteopathic curricula share commonalities with allopathic medical curricula, as a reflection of the osteopathic philosophy, osteopathic curricula emphasis the application of manual methods of patient examination and treatment. As

a result of this emphasis, clinical decision making is heavily reliant on palpatory diagnostic findings. In fact, the GOsC (General Osteopathic Council) in their Standard 2000; Standard of Proficiency requires osteopaths to conduct a thorough and detailed physical examination of the patient, using observational and palpatory skills, to inform clinical reasoning and subsequent osteopathic diagnosis (GOsC, 1999).

The holistic approach to diagnosis and treatment originated in United States in the 19th century. Practitioners use touch and manipulation of the musculoskeletal system to restore or improve mobility and balance, and thereby enhance well-being. Techniques range from gentle massage to high velocity mobilization of the joints. Now established alongside conventional medicine in North America, and practised throughout Europe and Australasia, osteopathy is one of the most respected and widely used complementary therapies, particularly for pain in the back and joints.

Osteopathy, from the Greek *osteon* (bone) and *pathos* (disease), was developed by Dr. Andrew Taylor Still from Virginia, who was an army doctor in the American Civil War. Prompted by the tragic deaths of his wife and three of the children from meningitis, in 1872 he devised osteopathy to stimulate the body's self-healing powers.

In 1892, Dr Still founded the American School of Osteopathy. Despite initial opposition from the conventional medical establishment, the therapy proved popular, receiving a major boost during the flu epidemic of 1919, when the morality rate for patients in osteopathic hospitals was far below that in conventional hospitals. In 1917, a pupil of Still's, Dr John Martin Littlejohn, founded the British School of Osteopathy in London.

KEY PRINCIPLES

The organs of the human body supported and protected by the musculoskeletal system (opposite). If this system of joints and muscles is correctly aligned and working well, the tissues of the body including the brain and nerves, will be healthy, and the circulatory, lymphatic, and digestive systems will function properly. On the other hand, Manual Osteopaths aim to improve the mobility of the joints and soft tissues using mild palpation and manipulation. An osteopath will be concerned about why there is a fault in the musculoskeletal framework as with the physical problem itself, and will look for the reasons behind the problem. For this holistic approach,

lifestyle and mental and emotional health are seen as important factors influencing physiological health.

EVIDENCE AND RESEARCH

There has been a considerable amount of research in United States, though not to consistently high standard. Much evidence is anecdotal and most osteopaths accept that more clinically controlled trials need to be carried out. Research studies under way in the United Kingdom, including Department of Health pilot projects to test the possibility of doctors utilizing osteopaths and chiropractors for National Health Service (NHS) patients. In 1994, the Clinical Standards Advisory Group recommended that manipulation should be available for NHS patients with acute back pain that doctors should liaise more closely with osteopaths, chiropractors and physiotherapists. Two studies published in United States and United Kingdom in the year 1998 and 1990 respectively, showed that *osteopathic manipulation* could improve recovery time for lower back pain patients. During the 1940s, a US physiologist used electrical measurements to confirm osteopaths' claims of increased activity in the muscles.

CHAPTER 1

HISTORICAL DEVELOPMENTS IN OSTEOPATHY

1.0 Introduction

The history of osteopathy and its guiding principles and philosophical framework are a rich source of evidence from which to begin an exploration of the therapy and its foundations. As illustrated in this chapter, the historical developments within the profession are intricately linked with both British and American osteopathic education. Although this thesis explores only British osteopathic education and practice, developments in America have contributed to the profession in the United Kingdom. The overview presented here will provide the reader with a greater insight into the foundations of modern osteopathy and its education providers, giving context to the following chapters that explore osteopathic education and practice in the United Kingdom. Osteopathic education providers must undergo a comprehensive review process driven by the Quality Assurance Agency for Higher Education (QAA) and the General Osteopathic Council (GOsC) when validating or renewing their recognized qualification provider status.

In preparing this chapter, I specially explore both archive and current publications detailing the history and professional development of osteopathy. Much of the work included within this narrative review was sourced from the British School of Osteopathy, which houses the largest collection of osteopathic literature in Europe. Additional material was sourced direct from osteopathic education providers and the General Osteopathic Council. It should be mentioned here that the historical detail relating to the British School of Osteopathy constitutes a large proportion of the narrative included here and this is representative of the colourful and detailed history of the school and its development.

HISTORICAL PERSPECTIVE

Dr. Andrew Taylor Still

The American physician, Dr. Andrew Taylor Still, founded osteopathy in 1874. Still was born in Virginia, USA, in 1828, relocating and settling in Kirksville, Missouri where his father established a mission school for Native American Indians, combining religious ministerial work with medical practice. Eager to continue the family work, Still assisted his father in both missionary work and medical practices. During his adult years, Still obtained his medical education in Kansas and served as a major in the Union Army during the Civil War (Trowbridge

1991). Many who have written about Still have noted that his military service had a profound effect upon him, as did his religious beliefs (Trowbridge 1991; Collins 2006). Medical practices of the day led Still to become disenchanted with orthodox practice culminating in the spring of 1864 when four of his children contracted meningitis and, despite conventional medical efforts, all tragically died (Handoll 1986). Personal tragedy for Still evoked his interest in alternative medicine, and he devoted himself to the search for the remedy of disease. For the following ten years, Still has developed his ideas until on the 22nd June 1874 he "flung to the breeze the banner of Osteopathy" (Still 1910). With the inception of osteopathy, he was seeking to find a way to improve patient treatment and management used in contemporary medical practices. The system of palpatory diagnosis and manipulation was the foundation on which the practice of osteopathy developed. All patients who consulted Still after 1874 were treated by his hands according to his new theories, and his recognition spread. In 1892, Still opened his first school, the American School of Osteopathy, in Kirksville, Missouri (Trowbridge 1991). At that time, three main achievements were synonymous with the name of Andrew Taylor Still. Still noted the relationship of health to the structure and mechanics of the human body; he developed palpation as a means of diagnosing and treating mechanical faults of the body; and finally, he began a school that taught his methods. His only failure during that era of osteopathic development was his inability to convince medical colleagues of the true value of osteopathic medicine, perhaps a legacy that holds true today. Deasen investigated in his work that Dr. Still was seen as a non-conformist (Deasen 1934). In religion, politics, medicine, science and philosophy he was considered to be independent in his thinking, a trait mirrored in his inception of osteopathy. Despite the unique nature of osteopathy to the time, Still studied the works of the era, including Huxley, Darwin and other European biologists (Trowbridge, 1991). Many authors have noted that key works of these biologists are apparent in osteopathic medicine and informed Still's practice. From the four books authored by Still, the conclusion reads the same: Osteopathy is a science and a philosophy based upon biological principles limited only by the ability of the human intelligence to comprehend (Still, 1910). Much debate has been levelled at the philosophy of osteopathy and its origins. Kimberley (1986) suggests that Still took three known principles, added another of his own, and molded them into the *philosophy of osteopathy*. The three principles are:

1. The principle of body unity.

2. The principle of *vis* medicatrix naturae – the healing power of nature.
3. The principle of structure / function interrelationships (Kimberley, 1986).

All of these principles had been discussed in medical literature of the time but Still added a further principle of his own, that deranged soma will result in altered physiology and/or chemistry of related tissues (Seffinger, 2003). This change in structure is identifiable by palpation and occasionally by observation. This concept has been known by many names: bony lesion, osteopathic spinal lesion; osteopathic structural lesion; osteopathic lesion.

Current terminology and practice favour somatic dysfunction, which may be defined as; "Impaired or altered function of related components of the somatic (body framework) system: skeletal, arthrodial, and myofascial structures, and related vascular, lymphatic, and neural elements" (Seffinger, 2003).

Still amalgamated these four principles to form osteopathy.

Development of Osteopathy in U K 1902−1986

Graduates of the first osteopathic schools in the USA brought osteopathy to the UK. The first arrivals to the UK were J. Dunham in 1902 and in 1903 L. Willard Walker and Franz Joseph Horn. The first attempt at formal organisation was the formation of the British Osteopathic Association in 1911 whose membership was confined to graduates of the American osteopathic schools practising in the UK. The turning point for British osteopathy was the return to England in 1913 of Dr. John Martin Littlejohn (Handoll 1986; Collins 2006).

Dr John Martin Littlejohn (1865-1947)

John Martin Littlejohn was born in Glasgow in 1865; his father was a probationary preacher. Following education in Scotland (Arts & Theology; anatomy and physiology) he, like Still, entered the church. Following a period of ill-health Littlejohn was advised to seek a warmer climate and in 1892, he emigrated to the USA. It was during his stay in the USA that he consulted Dr. Still for a throat condition. So impressed was he by Still's work that he enrolled to study osteopathy. Littlejohn graduated and gained his diploma from the American School of Osteopathy where he also accepted a teaching post and in 1900 founded the second school of osteopathy in Chicago, which he called the American College of Osteopathic Medicine and Surgery (Handoll 1986; Trowbridge 1991; Collins 2006). In 1898, Littlejohn was invited to speak at the Society of Science, Letters and Art in London. His lecture entitled "Osteopathy in

line of apostolic succession with medicine" was the first recorded formal lecture in osteopathy given within the UK. So successful was this inaugural lecture that Littlejohn was invited back to the Society the following year, to speak about osteopathy as a science (Collins 2006). In 1903, Littlejohn visited Europe and contacted the already established American graduates Horn and Walker to discuss the possibility of a school in England. In 1913, Littlejohn returned to England to settle and it was at this time that he set about founding a school in London. On the 7th March 1917, the British School of Osteopathy (BSO) was founded in London. It was first located in Vincent Square, then Abbey House, and Victoria Street and in the early 1930s moved to Buckingham Gate. In 1980, the BSO moved to Suffolk Street and then in 1997 moved south of the Thames into Southwark. Dr. Littlejohn ran the BSO on a basis of pure altruism. It had no state aid. It was non-profit making and all the fees paid by students went into the funds of the school, from which Littlejohn received no salary (Collins 2006). Until 2004, the BSO received no government funding. During this time the largest financial contribution made to the school came from the general clinic that is open to the public and student fees. In 2004, the BSO secured funding by entering a partnership with the University of Bedfordshire (formerly University of Luton). This partnership sees students receive funded places at the BSO, significantly reducing tuition fees and widening participation and access to osteopathy in British higher education.

Moreover, it should be mentioned however that Littlejohn's association with British osteopathy has not been without criticism. In 1935 Littlejohn and the BSO received criticism relating to the provision of education from the House of Lords Select Committee, which was considering the Osteopaths Bill. Littlejohn fought the criticism and continued to have an active role in the development of the BSO until 1940 when due to ill-health he ceased all teaching duties. This remained the case until his death in 1947. Littlejohn has been recognised as having a major influence on both osteopathic education in the UK and in the USA and as contributing to the introduction of osteopathy to the UK (Handoll 1986; Collins 2006).

The British College of Osteopathic Medicine

The British College of Osteopathic Medicine (BCOM) changed its name from the British College of Naturopathy and Osteopathy (BCNO) in 2003. In 1945, the British Naturopathic

Association (BNA) was founded as a result of a merger of the Nature Cure Association of Great Britain and the British Association of Naturopathy. The BNA had its own premises in Hampstead in 1954 but in 1961 the BNA became the British Naturopathic and Osteopathic Association (BNOA) and its college, the British College of Naturopathy, incorporated osteopathy to become the BCNO. The first students were enrolled onto the course on the 5th January 1949 with teaching taking place in the rooms of the principle, Stanley Lief, in Park Lane, London. With a move to Lancaster Gate in 1951 and then to Hampstead, BCOM finally moved to its present address in Finchley (Collins 2006). BCOM currently offers two undergraduate programmes, the Bachelor of Osteopathic Medicine (B.Ost Med) a 4-year full time course, and a 5-year Masters in Osteopathic Medicine for those students who achieve a

(Upper second) or higher upon completion of the third year of the B.Ost Med programme (British College of Osteopathic Medicine 2008). Both programmes include the award of Diploma in Osteopathy and Diploma in Naturopathy, professional awards denoting competence, and are GOsC and GCRN-accredited enabling professional registration. BCOM also offers a nine-month academic conversion degree allowing previous graduates with a Diploma in Osteopathy to convert to BSc (Hons) status. All programmes are validated by the University of Westminster. However in April 2008 BCOM announced that they are to enter a funding and validation partnership with London Metropolitan University subject to ratification from the GOsC and HEFCE. This will mean that all BCOM students from September 2008 will receive public student funding and that all programmes will be validated by London Metropolitan University (British College of Osteopathic Medicine 2008).

The European School of Osteopathy

The origins of the European School of Osteopathy (ESO) lie in physiotherapists being taught osteopathy at École Française d'Ostéopathie (EFO) Paris in 1951 guided by Paul Geny. As a consequence of the legal prohibition of osteopathic practice in France, the EFO was forced to close and its principal, Paul Geny, was subsequently imprisoned for illegally practicing as an osteopath (Collins 2006). However, in 1965, the EFO, once more under the leadership of Paul Geny, along with 16 undergraduates, relocated to London. The EFO rented rooms from the BCNO but remained an independent school. The French school expanded and continued to attract European physiotherapists who followed a 5-year part time course delivered in French. In 1969, the EFO became the educational department of the Maidstone osteopathic clinic and in

1974; the EFO expanded to include British students as well as welcoming students from other European countries to include Swiss, Spanish, Portuguese and Belgian nationals. Consequently the school became known as the European School of Osteopathy (ESO). The ESO was founded on the total lesion concept of Fryette and its teachings encompassed the Littlejohn philosophy of total body adjustment, as well as the specific adjustment technique, an elaboration on the work of the chiropractor Parnell. To accommodate the influx of English speaking students, the course became a 4-year full-time course, taught solely in English. The school became a registered charity and was incorporated as a company limited by guarantee relying on income generated by student enrolment. In 1978, the ESO moved to Tonbridge Road, but students still undertook their clinical training under the guidance of John Wernham at the Maidstone osteopathic clinic.

However this partnership ended in 1981. 1982 saw the school successfully gain accreditation from the General Council & Register of Osteopaths (GCRO) and an ESO clinic was established in 1983, though for a short time ESO students worked out of the BSO clinic. In 1983, students became eligible for membership to the GCRO and the University of Wales validated a BSc General degree with Honours in 1993. In 1996, the degree was updated to full honours with immediate effect with the first cohort of students graduating in that same year. The ESO currently offers a 4-year full-time BSc (Hons) Osteopathy degree validated by the University of Greenwich (The European School of Osteopathy 2008). The ESO retains strong links with a number of osteopathic schools in Europe and in 1995/1996 the Collège International d'Ostéopathie (CIDO) requested to be included in the ESO's degree accreditation as a partner in a partial franchise partnership. Under this agreement, students enrolled with CIDO completed their first two years of osteopathic education in France with their final two years being completed in the UK as students at the ESO. This partnership ensured that French students gained their clinical education and overcame the legal prohibition of osteopathic practice in France. To date, this partnership still exists, however the agreement may come under some scrutiny in the coming years once legislative changes and their impact upon osteopathic education in France have become clear (The European School of Osteopathy 2008). With the continuing expansion of the school, the ESO bought Boxley House in 1996. This building was to house many of the administration and teaching rooms whilst the main teaching clinic remains in Maidstone, thus retaining strong access links for prospective and current patients. The new millennium has seen the ESO validate the first full-time 1-year MSc course in Osteopathy

currently validated by the University of Wales and recognised qualification status was granted to the ESO in 2000 (The European School of Osteopathy 2008).

The London College of Osteopathic Medicine (LCOM)

London College of Osteopathic Medicine (LCOM) was the intended college of the British Osteopathic Association (BOA), based upon the American model of education and practice (Collins 2006). In 1927, the BOA opened a charity clinic in Vincent Square to bring osteopathy to those in the community with limited incomes. Osteopathic physicians in the UK campaigned to raise money to found a recognised osteopathic college of medicine and surgery in Britain. Due to the war and financial constraints the proposition became unrealistic. In 1946, the London College of Osteopathy opened to offer a one-year course in osteopathy to medical graduates. By 1950 it had graduated ten students and in 1955 was recognised by the GCRO. Between the years 1975 and 1978, the college closed due to financial constraints but reopened in 1978 in smaller premises in Boston Place under the name LCOM (The London College of Osteopathic Medicine 2008).

The London School of Osteopathy (LSO)

The LSO began as the Croydon School of Osteopathy and taught a combined course of naturopathy and osteopathy founded by the Natural Therapeutic and Osteopathic Society. In 1977, the school became a sole osteopathic course and in 1980-1982 the curriculum was revised. During 1982 the school moved from premises in the Kings Road to Putney but by 1992 the school had moved again, this time to the Docklands area of London. Anglia Polytechnic validated the BSc degree in 1993 with the school's first cohort graduating in 1998. In 2001, the LSO moved premises again this time to the East End of London, a short walk from the Mile End Road. The undergraduate course at the LSO is a 5-year part time programme validated by the University of Brighton since May 2002. LSO also provides an Accelerated Learning Pathway (3 years, part-time) designed for doctors and physiotherapists committed to training as osteopaths (London School of Osteopathy 2008).

College of Osteopaths Education Trust

COET is a recent addition to the list of RQ education providers in osteopathy, with its status being granted in 2000. The school began as early as 1948 with informal study groups establishing themselves as the Fellowship of Osteopaths in 1960. A two-year diploma course was

established in 1961/1962. In 1974, The College of Osteopathy and Manipulative Therapy emerged, later to become the College of Osteopathy in 1979. In 1997, Middlesex University validated the COET degree. COET is an independent charitable trust based in Borehamwood, Hertfordshire offering a five-year part-time degree course leading to a BSc (Hons) Osteopathy. In collaboration with Keele University, the college now offers a similar programme based in Staffordshire. The first cohort of students enrolled in September 2005 (The College of Osteopaths Educational Trust 2008).

Leeds Metropolitan University

The four-year full-time BSc (Hons) Osteopathy programme at Leeds Metropolitan University is the most recent addition to the RQ providers and hopes to welcome its first cohort of students in September 2008 (Leeds Metropolitan University 2008).

The Surrey Institute of Osteopathic Medicine (SIOM)

The Surrey Institute of Osteopathic Medicine (SIOM) is based at The North East Surrey College of Technology (NESCOT) in Epsom. The institute offers a 4-year full-time degree programme (BSc (Hons) Ost Med) validated by the Open University. A degree in Veterinary Osteopathy is also in development (Surrey Institute of Osteopathic Medicine 2008).

Oxford Brookes University

Oxford Brookes University (OBU) is a recent addition to the recognised osteopathic education providers in the UK. The five-year part-time programme leading to a BSc (Hons) Osteopathy is the first course to be delivered and incorporated into mainstream higher education. OBU offers fifteen weekend class tutorials and two residential weeks per year. Academic study and practical application of osteopathic techniques accounts for much of the student contact hours. Students also complete 1500 hours of supervised clinical practice in a purpose-built clinic in Oxford. The undergraduate degree was validated by Oxford Brookes University in 2002. A more recent introduction for the University is the development of the four-year full-time BOst (Hons)/MOst which heralds the introduction of the first undergraduate Masters qualification in osteopathy (Oxford Brookes University 2008).

The British School of Osteopathy (BSO)

John Martin Littlejohn's frequent visits to the UK in the early 20th century heralded the inception of British osteopathic education. Littlejohn visited Europe in 1903 calling at hospitals in France, Germany and Austria where he treated a number of patients. During this time,

Littlejohn also visited Britain which heralded his first discussion regarding establishing a school of osteopathy in Britain. Some ten years later, Littlejohn returned to the UK to reside permanently and in 1913 he resumed talks regarding the establishment of an osteopathic school. March 1915 saw the first attempt to incorporate the British School of Osteopathy, however, due to the war effort at that time, the Treasury refused to sanction the organisation of anybody involving a significant amount of capital which was not directly associated with the war. This date is still noted in historical documents as being the actual date relating to the foundation of the school (Handoll 1986; Collins 2006). During the war, the school developed through clinical education. A clinic was established in Southend, the first ever building being dedicated to the sole use of osteopathy built by the students of the school. The clinic relocated to Central Hall, Kiln Road, Thundersley, Essex and whilst the clinic was running successfully here, a new centre was opened in Enfield. During the two-year period 1915-1917, approximately 30-50 patients were treated on a weekly basis. The incorporation of the school was limited by the war effort and the foremost condition of establishing the school was that not more than two shares, each to the value of £1, be issued whilst the country was at war. As governing directors, the shares went to Littlejohn and F. J. Horn (Collins 2006). From 1917, the school was housed across two London sites with the main school being situated in Littlejohn's consultancy rooms at 48, Dover Street, whilst the clinic remained in Enfield. Patients at the clinic ranged from individuals unable to pay full fees to volunteers who had been enlisted in war service. The student body mainly comprised individuals who had found considerable benefit from osteopathy themselves and thus decided to dedicate their career to practising osteopathy. Following the end of the war, the ban on shares ceased and one share was sold to the British Osteopathic Association. This was to have repercussions for osteopathy in later years when the therapy sought regulation. On obtaining the one share the BOA insisted on ownership of the school with a view to developing British osteopathic education based on the American model. This was consequently refused and relations between the BOA and the BSO became strained. In 1921, Littlejohn completed the organisation of a four-year course in osteopathy, in the role of administrator and teacher for which he received no salary. The course was to combine both theoretical and practical work based on the guidelines of the Associated Colleges of Osteopathy in the USA. First and second years of study were devoted to fundamental subjects such as the basic sciences taught at Chelsea Polytechnic, Sheffield University or King's College London. The final two years of the course were used to

develop osteopathic practice and principles (Collins 2006). Due to expansion, the school moved to Vincent Square which was given to the BSO rent free for some two years by its co-founder, F. J. Horn. It was at Vincent Square in 1925 that the first Diploma was awarded to the first British Osteopath graduating from a school in the UK, Elsie Wynter Wareing. The school was to move again in 1927, this time to Abbey House, Victoria Street, Westminster where the demand for osteopathic treatment could be adequately met. In 1929, over 200 patients were treated per week in this new location. In 1930, the school moved again this time to 16, Buckingham Gate, SW1. The initial lease was for 21 years with a further lease being issued in 1949. Buckingham Gate was to be the home of the BSO for some 50 years until its move to Suffolk Street in 1980. The 1930s saw the BSO prosper with the course increasing in popularity and the curriculum and clinical education becoming established. However, it was also a time of great change with the debate surrounding the Osteopaths Bill in 1935 in which Littlejohn and the BSO were severely criticised for providing a level of education regarded as sub-standard by the medical profession and the General Medical Council. However, the GCRO was formed and as a result of discussion and improving relations with the BOA, Jocelyn Proby, a key figure in the BOA along with other notable osteopaths, became members of the BSO Board and external examiners. After a buoyant decade, which heralded great change for the BSO and British osteopathy, the 1940s saw the Second World War. A number of faculty and students were called up and the BSO's survival during this time was uncertain. The teaching faculty was further weakened by the resignation of Edward Hall and with the deterioration in the health of Littlejohn, his teaching duties ceased. Clem Middleton and Shilton Webster–Jones (a future principal of the school) took over the day-to-day running of the school but it was slipping further into financial crisis. After the end of the war, the school sought to rebuild but this was overshadowed by the death of Littlejohn in 1947. Webster-Jones became Principal in 1948 and remained so for some 20 years. 1950 saw a major revision of the curriculum with its move away from Littlejohn's classical osteopathy towards a more mechanistic approach. For some faculty this was deemed inappropriate, including notably John Wernham, who left the school and later established the Maidstone College of Osteopathy. Part of the curriculum change saw a move towards differential diagnosis requiring palpation, observation and examination of both passive and active movements. Audrey Smith, the member of staff responsible for osteopathic diagnosis, also encouraged students to consider lifestyle, occupational and emotional factors in their diagnosis as potential predisposing and maintaining

factors and compensatory mechanisms. In direct opposition to classical osteopathy where general osteopathic treatment is offered to the patient, the BSO supported diagnosis determining the treatment. Another osteopath who changed the way technique was taught at the BSO was Clem Middleton. He taught in a step-by-step approach, breaking techniques down into their individual components thus complementing the teaching of diagnosis by Smith.

Middleton has since been heralded as the osteopath who laid down the foundations for the teaching of technique over the last 50 years (Collins 2006). The 1960s saw a downturn in the fortunes of the BSO with financial crisis beckoning as student numbers dwindled to a mere 29 in 1966. The school sought alternative accommodation but nothing in Central London could be found that the school could afford and so in 1965 the lease on Buckingham Gate was renewed. In 1968, the BSO welcomed a new Principal, Colin Dove. He was a firm supporter of osteopathic research and sought to put the profession on a sound, rational foundation. Dove remained as principal at the school for only nine years but during this time encouraged postgraduate education and extended the osteopathic course from three years to four years. In 1977, the first non-osteopath became Principal, Stanley Bradford. This was not a choice welcomed by the profession and he reigned as Principal for a mere five years. Yet during this time the BSO relocated once more to Suffolk Street, close to Trafalgar Square, a most prestigious location. This was a massive financial gamble for the BSO. Despite this, it led to a surge in student numbers. This time also saw the BSO turn its attention to converting its course to a degree award. Initial discussions with the Polytechnic of Central London broke down but the appointment of Sir Norman Lindop as Principal was seen as advantageous, particularly since he had been knighted for his part in founding the Council for National Academic Awards (CNAA). The BSO decided to work without a collaborating institution but with the support of the Princess Royal as Patron, the CNAA approved the proposal for a BSc degree in 1989. In 1991 under the guidance of Clive Standen, the school survived another financial crisis but with the demise of the CNAA, the school sought another validation body in the form of the Open University in 1993. Due to the continuing financial crisis and the escalating cost of the building in Suffolk Street, the BSO accepted a bid from the University of Notre Dame for the premises and agreed to vacate in December 1996. The BSO struggled to find accommodation in Central London and was forced to put back its relocation until July 1997 when the school moved south of the river Thames to Borough High Street in Southwark. With a new location came a new Principal. Dr. Martin

Collins took over in February 1998 and his position as Principal ended in April 2006. Charles Hunt was appointed as Chief Executive and Principal with effect from May 1st 2006. In 1998 an application was made to the General Osteopathic Council to be granted Recognised Qualification (RQ) status as a provider of osteopathic education. In May 1999, the BSO was granted RQ status after a series of General Osteopathic Council (GOsC) visits and the submission of extensive documentation. Degree validation by the OUVS was delayed until 2000 when the BSO introduced its radical curriculum change in the shape of the Bachelor of Osteopathy degree (BOst), the first of its kind. Today, the BSO is working in collaboration with the University of Bedfordshire and has recently announced a further change to undergraduate provision with the introduction of the MOst, a four-year undergraduate Masters qualification. The school continues to expand with the opening of a new £5.2 million clinic situated five minutes from the academic centre in Southwark Bridge Road, SE1 (The British School of Osteopathy 2008).

Desire for Recognition and Registration

The first strides towards recognition of osteopathy and the profession's desire for registration began during 1924-1925 with the founding of the Osteopathic Defence League by Williams Streeter. The aim of this group was to alter the law in order to place osteopathy on a footing of legal equality with orthodox medicine but also to make more widely known the guiding principles of osteopathic practice. Parliamentary debate ensued with Arthur Greenwood MP suggesting the introduction of legislation to ensure the recognition and registration of practising osteopaths in the UK. The then Secretary of State for Foreign Affairs, Austen Chamberlain, stated that before a register could be successfully founded, osteopaths in the UK must develop colleges and schools of their own rather than educating osteopaths in America. With these suggested changes it was felt the osteopathic curriculum would conform to something approaching "the normal curriculum in this country" (Collins 2006). The desire to reform and improve osteopathic education in the UK was a policy of the British Osteopathic Association (BOA) in 1928. The BOA continued to strive to bring osteopathy before parliament with a view to recognition and the establishment of an independent osteopathic school with an educational status equivalent to existing medical teaching establishments. In 1930 the BOA sought to obtain a Royal Charter to incorporate it as a legal entity. It was hoped such status would allow the BOA to give registration and protection to the title of osteopath. A total of six counter-petitions to the motion were lodged and so the application failed in 1931. Despite the disappointment, the

application had not only raised awareness but had also provoked heated debate and in 1935, as the culmination of years of hard work, the Select Committee of the House of Lords met to discuss the Registration and Regulation of the Osteopaths Bill.

The aim of the Osteopaths Bill was to authorise the establishment of a state register for osteopaths, with a designated qualifying education and standard of proficiency. Evidence was to be heard over a total of twelve days with the main parties supporting the Bill being The Osteopathic Defence League, the BOA, the BSO and the Incorporated Association of Osteopaths. During the course of the proceedings, Dr. William Kelman MacDonald, on behalf of the BOA, cast doubt upon osteopathic education in the UK. During MacDonald's evidence he stated:

General Osteopathic Council

The GOsC began work in 1997 drafting documents for the process leading to RQ status for osteopathic schools in the UK. Thirteen institutions expressed an interest in being recognised providers of osteopathic education in the UK. To date, nine institutions have been successful in their quest. In 1998, the GOsC published the Standard of Proficiency (S2K). This document outlined areas of proficiency in osteopathic practice and education. The Quality Assurance Agency in September 2007 published the subject benchmark statement for osteopathy. The subject benchmark statement has provided a means for the academic community to describe the characteristics of programmes in osteopathy and is an important external reference point for institutions reviewing and developing programmes thus helping in the drive for quality assurance. The subject benchmark is not however, a definitive osteopathic core curriculum and should be viewed as a point of reference rather than a definitive specification for programmes. The subject benchmark statement was developed in collaboration with the GOsC, representatives from RQ providers and the BOA (The Quality Assurance Agency 2007). The draft benchmark statement was available for consultation in early 2007, and the author was able to contribute to the statement during the consultation phase. The GOsC continues its work to unite and regulate the osteopathic profession. Following a number of years of disquiet amongst osteopaths anxious about the trials and tribulations associated with the registration process and the Professional Profile and Portfolio (PPP), osteopathy is finally working towards a bright future as an integral part of British healthcare.

CHAPTER 2

EXERCISE AND PHYSICAL ACTIVITY IN HEALTH CARE SECTOR

CHAPTER INTRODUCTION

The driving force behind the studies contained within this thesis is the understanding and interpretation of exercise therapy in osteopathic education, treatment and management. Before any conclusions can be drawn regarding the application of exercise in osteopathic clinical and educational settings as detailed in later chapters, it is important to have an understanding of the founding principles of exercise and have an awareness of the theoretical underpinning of exercise prescription. Much of the work outlined in this chapter originates from the theory driving the application of exercise and physical activity not only in clinical and health care settings but also in relation to recreational and performance sport and exercise. When considering the possible implementation of exercise therapy in educational and clinical settings, it is important to have an understanding and appreciation of the current work outlining the relative efficacy of a variety of modes of exercise. This chapter, whilst discussing the principles of exercise prescription, will also provide an introduction to some important points that need to be considered when deciding on the efficacy and clinical applicability of certain modes of exercise. There has been much discussion surrounding the clinical content, validity and applicability of modes of exercise currently featured in randomized controlled trials and practice guidelines, and this chapter will outline some of the key discussion points surrounding the difficulties in clinical decision-making in light of the current published evidence. Some of the issues raised in this chapter have been identified as key in the potential for exercise therapy implementation by educationalists, students and clinicians in the chapters to follow. Individual understanding and interpretation of the terms exercise and physical activity can be as different as the physiological and psychological responses to undertaking the variety of activities defined as exercise and physical activity. These terms are often perceived and interpreted differently by people according to gender, class, and socio-cultural factors (Tudor-Locke, Henderson, Wilcox, Cooper, Durstine and Ainsworth 2003). It is also realistic to suggest that professionals entrusted with delivering the physical activity message interpret this terminology differently. It is

important to be clear about what we mean and understand by exercise and physical activity, particularly when as in the case of osteopaths, they interpret the exercise intentions of their patients and may consider the use of a range of activities as treatment and management strategies. Throughout this chapter and thesis the terms exercise and physical activity will be used in the context of clinical and academic osteopathic education and will refer to specific regimes and activities aimed at improving a wide range of patient outcomes and goals.

PHYSICAL ACTIVITY

Physical activity can be defined as any body movement produced by muscular contraction that leads to a substantial increase in the individual's energy expenditure (Shephard 1994). Physical activity can be further categorised to include occupational activities and leisure time activity. Leisure time activity means time that is discretionary to the individual, time that is free from work and occupational activities. Activities pursued have been seen to include walking, jogging, swimming, cycling, dancing and exercise within the home (Lan, Chang and Tai 2006). The extent and degree of leisure time afforded to each individual is dependent upon the time spent at work, travel time, and division of work within the home. It is reasonable to assume therefore that the amount of leisure time an individual has at their disposal is dependent upon the variables outlined here. What a person does with their leisure time is an individual choice although there are activities such as those outlined in the work of Lan et al. (2006) to include brisk walking, swimming and cycling that can be taken which will increase energy expenditure significantly.

The importance of engaging in a physically active lifestyle has been the focus of national and international public health guidance materials. In the last decade, the Department of Health has published two key reports outlining the evidence for the benefits of physical activity for health and recommendations for those responsible for implementing policy and programmes aimed at increasing physical activity via exercise, sport and travel (Dubbert 2002; Department of Health 2004a; Department of Health 2004b). The impetus for the change in policy and increase in guidance materials associated with raising the levels of physical activity amongst both the adult and adolescent population of the UK has been the increasing evidence linking the contribution of increased physical activity to disease prevention and management. Reports published on behalf of the Chief Medical Officer suggest that the estimated cost of inactivity in

England is £8.2 billion annually. These figures do not take into account the cost of obesity which alone costs some £7.4 billion (NICE Public Health Collaborating Centre - Physical Activity 2006). Results from The Health Survey for England published in 2003 suggest that physical inactivity is a real problem in the adult population with approximately six out of ten men and seven out of ten women so inactive that it affects their health (Department of Health 2003). Age, gender, social class and ethnicity have all been reported as factors impacting physical activity levels, as well as reported trends of a reduction in walking and cycling as a means of transportation (NICE Public Health Collaborating Centre - Physical Activity 2006). To date there has been only limited research exploring the impact of national and international physical activity guidelines and the response of the population to recommendations. In Australia, Merom et al. (2006) have published the results from the combined cross-sectional National Health Surveys from 1989-1990,1995-1996 and 2000 exploring the long term population responses to the physical activity recommendations made in 1996 (Merom, Phongsavan, Chey and Bauman 2006).

In contrast to the current baseline trends reported by the Department of Health in the UK, it appears that Australian adults have increased both leisure time walking and other forms of moderate intensity activity resulting in a 2% increase in the population attaining the physical activity recommendations of five weekly sessions of moderate intensity activity. As with other studies concerned with exploring physical activity levels, this study relied upon the two-week activity recall of respondents and noted that those members of the community regarded as disadvantaged did not alter their levels of physical activity. Valid and reliable measurement of physical activity within the population remains an issue (Keim, Blanton and Kretsch 2004) and more importantly those charged with the role of delivering the physical activity message need to look more carefully at encouraging physical activity in those members of the population for whom activity may have the greatest health benefits and who are currently not being affected by public health messages. In recent years there has been some discussion about who is responsible for reversing the trend of rising sedentary behavior in the United Kingdom. Much of the research in this field has focused on the delivery of the physical activity message from within primary care services. Smith (2004) in a review of the impact of physical activity interventions inprimary health care services noted that interventions which yielded a short term improvement in physical activity ranged from brief General Practitioner advice about this single risk behavior

supported by written materials to more lengthy counseling sessions. What is evident in this review is that successful physical activity interventions often involve major resource and system changes. The time pressures on General Practitioners during the consultation time available to them often impacts the quality and quantity of physical activity advice they can give (Smith 2004). Time as a barrier to assessing and advising patients about physical activity has also been reported in adult nurse practitioners (Burns, Camaione and Chatterton 2000). A primary health care-based counseling intervention has also been seen to have a positive impact upon physical activity levels, using a Physical Activity Specialist to deliver the activity message through the medium of motivational interviewing (Hardcastle, Taylor, Bailey and Castle 2008). Both Smith (2004) and Brown (2006) begin to explore the role health professionals can have in delivering the physical activity message. From an Australian perspective, Brown (2006) suggested that considering the large proportion of Australians who currently report chronic inactivity health-related problems, it would be appropriate from a public health perspective to have every health professional giving basic exercise and physical activity advice (Brown 2006). This argument is also a persuasive one in the context of UK health care. Delivering the activity message to those who are currently inactive will ultimately have the greatest impact on public health. Osteopaths as health professionals are in a prime position to undertake this role, finding out what their patients would like to do and then addressing the challenge of behavioral change and maintenance. In light of the overview of definitions of exercise and physical activity, to advise patients on the use of a more generalized approach to exercise, effectively removing the preconceived notions and concepts associated with the terms sport and exercise might be more palatable to those individuals who are not familiar with maintaining an active lifestyle. In support of the concepts outlined here, the General Osteopathic Council in their Standard of Proficiency state that osteopaths should be able to give exercise and lifestyle advice to patients (General Osteopathic Council 1998). It seems appropriate then, that in addition to developing and advising on specific, regional exercises appropriate to the patient's presenting condition, osteopaths might also advise on general exercise in the context of both short- and long-term management. Although this appears to be a general recommendation based on evidence, little research has explored whether osteopaths are indeed reacting to the evidence presented and incorporating it into their practice.

Moreover, it is intended that the studies contained within the body of work presented in this thesis will contribute to the exploration of general and specific exercise advice in osteopathic education, treatment and management.

AEROBIC CONDITIONING, PHYSICAL ACTIVITY, SELF EXERCISE

National guidelines for general health suggest that five 30-minute sessions of moderate intensity physical activity per week should be a reasonable recommendation (Department of Health 2004b). Typical of exercise aimed at improving aerobic conditioning include aquatic exercise (swimming), brisk walking, jogging, circuit training, aerobics or calisthenics and the use of static gymnasium equipment including treadmills, cycle ergometers, cross trainers and rowing ergometers. Research has suggested that aerobic exercise can produce analgesia through endogenous opioid mechanisms (North McCullagh and Tran 1990). This type of physical activity is often self-rated and includes non-occupational activity quantified by hours spent engaging in physical activity. It is a useful regimen for all patients, particularly those with limited access to facilities or those previously considered sedentary. Of particular interest is that leisure time physical activity often includes walking, possibly the most accessible form of activity for the majority of the population.

PATTERNS OF ACTIVITY AND EXERCISE

Clear distinctions can be made between exercise and physical activities dependent upon the physiological loading placed on the body and the nature of the activity including the time taken to participate. It is important to understand the distinctions between intensity, frequency and duration, as these parameters are often *keys* in the prescription of exercise advice.

INTENSITY

Intensity of exercise is expressed in performance parameters as the absolute work rate, often described as either external power output or oxygen consumption (Astrand, Rodahl, Dahl and Stromme 2003). Oxygen consumption as a measure of intensity is the preferred expression in performance paradigms as this eliminates problems associated with the quantification of mechanical efficiency and the variation of interpreting intensity based on the size of the

individual. There are of course inherent difficulties in quantifying intensity in these ways for the practitioner in the clinical setting. Practitioners very rarely have the specialist equipment to quantify activity intensity at their disposal. It would also be reasonable to suggest that to quantify the intensity of an activity in either the terms of power output or oxygen consumption would prove meaningless to the majority of presenting patients. A convenient and more globally meaningful way of classifying the intensity of a given activity is to refer to the oxygen cost of the task per unit of body mass (ml/kg.min). This information can be expressed as ratios of resting metabolism (METS) and has been a popular way of expressing the intensity of set tasks particularly in a rehabilitation setting (Ainsworth, Haskell, Leon, Jacobs, Montoye, Sallis and Paffenbarger 1993; Shephard 1994; American College of Sports Medicine 2000). In physical activity and exercise settings, expressing the observed intensity of an activity as relative to the individual's maximal aerobic power, observed heart rate relative to the peak value (%HR max) or rating of perceived exertion is favoured. What should be remembered is that expressing intensity as a function of measured peak values varies depending upon the task performed (variation between values achieved in cycle ergometry and treadmill running) and that transient illness or injury can adversely affect peak values relative to the figures measured. Differences in measured physiological workloads at the same rating of perceived exertion have been noted when using different exercise modes (Thomas, Ziogas, Smith, Zhang and Londeree 1995). For example, exercising on a treadmill at a rating of perceived exertion 13 is equivalent to 85% of maximal heart rate. In contrast, working on a cycle ergometer at the same RPE (13), is equivalent to 69% of maximal heart rate (Thomas et al. 1995; Zeni, Hoffman and Clifford 1996; Moyna, Robertson, Meckes, Peoples, Millich and Thompson 2001). Of use particularly for those practitioners who intend to personally supervise exercise is the Borg scale or the rating of perceived exertion (RPE). This scale was developed in 1971, with perceived exertion ranging from 6 units at rest to 18-20 units indicating extremely hard work. The rating of perceived exertion is widely viewed as a tool that can effectively regulate exercise intensity. More recently, literature has suggested that using the rating of perceived exertion enables patients to ultimately become better perceivers of exertion and to accurately, confidently and autonomously control exercise intensity (Buckley 2003). Perceived exertion can however be influenced by factors other than physiological workload. Medication, muscle mechanics, physical environment and psychosocial factors such as limited experience of fatigue will inflate effort ratings (Buckley 2003) and so perceived

exertion as a measure of exercise intensity should be used appropriately and in some cases, with caution. Evidence for the use of these measures of intensity in a therapeutic setting is limited with cardiac rehabilitation notably using these measures during aerobic and conditioning phases (Coats, McGhee, Stokes and Thompson 1995). The clinical applicability of these measures in manual therapy and osteopathy may be limited by the use of exercise therapy with individuals rather than groups of patients and the focus on anaerobic, strengthening and mobilizing exercise rather than aerobic exercise. The measures of intensity outlined here relate directly to those instances where the exercise being utilised is aerobic in nature. Aerobic exercise is quantified by aerobic power or maximal oxygen uptake, which represents the upper limit of aerobic exercise tolerance and the proportion of exercise attributable to aerobic metabolism (Astrand et al. 2003). Intensity as a factor in prescription should also be considered when utilizing other modes of activity including strength and resistance work. The rapid rest to-exercise transitions sometimes performed at high intensities are characteristic of anaerobic exercise such as resistance-type work. The intensity of this type of work can be expressed as power output and variations in intensity can be achieved through using increased resistance or in some cases by moving the given load at a faster rate. The closer the load is to the maximal achievable velocity, the greater the intensity and resultant training effect on the musculature being worked (Fleck and Kraemer 1987).

Frequency and Duration of Exercise

Exercise frequency relates to the stated number of exercise sessions completed or prescribed over a determined period of time. Practitioners may wish to elicit frequency information from patients and in this case the patient is often asked to recall how often they have exercised during one week. In some cases, it is appropriate to ask the patient to recall information over a longer period of time; however it is worth remembering that asking for longer periods of recall can introduce inaccurate assessments of activity (Merom et al. 2006). There has been some discussion in recent years over the recommended frequency of exercise sessions for health gains in the general population. The Department of Health in their paper entitled “At least five a week” suggests that five 30- minute sessions of moderate intensity activity are sufficient for gains in general health, reducing the risk of premature death from cardiovascular disease and some cancers whilst significantly reducing the risk of type 2 diabetes and improving

psychological well-being (Department of Health 2004b)**.** The frequency with which an individual might exercise is often dependent on their stated goals and the general aims of the exercise sessions. Exercising aerobically at a moderate intensity five times per week might be appropriate for general health gains but for some individuals who wish to improve strength or flexibility, the frequency of the prescription and indeed the duration of the exercise bout will vary (Astrand et al. 2003). Duration can either be expressed as a measure of time (seconds or minutes typically) or as a repetition. Very rarely are exercises used in the context of a sole repetition. This might only be the case where the individual is concerned with giving some indication of maximal power output as can be the case in resistance work. More often than not, exercises are prescribed in sets, whereby a number of repetitions, as determined by the practitioner or exercise specialist, contribute to a set. The intensity, frequency and duration of any exercise or the regime in which it is contained will contribute to the physiological response (Astrand et al. 2003). The result or outcomes of any exercise regime can be quantified in terms of general or specific physiological gains. For example, the outcome of a regime of increased aerobic work might be a general improvement in fitness whilst a specific, tailored regime of strengthening and flexibility might result in improved function and range of movement at a specific joint. The gains and adaptations seen as a result of increased activity or exercise, whether it is specific or general, is often referred to as the dose-response relationship (Shephard 1994). It is observed that the response to exercise is proportional to the dose (in this case the frequency, duration and intensity of the exercise or prescription). It is however, feasible to assume that there is a threshold above which no further adaptation or physiological gains can be made, and in some extreme cases, excessive exercise can lead to extreme fatigue, poor compliance and injury. For the practitioner, the balance between the dose of exercise and the desired response/outcome is an important one, and when giving exercise advice the practitioner should always bear these factors in mind.

THERAPEUTIC EXERCISE

Therapeutic exercise is used frequently by health professionals with the aim of improving physiological as well as functional ability and capacity, mobility and sometimes pain relief. The aim of the exercise prescribed is often dependent upon patient diagnosis and the goals of the patient and practitioner. Schnieders et al. (1998) confirm in their work that therapeutic exercise is a common treatment modality used by physiotherapists and Heale demonstrated that

chiropractors utilise exercise within their treatments (Heale 1998; Schnieders 1998). More recently, a prospective study investigating outcome differences between chronic back pain patients treated with group exercise, physiotherapy or osteopathy has identified exercise as a potential therapy for inclusion within the osteopathic consultation (Chown, Whittamore, Rush, Allan, Stott and Archer 2008). The use of exercise outside the immediate treatment environment has also been investigated with home exercise programmes featuring in physiotherapy research (Kolt 2003). Exercise in a community setting developed and delivered by physiotherapists was included in a large randomised controlled trial looking at the effectiveness of physical treatments for back pain in primary care (UK BEAM Trial Team 2004). The type of exercise advice given by manual therapists ranges from activity recommendations (Frost 2004) to progressive general exercise (Frost 1995) to more specific exercise interventions including stretching (Bendix, Bendix, Labriola, Haestrup and Ebbehoj 2000; Chown et al. 2008) range of motion activities (Deyo 1990) and stabilisation exercises (Byrne, Doody and Hurley 2005). There is a wealth of literature detailing the uses of therapeutic exercise in a clinical setting with some of the most common aims of a therapeutic exercise would be discuss :

• Increase or maintain range of movement (ROM).
• Increase muscular strength.
• Increase muscular length.
• Reduce pain.
• Improve physiological parameters to include power and endurance.
• Improve stability.
• Improve flexibility.
• Facilitate behavioural change to improve well-being and self efficacy. (Geffen 2003; Everett 2005; Zakas, Balaska, Grammatikopoulou, Zakas and Vergou 2005).

We have demonstrated here in the following sections are some of the more frequently used therapeutic exercise approaches selected by the practitioner to fulfill specific patient's conditions.

Range of movement

Range of movement can be defined as the functional component of movement at an individual joint (Everett 2005). Of particular concern to the health care professional considering the use of therapeutic exercise is the observation of the joint and the identification of abnormal

limitations to the range of movement. Causes of abnormal limitations can include injures or disease to the structure, surface or surrounding soft tissues and the effect of decreased range of movement should be considered in light of the role and importance of the joint in functional daily activities. Upon identification of the cause of the abnormal limitation, treatment can be tailored to impact on the changes which have been seen to limit the range of movement. Therapeutic exercise aimed at increasing range of movement at a limited joint should also attempt to strengthen and stabilize (Everett 2005). Both passive and active movements are commonly used in the treatment approaches to increase range of movement. Passive movements are those that are produced by an external force and can include stretching, manipulation and relaxed passive movements. In contrast, active movements are those within the unrestricted range of a joint produced by an active muscular contraction and include active assisted exercise and free exercise (Everett 2005). Therapeutically, active movements are often performed in the form of exercise and this may be with the assistance of the health professional or as active exercise undertaken solely by the patient. In contrast, passive movements can include stretching which by taking movement at the joint beyond the abnormal available range should result in a change in the length of soft tissues crossing the joint and increase or regain available *range of movement* (Everett 2005). Recent research with a group of élite athletes (water polo) has shown that a manual therapy intervention which included passive stretching at the hip significantly increased rotational range of movement and had a minimal effect upon pain (Mosler, Blanch and Hiskins 2006).

Flexibility

Flexibility has been defined as the range of movement of a single joint or at multiple joints (Holland, Tanaka, Shigematsu and Nakagaichi 2002) with flexibility exercises being used both in the prevention of injuries (predominantly used in athletic populations) and in the restoration of normal joint movement. A reduction in flexibility has been seen to contribute to reduced joint range of movement, mobility, balance and also contribute to a decline in the ability to carry out daily activities to a desired level (Zakas et al. 2005). Graduated stretching over a period of time has been seen to increase the length of both the contractile and connective tissues contributing to the restoration of normal joint motion (Harvey- Sutton, Wilson and Geffen 1998). Flexibility has been seen to be effected by three modes of stretching these being static, ballistic

and proprioceptive neuromuscular facilitation. Static stretching is often the mode of choice in a therapeutic setting due to simplicity and reduced risk of trauma and injury (Zakas et al. 2005).

Strengthening Exercises

Therapeutic strengthening exercise is commonly used to minimize disuse atrophy, increase circulation and maintain muscle condition. Isometric strengthening where the muscle contracts without movement is extremely useful in joint injury. Isotonic strengthening where muscle contraction takes the joint through the range of motion is useful where the range of motion is characterised as being pain-free. Isotonic strengthening often involves additional loading characteristic of typical resistance type work. This is particularly useful in the development of functional strength and power (Geffen 2003). Research has shown that both pain tolerance and pain thresholds are increased following the utilisation of resistance and isometric exercise (Koltyn 2000). Strengthening exercises are the mainstay of a number of low back pain interventions with this mode of exercise being used as an integral part of a multimodal approach (Donchin, Woolf, Kaplan and Floman 1990; Hansen, Bendix, Skov, Jensen, Kristensen, Krohn and Schioeler 1993; Risch, Norvell and Pollock 1993; Bentsen, Lindgarde and Manthorpe 1997; Ljunggren 1997; Descarreaux, Normand, Laurencelle and Dugas 2002; Petersen, Kryger, Ekdahl and Olsen 2002; Aure, Nilsen and Vasseljen 2003; Friedrich, Gittler, Arendasy and Friedrich 2005). As is the case in exercise prescription for performance enhancement, exercise progression is a key element in any therapeutic programme. Progression may be achieved by gradual increases in loading utilizing resistance equipment. For patients without access to such equipment, exercises that use the patient's own body weight as resistance can be used.

Proprioceptive Training

Proprioceptive training aims to increase the speed and efficiency of muscular control to prevent re-injury (Geffen 2003). Proprioceptive training can include progressive static balance training (progression from firm to labile surfaces) and variation in the difficulty of balance and control exercises (increasing the speed required to complete a proprioceptive task) (Geffen 2003).

Spinal Stabilisation

This is a very specific therapeutic regimen designed to control pain through active segmental stabilization protecting the spine from strain and re-injury (Sung 2003). The programme is based on theoretical knowledge with clear recommendations for exercise progressions once the stabilization skill has been mastered. It involves co-contraction of transversus abdominis and multifidus but is reliant on highly-skilled exercise professionals or practitioners to teach the skill to the patient. In this thesis we mainly focus on pain relief through active segmental stabilization, progressions associated with this mode of exercise are clearly defined, especially once the skill of co-contraction has been mastered (Jull and Richardson 2000).

CHAPTER 3

EXERCISE AND OSTEOPATHIC CONCEPTS, PHILOSOPHY AND PRACTICE MODELS

CHAPTER INTRODUCTION

The nature of osteopathic philosophy, concepts and practice means that there are no true models of osteopathic treatment. The philosophy and concepts underpinning osteopathic practice give context to the osteopath's distinctive approach to health care. The underlying philosophy acts as a unifying set of ideas for the organization of scientific knowledge in relation to all phases of physical, mental, emotional and spiritual health, along with distinctive patient management principles.

Osteopathy originated in the USA in 1874, and the development of the profession there led to trained practitioners, known as 'osteopathic physicians', having full and unlimited practice rights, with their scope of practice equivalent to medical practitioners (Carreio and Fossum 2011). The scope of practice of the osteopathic physician in the USA is well understood; osteopathic physicians are regarded as "parallel and distinctive" in regulatory and legislative affairs, as well as being included in consultation for most issues of public health policy (Peterson 2011).

In countries such as Australia, Britain and New Zealand, practitioners have limited practice rights (Carreio and Fossum 2011). Osteopathy emerged from the USA in the early part of the twentieth century to these countries (Carreio and Fossum 2011), however the individual legislations of these countries did not permit the full license practice of osteopathy as undertaken in the USA, and this difference resulted in the appearance of two recognized groups – the osteopath, and the osteopathic physician. Practitioners with limited practice rights, such as those in Australia, Britain or New Zealand, are described as 'osteopaths', as opposed to 'osteopathic physicians' (Carreio and Fossum 2011). Both groups share the same fundamental philosophies and principles of osteopathic medicine, and the same core competencies (Carreio and Fossum 2011); however their scopes of practice vary significantly. Despite this disparity, (Carreio and Fossum 2011) investigated that both osteopaths and osteopathic physicians have achieved "nationally recognized academic and professional standards within their country" that allow them to provide diagnosis and treatment based on the principles of the osteopathic philosophy.

THE ORIGINS AND NATURE OF OSTEOPATHY

Andrew Taylor Still (1828-1917), the founder of osteopathy, was convinced that 19th century medicine and patient care were inadequate, so he aimed to improve all aspects of medicine and place them on what he viewed as a more rational and scientific basis. He created an innovative system of diagnosis and treatment with two major emphases. The first focussed on the treatment of disease whilst emphasising the normalization of body structure and function. Practitioners required a detailed knowledge of anatomy from which to base diagnostic and clinical work, most notably palpation and manipulative treatments. The second emphasis of practice was far broader, highlighting the importance of health and well-being and the avoidance of negative health habits (Seffinger 2003). The origins of osteopathic philosophy can be traced back to the influential figures of Hippocrates (c.460BC-c.377BC), Galen (c.130-c.200) and Sydenham (1624-1689) who each criticized standard medical practices and focussed on the patient's natural ability to heal. Still envisaged osteopathic practice and care in a similar way and combined contemporary philosophical concepts and principles with existing scientific theories and accepted different aspects of these philosophies and judged which would work best for his patients and practice. Developing Still's initial thoughts on combining holistic practice with scientific theory, the Charter of the first osteopathic school stated that their aim was to improve the current system of osteopathic medicine by introducing a more scientific and rational approach (Seffinger 2003). Whether British osteopathy has truly achieved holistic practice integrated with scientific thinking remains to be seen and many British osteopaths would argue that such an aim is far removed from the original concepts envisaged by A. T. Still. James Jealous, an American practitioner, presents an argument for osteopaths to accept the death of osteopathy. Jealous (1999) claims that osteopathy in the USA is now no different to allopathic medicine and that the principles on which osteopathy were founded are gone. Jealous goes on to suggest that osteopathy is primarily an alternative to orthodox medicine and is concerned with finding the health in the patient rather than the disease (Jealous 1999). This may indeed be the case in the United States but it is clear that the traditional osteopathic principles still underpin education and practice within the UK. Jealous' paper, presented at an American Osteopathic Association Convention in 1999, draws on one of the key osteopathic concepts identified by Still in his early work. This was that the practitioner does not cure disease, but is responsible for correcting structural disturbances and thus encouraging the patient to heal his or herself. Lesho (1999) also that osteopathic medicine is a therapeutic system based **on** the premise that the

primary role of the physician is to facilitate the body's inherent ability to heal itself. Osteopathic philosophy maintains that the structure and function of the body are inseparable and that the problems in one organ affect other organ systems (Lesho 1999). In 1879, after practising combined orthodox medicine and osteopathy, Still became convinced that his approach to osteopathic medicine, focussing on the emphases of manipulation and promoting healthy living and well-being, achieved the same or better results than standard orthodox care which used predominantly medication. In the latter part of the 19th century, osteopathy was embraced as being not only a neuro musculoskeletal–oriented diagnostic and treatment system, but also a comprehensive and scientifically-based school of medicine that embraces a distinctive philosophy (Seffinger 2003). Classic osteopathic philosophy can thus be organized in terms of health; disease and patient care as illustrated in Figure 3.1

Figure 3.1**:** Classic Osteopathic Philosophy (Seffinger 2003):

Serial No	Health	Disease	Patient care
1.	[a] Health is a natural state of harmony. [b] The human body is a perfect machine created for health and activity. [c] A healthy state exists as long as there is a normal flow of body fluids and nerve activity.	[a] Disease is an effect of underlying, often multifactorial, causes. [b] Illness is often caused by mechanical impediments to normal flow of body fluids and nerve activity. [c] Environmental, social, mental, and behavioural factors contribute to the aetiology of disease and illness.	[a] The human body provides all the chemicals necessary for the needs of tissues and organs. [b] Removal of mechanical impediments allows optimal body fluid flow, nerve function, and restoration of health. [c] Environmental, cultural, social, mental and behavioural factors need to be addressed as part of the management plan. [d] Any management

			plan should realistically meet the individual needs of the patient.

EXERCISE AND PHYSICAL ACTIVITY WITHIN OSTEOPATHIC PHILOSOPHY

Osteopaths have long regarded patient care as the paradigm in which exercise and physical activity feature as part of treatment and management. In his early years of osteopathic practice, Still emphasized the importance of a comprehensive treatment plan for the patient. Although Still was heavily committed to the use of palpatory diagnosis and manipulative treatments, he acknowledged and continued with the many other aspects of patient care (Seffinger 2003). Still noted the importance of patient education and regularly added exercise as a behavioural adjustment to his management of patients. In his work, Osteopathy Research and Practice (1910), he noted the importance of giving hope to patients and, at the same time, providing them with a realistic approach to managing their own clinical condition (Still 1910). The emphasis of the patient as being in partnership with the practitioner and to some extent, responsible for his or her own long term health care, was a strong philosophical approach adopted by Still. It will be interesting to consider whether this philosophical approach continues to be adopted by contemporary osteopaths and chapters six and seven explore this further. The American Osteopathic Association recently proposed the consideration of a number of key principles in patient care and whilst the patient is undoubtedly the focus for health care, they reiterate that the patient must take the primary responsibility for his or her health, adopting a healthy lifestyle and adhering to any recommendations given to them by the osteopathic practitioner including recommendations for exercise and physical activity (Seffinger 2003). These recommendations although drawing on osteopathic philosophy are also reflective of orthodox standards of care. The osteopath's potential role in the promotion of healthy living, which undoubtedly includes the encouragement to participate in exercise and physical activity, has been viewed by a number of practitioners as image-enhancing. Health as described by the World Health Organization includes patients' physical, mental and psychosocial capabilities used in performing tasks demanded by their daily activities (Tones and Green 2004). An environment that emphasizes specific interest in well-being is an important part of any health care plan.

Physician attention to all components of health (including exercise and physical activity) should be included in the plan to advance osteopathy's image (Heath and Kelso 1999). Although similar guidelines for patient management and care are not widely seen in British osteopathic literature, The Standard of Proficiency (S2K) documentation written and provided by the General Osteopathic Council notes the importance of exercise in osteopathic management and even goes as far as stating that practitioners should be aware of the premise of exercise prescription and the usefulness it has for the patient. To date, British practicing osteopaths have provided only limited indirect evidence for including exercise as a fundamental adjunct to current osteopathic treatment. The work of Chown et al. (2008) details the nature of an osteopathic consultation in the context of a prospective randomized trial of chronic low back pain patients to either group exercise, physiotherapy or osteopathy. The osteopathic consultation is seen to include stretching and exercise advice (Chown et al. 2008). Sandler (1991) provides a historical perspective to the osteopathic treatment approach stating that osteopathy is moving away from the narrow, structural, even reductionist basis of osteopathic education towards an integrated and deeper understanding of the potential contribution of osteopathy to patient health care. Perhaps this reflects broadening of treatment horizons and delving deeper into the treatment options available to osteopaths. However, there is limited documented evidence to show that osteopaths are including exercise in their treatment and management of patients.

At the time of writing, there is only one study which focuses on the osteopathic use of exercise in the management of British patients. Lloyd (1993) demonstrated at the use of osteopathic maintenance treatment, which included the use of and recommendation of exercise by the practitioner. Osteopathic maintenance treatment is by no means a universal osteopathic policy, with some arguing against it on philosophical grounds (that it does not encourage patients to take responsibility for their own welfare, nor does it address psychological, social or environmental factors). In the case of the work of Lloyd (1993), osteopathic maintenance treatment has been defined to include self-help policies and assistance directed to other relevant factors. Additional to maintenance treatment, care for the patient also had to include some form of manual treatment. The study was implemented in 1991 as a retrospective study, whereby 5.3% of registered osteopaths (as of 1991) replied. Of this sample, 98.8% had used osteopathic maintenance treatment (as defined by Lloyd) at some point. Most of the osteopaths replied that the reason for the use of osteopathic maintenance treatment in their practice was due to personal

preference of practice style and personal experience in practice (Lloyd 1993). Despite the widespread use of maintenance treatment, 96% of respondents reported that they did not monitor the results of the maintenance treatment given to the presenting patient. Utilization of outcome measures in osteopathic practice is not widespread and the report that osteopaths do not monitor results of treatment is not surprising. There were additional reasons for giving maintenance treatment as an adjunct to manual techniques, these being: where occurring, postural degenerative or abnormality considerations suggest relapse was likely; policy taught at undergraduate level or commended by a respected colleague; patient repeatedly re-presented; patient requested continuing care; theoretical conviction that the policy must be efficacious; policy was a mark of professional care and would enhance the esteem of the profession; personal experience of spinal pain; placebo support of the patient (Lloyd 1993).

This study surveyed a rather small percentage of practicing osteopaths registered in 1991 (5.3%), and although definitive conclusions regarding the use of exercise in osteopathic treatment cannot be made, it is clear that osteopaths are aware of alternative treatment options available to them. Of note in this study is the variety of reasons given for including maintenance treatment in the management plans of patients. These reasons appear to agree with the anecdotal evidence provided by current osteopaths who suggest that their reasons for using exercise in osteopathic management are varied and are dependent in the main on personal experiences both during osteopathic training and during their careers. Indeed osteopathic reasoning for the potential inclusion of exercise therapy is explored further in chapters six and seven of this thesis.

In the work of Lloyd, 96% of all respondents claimed that they did not monitor the results of maintenance treatment given to their patients. The argument for evidence-based medicine may mean that practitioners need to take a careful view of monitoring not only patients with regards to the exercises they prescribe but also the variety of other techniques they employ on a daily basis. Basing treatment on evidence is an important focus for discussion in osteopathy. Heath & Kelso (1999) detail in their paper the progress the American Osteopathic Association (AOA) is making to replace opinion based decisions with those based on evidence in health care delivery and management. They are now emphasizing the need for practitioners to make decisions supported by an evidence base on patient evaluation, management and measuring health outcomes (Heath and Kelso 1999). This is in agreement with work in chronic pain suggesting core outcome measures encompassing the domains outlined by the AOA (Dworkin, Turk, Farrar

and IMMPACT Team 2004). The achievement of this would undoubtedly contribute to the quality of evidence in the field, giving more influence to findings of treatment efficacy and ensuring that comparisons between trials and treatments can be made. Heath & Kelso (1999) stress that word-of-mouth and patient testimonials are no longer sufficient in 21st century health care and that patient satisfaction, improved health status and effectiveness in managing patient health problems must be documented. With the introduction and increasing importance of clinical governance in the UK, British osteopaths might find themselves under considerable pressure to alter the way in which they practice. However, arguments against adopting this might centre around the potential loss of the osteopathic heritage and the loss of the emphasis on restoring and maintaining neuro musculoskeletal functions and their relationships to health. US practitioners recognize this fact but also hold high regard for clinical governance. A recent US mission statement was written to include and acknowledge the osteopathic heritage but they also accept the need for the osteopathic management of health care delivery to include publishing guidelines for health assessment procedures and measuring health care effectiveness (Seffinger 2003). Elements of an osteopathic health care plan need to address historical foundations improving the health of the presenting patient. This should include research on the effectiveness of manual treatment (interventions) used in general, specific or adjunctive care to include exercise prescription.

HEALTH PROMOTION IN OSTEOPATHIC CARE

In the original concepts of osteopathy written by Still, there is an expectation that the patient should adopt a level of self-care and become responsible for his or her own well-being. The World Health Organization (WHO) has adopted a rather simplistic view of health, defining health as "a state of complete, physical, mental and social well-being and not merely the absence of disease or infirmity" (Tones & Green, 2004, p 14.). The WHO's somewhat dated definition of health (over 60 years old) has been described as idealistic as most people rarely achieve a complete state of well-being (Lucas & Lloyd, 2005). Despite this, the notion that health is much more than the absence of disease is a fundamental concept in health promotion. The osteopath could be regarded as contributing to the empowerment of the patient to act in his or her own interests – a common aim in health promotion. Such concepts in health promotion entail individuals being motivated to develop a concern for and an interest in their own health and then

to work together with others on trying to improve matters. Tones and Green (2004) suggest that the emergence of health promotion as a discipline was in direct response to the need to address both environmental and behavioural determinants of health and effectively to "make healthy choices easy choices" (Tones and Green 2004).

"Empowerment" came to be used to describe the process by which individuals acting in groups could develop sufficient resources to act in their own long-term interests. In the context of osteopathic practice, a useful definition of empowerment is offered in the work of Lucas and Lloyd (2005) where empowerment can be viewed as having control over one's life, being able to exercise choice in terms of what one does and is, and allows scope for development (Lucas and Lloyd 2005). In practice this means that those health care professionals charged with promoting health may adopt broad strategies. This may mean the creation of an environment supportive to the achievement of health but of more significance to osteopaths, providing people with the information and skills required to make health decisions and mediation between groups to ensure the pursuit of health (Tones & Green, 2004). Key to the success of health promotion is effective health education and healthy public policy. Ensuring that individuals are educated in making informed choices is essential to the success of health promotion strategies. Tones & Green (2004) also suggest that to achieve individual empowerment, the service providers and organisations responsible for promotion must go through a process of health education. This scenario would indicate that osteopaths as health care professionals striving to educate and promote healthy behaviours and lifestyle choices should be well versed in appropriate education, be competent in communicating this information with patients and be aware of the health-promoting role of the osteopath and the General Osteopathic Council as the body responsible for professional issues. The work in chapters five, six and seven of this thesis will help to build a current picture of whether osteopathic educators and practitioners have undergone a process of health education and whether they are in fact in a position to promote healthy behaviours to their patient groups. The role of the osteopath in facilitating individuals to feel empowered to make behavioural change needs careful consideration. There appears to be some consensus in the literature suggesting that there is often limited regard given to the notion that the way in which health care professionals would like to improve a patient's health is in fact of importance for the patient themselves (Lucas and Lloyd 2005). People make lifestyle choices for a variety of reasons. For some, the choice is limited and this can be a function of education, socialization, situational

factors and goals and economic conditions. Even when an individual can be viewed as having an enhanced capacity, not always are the choices made healthy ones. Choices are rarely made for purely health reasons. Individuals may choose to adopt behaviour for economic reasons and in some cases the behaviors are considered to be unhealthy. Essentially the choice is driven by the individual's desire for and values associated with quality of life. Raeburn & Rootman (1998) suggest that quality of life is often defined as a goal and that health decisions, whether considered healthy or not, are made to make a contribution to an individual's own quality of life. The term empowerment is often misconstrued and misunderstood by health care professionals and very rarely is the experience of empowerment investigated from the perspective of the patient. What has been revealed is that empowerment is the ability to define and express individuals' own needs rather than being directed by the health care professional. In turn, they may view themselves as experts about their own needs over and above the views held by their practitioner. This goes against the concept that the practitioner is the expert in the patient practitioner relationship, and the need for the practitioner to be an active listener and respond to the desires and needs of the patient is paramount. There is evidence here then that patients should themselves inform the strategies for health promotion both in the context of national policy and personal treatment and management (Lucas and Lloyd 2005). By doing this, the practitioner should be aware that the desired behavioral outcome (adoption of an active lifestyle for example) may not be of importance to the patient and consequently the desired behavioural change may not be adopted. The important point here for practitioners is to be reflective listeners with their patients. Often patients will give clear indications of their exercise and physical activity intentions during the patient-practitioner interaction and it may be that the patient's own needs and goals in relation to exercise do not mirror those of the osteopath. To strive for a behavioural change that has little meaning or importance to the patient will often result in poor concordance between the patient and health care professionals' perceptions (Horne 1998). The role osteopaths adopt in health promotion and behavioral change in relation to physical activity and exercise is explored in greater depth in chapter seven. In summary, the paradigm of patient care has been regarded as the best place for exercise therapy and physical activity in osteopathy with A. T. Still, the American Osteopathic Association and to some extent British standards of osteopathic proficiency agreeing, by putting the patient in direct partnership with the practitioner over activity-based decisions. To date, there is limited research evidence for the use of exercise

therapy in osteopathic practice, but with an increasing focus on the necessity for evidence-based practice, osteopaths find themselves looking to the evidence from other therapies to guide their decision-making processes. In tandem with the osteopathic model of patient-practitioner partnership, osteopaths may also find themselves increasingly looking to models of health promotion and education in relation to exercise therapy and physical activity in osteopathic practice. In the context of wider health promotion, osteopaths could be viewed as enabling the empowerment of their patients in adopting healthy lifestyle choices to include the adoption and maintenance of physical activity. To complement this process, osteopaths could also be viewed as educators, providing their patients with the skills and knowledge necessary for behavioural change. An important conflict in this perceived health promotion and education role is the understanding that since health behaviour selections are based on individual choice and circumstance, the choices made are not always healthy ones. This is an important conflict that the osteopath might need to consider and reflect on when offering exercise advice to their patients.

4. LITERATURE REVIEW INVESTIGATING RESEARCH, THEORIES AND MODELS OF CHRONIC PAIN AND TRAUMA

INTRODUCTION

It is important to this field of enquiry to understand the scientific and biomedical advances made in the fields of long-term pain and trauma as these may inform perspectives on the social, psychological and spiritual effects of embodied historical trauma upon colonized, marginalized populations. Research clearly indicates the need for a paradigm shift that places people's identities and their dignity at the centre of future developments in the treatment of long-term pain, especially long-term pain that may stem from historical trauma. While the following section presents an overview of research that informs these ideas, the subject of long-term pain is complex and research in the field is vast. Out of necessity, this review narrows the focus to research that informs understanding of the complex topic of long-term pain and its possible relationship with embodied historical trauma. The literature review is presented in three sections. The first examines 'what pain is' and then discusses various pain models that inform recent developments in the understanding of what causes long-term pain. Recent theories and models are discussed, which highlight that long-term pain may be mediated by central processes and a

limited understanding of how plasticity in the brain and central nervous system may affect long-term pain is presented. The second section discusses the relationship between stress and long-term pain, which is a complex multi-layered subject that is not completely understood in scientific terms. Research examining the effects of cortisol on the brain and the body is addressed and dysregulation of the autonomic nervous system is discussed in relation to how this may affect cardiovascular function, breathing patterns and long-term pain. This is followed by an examination of research that considers the trans-generational effects of stress and trauma in relation to long-term pain. Post-traumatic stress disorder is also addressed and informs understanding of both the harmful effects of exposure to a single traumatic event and to prolonged and repeated exposure to stress. The third section addresses 'emotion' and a psychogenic theory of pain, which considers how difficult emotions may impact upon homeostatic mechanisms at the level of the brain to affect long-term pain. Recent advances in brain imaging research suggest that social and emotional stress may affect long-term pain and experimental studies investigating anger suppression are reviewed. How identity construction may affect long-term pain and how long-term pain may impact upon identity construction, are considered. Spiritual, historical and cultural considerations are briefly addressed in relation to how religion and science impact upon indigenous Māori approaches to understanding health, illness and long-term pain. Finally, findings from research combining psychological, emotional and physical therapeutic approaches to managing and treating long-term pain are reviewed.

A) About Long-term Pain, Models and Theories

In considering ethical perspectives on pain, Ferrell (2005) quotes pain theorist Margo Mc Caffery (1968) who maintains that: "pain is whatever the experiencing person says it is, existing whenever he/she says it does" (p. 88). Further, it is well documented that a client self-report is the most reliable indicator of pain intensity (Wells, Pasero, & McCaffery, 2008), suggesting that the human experience of pain is subjective. Cassel (1982) demonstrated suffering as "a state of severe distress that threatens the intactness of the person" (p. 640) that "may occur in relationship to any aspect of the person" (p. 641). Cassel (1982) situates suffering and pain in the realm of social and cultural aspects of the person, where relationship to self, body, family, society or other sources of abstract meaning may influence pain and suffering. Cassel maintains that understanding the place of the person in pain requires a rejection of historical dualism that seeks to separate the mind and the body (Cassel, 1988). Wells et al. (2008) suggested that many

definitions of pain provide for a physiologic perspective that defines pain at the tissue and not the human level, suggesting that much biomedical literature regarding long-term pain may neglect to truly account for the fact that pain is subjective and may have specific meaning for the person who experiences it. It is estimated that between 10% and 30% of the adult population normally suffer with long-term pain (Dominick et al., 2011; Gatchel, Peng, Peters, Fuchs, & Turk, 2007) and due to a rapidly aging population both globally and locally, these figures are set to rise (Hoy et al., 2014; Statistics New Zealand, 2014a). In the case of chronic lower back pain, lifetime prevalence is thought to be as high as 84%, with 12% of the population being disabled by lower back pain. The cost of pain is substantial and reduced effectiveness at work as a result of pain – known as 'presenteeism' – is thought to result in 36.5 million lost workdays annually in Australia (International Association for the Study of Pain, 2004; Phillips, 2009). A study sponsored by Pfizer NZ Ltd (2012) revealed that the annual total cost of long-term pain for Australia in 2007 was estimated at $33.4 billion, while in 2010, the total annual cost of arthritis alone in New Zealand was estimated at $3.2 billion (Pfizer New Zealand Ltd, 2012).

(B) Acute and chronic / persistent / long-term pain

Pain is a sensation of importance for self-preservation (Melzack, 2001; Zborowski, 1952) and in biomedical terms, it is considered as either acute or chronic. Acute pain may signal potential or actual tissue damage from injury or disease and motivates a person to act to prevent and treat its cause. Memory encodes the experience so that future encounters with the noxious stimuli are avoided. Acute pain is understood as being an adaptive process where damaged body tissues heal within a set time frame and pain subsides. Acute pain is mostly resolved successfully within a biomedical framework (Lumley et al., 2011). Chronic or long-term pain is defined as pain that persists for 12 weeks or more or that lasts beyond the time expected for damaged tissue to heal (Treede et al., 2015). Recurring long-term pain may be experienced over many months or years with interspersed pain free periods occurring in between bouts of persistent pain (Gatchel et al., 2007). While much research in the last two decades on the subject of long-term pain has improved understanding, theories regarding its etiology and identification of the exact biophysiological mechanisms involved in much long-term pain are still developing (Asmundson, Coons, Taylor, & Katz, 2002; Gatchel et al., 2007; Melzack, 2001).

The International Association for the Study of Pain and reclassification of Chronic idiopathic pain

Thieme and Gracely (2012) suggested that in society, long-term musculoskeletal pain may by definition be considered a problem that is characterized by unsuccessful treatment outcomes. Many types of chronic pain defy explanation and do not respond to traditional biomedical methods (Thieme & Gracely, 2012). For example, in the case of idiopathic lower back pain, while there appears to be a correlation between lower back pain and the degeneration of lumbar discs seen in clinical imaging, systematic reviews with meta-analysis conclude that at the individual level, none of the lesions identified by MRI may be established as a cause of lower back pain because similar MRI abnormalities are very common in people who are asymptomatic, they do not coincide with lower back pain, and they do not predict the response to evidence-based therapy for non-specific lower back pain (Balagué, Mannion, Pellisé, & Cedraschi, 2012). In response to emerging research findings, in 2015 the International Association for the Study of Pain together with the World Health Organization redefined classification categories for chronic pain conditions (Treede et al., 2015). A new category – c*hronic primary pain* – is described as follows primary pain is pain in one or more anatomic region/s that persists or recurs for longer than three months and is associated with significant emotional distress or functional disability in that it interferes with daily living and participation in social roles and cannot be explained by another chronic pain condition. The new category includes chronic widespread pain, back pain that is not musculoskeletal or neuropathic, fibromyalgia and irritable bowel syndrome (Treede et al., 2015). While contemporary models recognize that pain is a complex, subjective and perceptual experience involving psychological, social, cultural and biological factors (Gatchel et al., 2007; Melzack, 2001; Penney, 2010), the mainstream biomedical approach continues to promote the concept of pain as being a purely sensory experience involving noxious stimuli related to an injury, inflammation or organic pathology. Not wishing to be seen as incompetent, doctors may be compelled to try and identify a structural cause for persistent pain (Asmundson et al., 2002) and in doing so, they may ignore emotional difficulties or stressful life circumstances that may contribute to pain. This may be problematic for people who have recalcitrant persistent pain that fails to resolve or respond to pain medication (Casey, 2014). Many people with long-term pain may end up thinking that their doctor believes their pain is imaginary (Casey, 2014) and may fear labels such as ‘hypochondriac’ or ‘psychosomatic’ that imply they may have a psychological disorder. Such encounters may leave the patient feeling resentful, helpless and

disillusioned with their doctor and the health-care system (Okifuji , Turk, & Curran, 1999). Asmundson et al. (2002) maintain that many people who have long-term pain may in the end turn to a psychologist or pain specialist for help (Asmundson et al., 2002).

A. The biopsychosocial model

Engel's (1977) biopsychosocial model is widely accepted as being a necessary alternative to the reductionist biomedical approach to health-care and is particularly salient in the treatment of idiopathic long-term pain. The model recognizes that psychological factors may influence the experience of long-term pain, which confounds the biomedical view that pain is merely a physical sensation (Penney, 2010). While in theory the model is more holistic in that it encourages consideration of the biological, psychological, social, cultural and historical factors that may contribute to long-term pain, the literature suggests that historical and cultural factors receive little to no attention in pain research (Chapman et al., 2008). If a model that is designed to respond to a person in their world ignores historical and cultural perspectives, complex variables that may influence collective and individual wellbeing, disease and pain may be overlooked (Chapman & Nakamura, 1999; Chapman et al., 2008).

In practice, the biopsychosocial model holds that the onset of chronic or long-term pain following acute pain involves patterns of conditioned learning in which the adaptive alarm of acute pain fails to resolve and is no longer a reliable indicator of tissue damage. The model suggests that long-term pain develops as a result of *maladaptive* social, behavioural, neurological and biological responses to pain that may maintain the acute pain state (Hannibal & Bishop, 2014). Avoiding activity, resting and negative emotional responses such as fear, worry and rumination may contribute to what is termed the vicious cycle of pain (Gatchel et al., 2007; Lumley et al., 2011). The biopsychosocial approach is mainly used in the physical therapy setting and is directed at getting patients to modify their *dysfunctional* pain behaviours and negative emotional reactions to pain (Hannibal & Bishop, 2014). For example, responses to pain that cause the person to avoid activities they think will make pain worse, such as exercise, become the target of strategies that aim to reduce 'fear avoidance' behaviour (Norton, 2003). Exercise has been shown in many studies to reduce bouts of long-term pain and graded exposure methods encourage a gradual return to activity and exercise as a means of managing long term pain (Hannibal & Bishop, 2014). The fear avoidance model suggests that confronting pain may break the vicious cycle and promote recovery (Norton, 2003). While evidence suggests that

confronting pain is useful for alleviating pain-related fear behaviour, pain may persist because other fears or stressors that may exacerbate pain remain unaddressed (Gatchel et al., 2007). A recent amendment to the 'fear avoidance' strategy for addressing pain advises that clinicians need to be mindful of patients fear and anxiety in general as the presence of these may indicate a state of physiological arousal or in other words, 'stress', that may exacerbate long-term pain (Norton, 2003). The association between long-term pain, depression and anxiety is discussed further on in this chapter.

B. The Neuromatrix Model

Melzack (2001) proposed the 'neuromatrix model' in which pain is defined as a multidimensional experience produced by a characteristic 'neuro-signature' or nervous system response pattern generated by a widely distributed neural network – 'the body self neuromatrix' – in the brain. The theory asserts that the output patterns of the bodself neuromatrix activate perceptual, homeostatic and behavioural programs after injury, pathology or chronic stress that may contribute to the experience of long-term pain. Melzack (2001) states "we are so accustomed to considering pain as a purely sensory phenomenon that we have ignored the obvious fact that injury does not merely produce pain, it also disrupts the brains homeostasis regulation system". Hans Seyle, who advanced understanding of stress in the biological sense of tissue injury, infection and pathology, also highlighted the importance of psychological stress and his theory that chronic stress causes much illness is now widely accepted (Chrousos & Gold, 1992; Goldstein, 2010). Melzack's (2001) neuromatrix model of pain is informed by advancing research in the field of neuroscience and by research documenting the damaging biological effects of chronic stress (Chrousos & Gold, 1992). Both subjects are addressed further in this chapter.

Experimental research conducted by Ramachandran in the 1990s, in which a mirror box has been used to successfully treat phantom limb pain, completely changed scientific understanding of long-term pain (Ramachandran & Rogers-Ramachandran, 1996) and informs the perspective that pain is in fact a perceptual experience produced by an extensive neural network in the brain, rather than by direct sensory input evoked by tissue damage, inflammation, or other pathology alone (Melzack, 2001). Recent advances in brain imaging technology have led to a surge in research investigating the interconnected constructs of long-term pain, the brain, psychological and emotional stress and related biochemical interactions. The remainder of this

chapter addresses the literature that focuses on the brain and neuroendocrine function in relation to biological, psychological and emotional effects of stress and trauma on long-term musculoskeletal pain.

C. Central sensitization, plasticity and related pain research

Before reviewing a range of current research, the concept of central sensitization is discussed. This is an extremely complex process involving hyper-arousal of the central nervous system neurons that triggers neuro-chemical and neurotransmitter activity in the brain and spinal cord. Experimental research has increased understanding of 'chronic primary idiopathic pain', making clear that the brain's response to both physical assault or injury and psychological stress or trauma share overlapping neurological mechanisms that are not completely understood (Lumley et al., 2011). Central sensitization may generate pain in the body in the absence of peripheral tissue damage (Lumley, Sklar, & Carty, 2012); however, peripheral tissue damage may also generate central sensitization and as such the two mechanisms are interconnected.

Three perceptual dimensions have been identified in the pain experience (Lumley et al., 2011). The *sensory-discriminative dimension* senses location, timing and the physical properties of noxious stimuli (heat, pressure or noxious chemical), which when perceived, prompt withdrawal reflexes in order to limit tissue damage. The *affective emotivational dimension* is associated with emotion in which the perceived unpleasantness of noxious stimuli motivates escape, defensive behaviour and recuperation. Finally, the *cognitive-evaluative dimension* appraises the meaning and consequences that pain has for the individual (Lumley et al., 2011). The first two perceptual pain dimensions are mediated by two separate but parallel neural systems arising from within the dorsal horn of the spinal cord. The lateral pain system is responsible for assessing the sensory-discriminative aspects of pain and has axons ascending laterally within the spino thalamic tract of the spinal cord that synapse with lateral nuclei in the thalamus. From there, neurons project to the somato sensory cerebral cortex. The medial pain system (lying adjacent to the lateral) is responsible for the affective-motivational aspects of pain, consisting of medial axons of the cord and brain stem that synapse with medial thalamic nuclei that send further projections to a number of regions in the brain including the limbic system and the cingulate cortex. Experimental and clinical studies support the distinction between the two systems, where damage to the lateral system has been shown to make it difficult to localize or describe the physical properties of pain while the unpleasantness of the experience remains

(Ploner, Freund, & A., 1999). An imaging study directing people to think about the location of a noxious stimuli showed activation of the primary somato sensory cortex when they did so, while directing them to think about how unpleasant the stimulus was, showed activation of the medial pain system (Kulkarni et al., 2005).

Recent research suggests that long-term pain may involve neural plasticity and sensitization of the medial pain system in which the medial thalamus is the primary relay of nociceptive input to the anterior cingulate cortex (Lumley et al., 2011). In experimental research, repeated stimulation of this pathway via pain applied to peripheral tissues caused changes in neurons in the cingulate cortex and the modification of cingulated synapses appeared to regulate afferent signals that are considered important to the process in which the perception of acute pain becomes long-term pain (Shyu & Vogt, 2009). When pain is triggered by peripheral injury or a repetitive pain stimulus to the tissues, it may lead to long-term changes in the morphology, neurochemistry and gene expression in the anterior cingulate cortex, which may contribute to the maintenance and exacerbation of long-term pain (Cao et al., 2009). Three characteristics of central sensitization are known to occur: an enhanced pain response to normally painful stimuli or hyperalgesia, a decrease in the pain threshold to normally painful stimuli or allodynia, and an increase in spontaneous activity or spontaneous pain (Lumley et al., 2011). The medial pain system has projections to other subcortical regions that are considered key to emotional expression such as the amygdala, the hypothalamus and the periaqueductal gray. Lumley et al. (2011) investigated on studies demonstrating that peripheral pain may induce changes in neurons projecting from the basolateral amygdala to the medial prefrontal cortex, whose neurons are associated with cognitive and emotional processing. For example, partial kindling (repeated stimulation) of the basolateral amygdala in rats generated prolonged sensitization of neurons, which correlated with increased affective responses to painful shocks. This kind of sensitization is thought to be a factor in the persistent pain of fibromyalgia because people with the condition have enhanced defensive brain activations to non-painful, threat-related stimuli (Lumley et al., 2011). The hypothalamus amongst other things organizes innate defensive behaviours to threat, including anticipation of and ‘actual’ pain. Lumley (2011) reports that in murine studies, stimulating this structure elicited pain-like behaviour and manipulating inhibiting neurotransmitters altered rats’ emotional response to painful shock.

In a novel brain-imaging study, Rainville, Duncan, Price and Carrier (1997) used positron emission tomography (PET) and hypnosis to ascertain the cortical areas involved in the pain affect in normal human volunteers. Hypnotic suggestion both increased and decreased pain unpleasantness without changing the perceived intensity of pain sensations (Rainville, Duncan, Price, & Carrier, 1997). Changes in pain-evoked activation in the anterior cingulate cortex were consistent with the encoded suggestion of perceived unpleasantness; however, primary somatosensory cortex pain-evoked activation was unaltered. The experimental study links frontal lobe limbic activity with pain affect or emotional awareness of pain (Rainville et al., 1997), which is in line with clinical lesion studies in which unpleasantness of pain was absent with frontal lobotomy (Foltz & White, 1962). The findings suggest that affective states may alter perception of pain independently of pain intensity and Rainville et al. (1997) propose that pain-related activation in the anterior cingulate cortex reflects nociceptive input from a pain pathway that is highly modifiable and that emotional and behavioural reactions to pain largely determine the level of anterior cingulate cortex activation. Further, the close proximity of nociceptive, motor and attentional regions of the anterior cingulate cortex might allow for local interconnections where its output is able to command immediate behavioural reactions. Rainville et al. (1997) maintain that there is at least a partial segregation of function between pain affect and sensation, where the anterior cingulate cortex possibly reflects the emotional experience that provokes behavioural reactions to pain. The close proximity of the lateral and medial pain systems, however, suggests their functions are inextricably interconnected and plastic changes that may occur between the two may affect long-term pain. While studies suggest that central sensitization and brain plasticity are important, Chapman and Nakamura (1999) demonstrated that many pain models are not equipped to incorporate new understandings of the multiple biological, psychological, social, cultural and historical factors that may affect the pain experience. Recent advances in brain imaging studies highlight marked explanatory gaps in the understanding of pain resulting from the separation of research in the fields of classical neurophysiology and perceptual psychology (Chapman & Nakamura, 1999; Chapman et al., 2008). It is evident from the above studies that long62 term pain and trauma, both physical and psychological, may alter the brain's architecture and biochemical processes, and unless new models and methods of treatment are developed and applied that reflect new understanding, then much long-term pain may remain unresolved. The psychological, social and emotional effects of

trauma and prolonged stress upon long-term pain have until recently been given little attention in research; however, these effects are highly salient for understanding the multiple pathways that may contribute to the development and maintenance of pain.

Neural and behavioural changes in the development of expertise

Expert osteopaths demonstrate palpatory literacy to the extent that they often speak of having 'listening' or 'seeing' hands (Kappler, 1997). The effective use of highly developed and refined palpatory skills supports the diagnosis of dysfunction (GOsC, 1999). Although these claims lack empirical validation, it is plausible that expert osteopaths acquire these skills through years of deliberate practice. Deliberate practice has typically been regarded as an important predictor for the development of expertise on a range of fields of professional practice (e.g., medicine) and sports (e.g., Ericsson et al., 1993; 2007). For example, Ericsson (2007) argued that observed differences in clinical decision making processes are attributed to ongoing deliberate practice. The concept of deliberate practice initially developed by Ericsson and colleagues (1993), was influenced by the work of Simon and Chase (1973) on the acquisition of expertise in the sport of chess. Ericsson et al.'s (1993) framework is based on the premise that expert performance is primarily the result of years of intense and appropriately-guided practice. Although this is a plausible hypothesis, individual differences within the same level of osteopathic expertise could account for observed differences in clinical reasoning processes (Esteves, 2004), or diagnostic variability (e.g. Mior et al., 1990).

This subsection reviews behavioural and neurobiological evidence on the development of professional expertise. In doing so, it seeks to appraise the role of experience-based neuro plasticity by drawing upon evidence from studies of sensory deprivation and mental imagery.

Experience in diagnostic palpation

Links between clinical experience in manual medicine and improvements in palpatory accuracy and sensitivity have been explored by a number of researchers (Mior et al.,1990; Chandhok and Bagust, 2002; Foster and Bagust, 2004). Although Chaitow (2003) demonstrated that the precision of palpation as a diagnostic tool requires extensive training and clinical experience, the research evidence supporting improvements in palpatory performance linked to

experience is still contradictory. Whereas, for example, Bagust and colleagues (Chandhok and Bagust, 2002; Foster and Bagust, 2004) demonstrated improvements in tactile acuity in chiropractors, Mior et al.'s (1990) work failed lend support to the hypothesis that expertise is associated with improvements in palpatory performance. Chandhok and Bagust (2002) examined any differences in tactile acuity in the index fingers of the dominant and non-dominant hand in chiropractic students (age range, 18 to 30 years old) at different stages of their undergraduate training. They found that compared to year one students, those in the penultimate and final years of the course had greater tactile acuity in the index fingers of both hands. The improvements in tactile acuity were demonstrated by a reduction in 2-point discrimination thresholds, which represent a decrease in the sensory receptors' receptive fields. Chandhok and Bagust suggested that their findings may indicate that the training in palpatory clinical examination techniques contributes to the observed improvement in tactile acuity. However, the results need to be interpreted with caution. Although the authors compared the tactile acuity in the index fingers of both dominant and non-dominant hands of chiropractic students, the absence of a control group does not provide strong support for Chandhok and Bagust's hypothesis. The results may be confounded by, for example, the participants' practice on the task.

Furthermore, the reproducibility and sensitivity of the 2-point discrimination task as an indicator of tactile acuity has been questioned (e.g., Bell-Krotoski and Buford, 1997; Lundborg and Rosen, 2004). For example, Bell-Krotoski and Buford have argued that a difference in applied force during the sensory stimulation makes it possible for participants to successfully perform the 2-point discrimination test. Foster and Bagust (2004) modified their research group's previous investigation (Chandhok and Bagust, 2002) to include chiropractors with more than five years of postqualifying clinical experience in their study. In addition, they investigated the palpatory sensitivity in detecting a nylon monofilament under a variable number of sheets of paper.

Participants were blindfolded during the detection task. Their findings demonstrated that although tactile acuity improved through the chiropractic undergraduate programme; those improvements were not retained during professional clinical practice. As ageing leads to progressive impairments in tactile acuity, Foster and Bagust's findings may be explained by a progressive deterioration in tactile acuity amongst the experienced clinicians. Notwithstanding this, palpatory ability improved across the different levels of training and

clinical expertise. Foster and Bagust argued that although the 2-point discrimination threshold task provides good insights into the development of tactile acuity in practice; it is not a good measure of palpatory ability. One could argue that it seems plausible that the observed improvements in tactile ability throughout the different levels of expertise may indicate the occurrence of cortical neuroplasticity rather simply being associated with peripheral changes in the size of receptive fields. However, despite the fact that intensive training in the use of the hand in complex skills requiring precise sensory input leads to increased spatial representation in the somatic afferent system; it is still unclear whether the enlargement of the representations of trained fingers in the somatosensory cortex is associated with an increase in the skilled use of the fingers (Mountcastle, 2005, p. 444). Improvements in palpatory ability could nevertheless be explained by clinical experience related cross modal plasticity. In fact, this argument is supported by the work of Saito and colleagues (2006), who used fMRI to investigate the effects of long-term training on tactile shape determination of two-dimensional shape on a group of eight Mah-Jong experts. Arguably, Mah-Jong players develop haptic capabilities similar to those observed amongst manual medicine practitioners. Eight Mah-Jong experts (mean training duration 9.1 +/- 4.6 years) and twelve healthy, sighted individuals who were naïve to Mah-Jong, participated in the study. All had to perform a two-dimensional tactile shape discrimination of Mah-Jong tiles in the absence of vision. They were required to keep their eyes closed throughout the experimental session. Saito and their co-workers predicted that stronger activations in the visual cortex, including the multisensory ventral association areas in the visual cortex, would be observed in participants who were well-trained on the tactile discrimination of Mah-Jong tiles. In line with their experimental hypothesis, they observed activations in the left LOC and V1 when the expert participants performed the tactile discrimination of Mah- Jong tiles. In contrast, naïve individuals showed activations in the LOC but not in V1.

Furthermore, the researchers also observed similar patterns of activation in the expert group whilst performing Braille tactile discrimination tasks. Saito et al. (2006) argued that the observed activations in the primary visual cortex of well-trained individuals may be attributable to long-term training-related cross-modal plasticity. These findings are important for this thesis because they support the hypothesis that extensive periods of training and subsequent clinical practice may lead to visual-tactile cross-modal plasticity in the brains of osteopathic clinicians. Further evidence linking V1 to the development of tactile expertise amongst Mah-Jong players

could have been obtained through a TMS study. Applying TMS to the occipital cortex during a tactile discrimination task would have contributed to a further development of their causality hypothesis. Saito et al.'s (2006) results could be explained by a higher reliance on visual imagery amongst experts. That is, they may have relied on learned visual representations of Mah-Jong tiles whilst performing tactile discriminations.

Chapter 5

Exploring the use of vision and haptics in the diagnosis of somatic dysfunction

Authors in the field of osteopathic medicine have claimed that the hallmark of osteopaths is their effective use of a highly developed and refined skill of palpation (e.g., GOsC, 1999). Used in conjunction with other clinical evaluation methods such as visual inspection, diagnostic palpation plays a central role in osteopathic clinical decision making.

Guided by an appropriate and contextually relevant case history-taking, osteopaths use the clinical examination as a means of identifying the presence of altered function in the patient's somatic framework (e.g., Kuchera and Kuchera, 1992). Although the existence of somatic dysfunction, and its putative patho-physiological mechanisms have been questioned by researchers in the field of osteopathic medicine (e.g., Fryer, 2003; Fryer et al., 2010a); its diagnosis is nevertheless regarded by osteopaths as important to their clinical decision making (Fryer et al., 2009; Fryer et al., 2010b). Diagnostic judgments regarding the presence of *somatic dysfunction* take into consideration, for example, the tenderness, texture, and compliance of soft tissues (Greenman, 1996; Lewit, 1999; DiGiovanna, 2005c). In a recent survey, British osteopaths reported that the presence of altered soft tissue texture, and the quality and range of joint mobility, are important clinical findings for the diagnosis of somatic dysfunction in the spine and pelvis (Fryer et al., 2010b). Notwithstanding this, the signs of altered tissue texture and joint mobility have been consistently reported as lacking clinically acceptable levels of intra- and interexaminer reliability (e.g., Seffinger et al., 2004; Stochkendahl et al., 2006, for reviews).

The majority of these clinical signs of somatic dysfunction are conveyed by the clinician's senses, in particular, vision and hepatics. Information conveyed by the senses (i.e., what can be thought of as bottom-up processing) is likely to be processed in various areas of the clinician's brain, taking into account both prior knowledge and experience (i.e., topdown

processing, or prior knowledge). *Perceptual* judgments regarding the presence of somatic dysfunction are likely to depend on both analytical and non-analytical reasoning strategies. The results from the two studies discussed in previous chapters provided preliminary evidence suggesting that in the development of expertise in osteopathic medicine, biomedical knowledge and osteopathic knowledge become encapsulated into high level, but simplified causal models, and diagnostic categories that contain contextual information regarding the patient. Despite this, biomedical knowledge remains strongly represented in the expert clinicians' LTM, thus playing a critical role in osteopathic clinical reasoning. In fact, it can be argued that a strong mental representation of anatomical, physiological, and patho-physiological knowledge is likely to enable both experienced osteopaths and students to effectively diagnose the presence of somatic dysfunction. Moreover, the evidence from the two studies reported in Chapter 4 suggests that analogical reasoning is likely to be used by experienced clinicians when presented signs, symptoms, and contextual clinical data, are analogous to similar information stored in their LTM as episodic memories. Analogical reasoning can arguably provide the link between palpatory diagnosis and representations of tissue dysfunction encoded in the osteopath's LTM. The diagnosis of somatic dysfunction cannot be made in the absence of subjective information gathered at the case-history taking stage of the consultation.

Instead, the findings from a clinical examination need to be carefully interpreted in the context of the patient's present and past medical history, and contributory factors to the development of the problem such as his/her work-related activities. Although an osteopathic clinical examination is certainly a multisensory experience, one that requires the integration of visual and haptic information regarding the assessment of tenderness, asymmetry and restriction of motion and soft tissue changes, both bottom-up sensory processing and top-down clinical decision making processes are likely to influence diagnostic judgments of somatic dysfunction. Clinical experience is likely to play an important role in shaping the way in which expert osteopathic clinicians gather diagnostic data through their visual and haptic systems, process that information, and make clinical decisions. Putative neurophysiological changes associated with the development of diagnostic expertise are likely to contribute to an increased efficiency in multisensory integration of diagnostic data. Furthermore, understanding the rules and laws underlying multisensory integration may provide an explanation for at least part of the poor reliability of diagnostic tests in osteopathic practice. Crucially, the findings from the studies

reported in this thesis can be used to improve currently used teaching and learning strategies in both clinical and classroom-based settings. The present chapter explores the way in which osteopaths and students use their senses during an osteopathic clinical examination aimed at diagnosing a somatic dysfunction in the thoracic spine, lumbar spine, and pelvis. In the diagnosis of somatic dysfunction, osteopaths have to examine the texture, compliance, warmth, humidity, and movement of soft tissues and joints. Since tissue texture perception and intervertebral joint mobility are multidimensional tasks, vision and haptics are likely to play a synergistic role, and occur within the context of cross modal visuo-haptic networks. Considering the evidence demonstrating the presence of bimodal neurons in somatosensory and visual areas of the brain (e.g., IPS and LOC, Tal and Amedi, 2009), then visuo-haptic integration is most likely to be central to the diagnosis of somatic dysfunction. Clinical practice is likely to contribute to adaptive neuroplasticity. Consequently, if the nervous system of osteopaths undergo alterations at a structural and functional level, which result from their extensive use of vision and haptics in patient diagnosis and management, then expert osteopaths should be more efficient in the multisensory integration of diagnostic data. As a result, expert osteopaths are likely to be more consistent in their diagnoses. If ongoing clinical practice causes expert clinicians to learn how to combine sensory information from different modalities in a more effective way than novices, then they should be more consistent in their diagnoses when simultaneously using vision and haptics. Novices, by contrast, are likely to produce more consistent diagnoses by focusing their attention only on a single sensory modality of input at a time. Although the validity and reliability of diagnostic palpation has been extensively examined in fields of manual medicine (e.g., Seffinger et al., 2004; Stochkendahl et al., 2006, for reviews) and other non-manual medical disciplines (e.g., Gadsboll et al., 1989; Jarlov et al., 1991a; Yen et al., 2005); attempts to investigate the role of multisensory integration in the context of a clinical examination are still preliminary. For example, Vukanovic-Criley et al. (2006) found that in comparison to students and non-specialists, consultant cardiologists were better at simultaneously integrating auditory and visual information in a virtual cardiologic patient examination. Meanwhile, Maher and Adams (1996) investigated the impact of vision on tactile/kinaesthetic judgments of stiffness in a group of physiotherapists, physiotherapy students, and lay people, and found that participants judged stimuli as significantly stiffer when vision was occluded. They argued that their findings were attributed to the directing of the participants' attention to the tactile and proprioceptive

modalities; however, no comparisons between students, clinicians, and lay people were attempted.

Considering the absence of research examining the way in which clinicians use their senses in an osteopathic clinical examination, it was decided that a quasi-naturalistic observation research approach would provide the ideal means for gathering preliminary data supporting the design of subsequent studies. Naturalistic observation of work practices has been endorsed as a valid research method to study the development of expertise in professional settings (see Clancey, 2006, for a review). However, in the context of osteopathic medicine this would require an observation of clinicians and students whilst diagnosing and managing a real, previously untreated patient. The term quasi-naturalistic observation is therefore used to describe the research method utilized for the purpose of

The1ast two studies.

Now we perform the rigorous study, explored the way in which one senses in various aspects of an osteopathic clinical examination aimed at diagnosing a somatic dysfunction in the thoracic spine, lumbar spine, and pelvis, on a few patients with a history of chronic *low back pain*.

Figure 1: A close up view of a patient

Furthermore, the study examined the intra-examiner reliability in identifying a somatic dysfunction, whilst attempting to make links between intra-examiner levels of agreement and the use of the different senses in their clinical examination. Importantly, the purpose of studies and is not to investigate the reliability of diagnostic palpation but to understand how expert and novice practitioners use their visual and haptic systems in the context of a clinical examination. Finally, the pilot study provided an opportunity to validate and further develop the utilized research method and methodologies in days to come.

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