The use of ideomotor therapy in the treatment of chronic neck pain: A single systems research design.

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A research project submitted in partial requirement for the degree of Master of Osteopathy, UNITEC Institute of Technology, 2008
Declaration

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This Research Project titled “The use of ideomotor therapy in the treatment of chronic neck pain: A single systems research design” is submitted in partial fulfilment for the requirements for the Unitec degree of Master of Osteopathy.

CANDIDATE’S DECLARATION

I confirm that:

• This Research Project represents my own work;
• The contribution of supervisors and others to this work was consistent with the Unitec Regulations and Policies.
• Research for this work has been conducted in accordance with the Unitec research Ethics Committee Policy and Procedures, and has fulfilled any requirements set for this project by the Unitec Research Ethics Committee.

Research Ethics Committee Approval Number: 2008.847

Candidate Signature: Date:
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My parents Jan and Jono: thank you for your support and encouragement. You have always believed in me. This is as much for you as it is for me.

And to all the friends I ignored for such a long time, thank you for still being there at the finish line.
Abstract

Introduction: Neck pain is common and is a significant medical and socioeconomic problem in New Zealand. There are many treatments for neck pain, however the effectiveness of manual treatment for neck pain is poorly established. The aim of the present study is to document the effectiveness of an emergent manual therapeutic technique Simple Contact in five subjects suffering from chronic neck pain.

Methods: A prospective single-system research design using an A-B-C protocol was used to evaluate the effectiveness of the intervention Simple Contact in reducing levels of pain intensity, disability due to neck pain and fear avoidance behaviour, and increasing functional status levels. Subjects satisfying the study inclusion and exclusion criteria commenced a 9-10 week study consisting of a 3-4 week baseline period followed by a 3 week intervention period and a 3 week follow-up period. Outcome measures used to record levels were Quadruple Visual Analogue Scale, Neck Disability Index, Tampa Scale for Kinesiophobia, Fear Avoidance Beliefs Questionnaire and Patient Specific Functional Scale.

Results: Visual analysis of the data was used to attempt to identify any change in outcome measures that might be due to the intervention. Where relevant, trendlines were fitted to data from all three phases and to data from the intervention and follow-up phases. Variability of data and limited data points in the baseline phase make it difficult to conclude whether or not the intervention had an effect. Electronic submission of results by subjects allowed subject compliance to be checked. Poor compliance with scheduled dates for submission of data seriously weakens the integrity of the study and the ability to confidently draw conclusions from the results. This identifies a methodological weakness for studies reliant on self-report measures of change.

Conclusions: The current research was not able to make conclusions as to the effectiveness of the intervention Simple Contact on reducing levels of chronic neck pain in the five subjects studied. However, visual analyses of the results suggest that
the intervention was having no detectable effect on the outcomes measured. Future research in this area should attempt to obtain more baseline data and maximise compliance with scheduled dates of submission of data by subjects.
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Glossary

**Chronic Pain:** “Pain that persists for extended periods of time (i.e., months or years), that accompanies a disease process (e.g., rheumatoid arthritis), or that is associated with an injury that has not resolved within an expected period of time” (Turk & Melzack, 2001 pp. 4)

**Dysfunction:** “Impaired or altered function of related components of the somatic system: skeletal, arthroidal and myofascial structures, and related vascular, lymphatic and neural elements.” (Jones, 2003 pp. 157)

**Hypervigilance:** Abnormally increased arousal, responsiveness to stimuli, and scanning of the environment for threats (Dorland & Newman, 2003)

**Minimum Clinically Important Difference (MCID):** The minimum level of change recorded in an outcome measure that is considered to be clinically relevant.

**Nociceptor:** “A receptor preferentially receptive to a noxious stimulus or a stimulus which would become noxious if prolonged” (Merskey & Bogduk, 1994. pp 213)

**Pain:** “An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (Merskey & Bogduk, 1994. pp 210)

**Serial Dependency:** Correlation existing between sequential measures from the same individual (Ottenbacher & Hinderer, 2001)

**Simple Contact:** The manual therapeutic technique designed to facilitate an environment ideomotor movements may freely occur (Dorko, n.d.-b)

**Single System Design (SSD) also called Single System Research Design (SSRD):** Quasi-experimental, prospective research design, using a sample of one (n = 1). The design involves sequential introduction and withdrawal of an intervention. The effect of the intervention may then be assessed through one or more outcome measures through repeated measurements (Sim, 1994).
Chapter 1: Literature Review
Introduction

Despite the prevalence of research regarding incidence and epidemiology of neck pain, little literature exists regarding the effectiveness or efficacy of manual therapy in the treatment of neck pain (Carroll et al., 2008). Chronic neck pain, as with other chronic conditions, is generally considered to be associated with a multifactorial aetiology and does not lend itself to simple diagnosis. In clinical terms, there are often difficulties in pinpointing an anatomical structure that may be the source of nociception underlying the pain symptoms (Apkarian, Bailiki, & Geha, 2009). Several theoretical models exist that attempt to explain the mechanisms of neck pain, including biomechanical, neurological and cognitive behavioural models. An emergent therapeutic technique may offer a way of reconciling such a complex aetiologica picture. With foundations in psychological and physiological literature regarding instinctual motor behaviour, termed ideomotion, this manual therapeutic technique Simple Contact pioneered by Barrett Dorko in the early 2000s may be a viable and effective method for the treatment of chronic neck pain.

The research investigation reported in this dissertation employed a single system design to investigate whether ideomotor-based therapy was effective in the treatment of chronic neck pain. Five subjects with neck pain of a minimum 6-months duration were enrolled in the study, and monitored over a 9-week period. During this 9-week period, validated outcome measures for disability, pain levels, fear avoidance factors and functional status were employed to measure change.

The dissertation begins with a review of basic pain physiology before exploring some of the theories regarding the development and maintenance of chronic pain. It then provides a context for and outline of ideomotor behaviour, before presenting a series of single system (n=1) investigations. Vignettes describing the patients and their relevant health information will be presented, followed by results and discussion regarding the patients involved in the study. Finally a section of general discussion is presented including a discussion of the methods employed and consideration of important weaknesses of the study and research design in general.
Background

Pain review

Nociception\(^1\) generated outside the central nervous system (in the periphery) is generally of three types: i) nociceptive afferent signals due to mechanical deformation of tissues; ii) generated by chemical irritation of tissues by inflammatory mediators (see footnote \(^1\)), such as muscle or bone; or iii) thermal nociception; this being less relevant in considering musculoskeletal pain mechanisms (Hill 2001; Julius and Basbaum 2001; Charlton 2005). Certain characteristics of these different types of nociception exist that may facilitate their identification by clinicians and may be apparent during medical interviews. ‘Mechanical pain’, generated by deformation of innervated tissues, (e.g., Hill 2001; Julius and Basbaum 2001; Charlton 2005) may be aggravated with certain movements, relieved by certain movements or positions and can be intermittent. ‘Chemical pain’\(^2\) may be contrasted with mechanical pain in that ‘chemical pain’ is relatively constant in intensity, possibly worse after periods of inactivity, and is not relieved a great deal through positional change (Magee, 2006). Movement may help to relieve chemical pain through cycling of interstitial and lymphatic fluid in tissues, thereby facilitating removal of inflammatory chemicals. Indeed resolution of chemical pain other than through the use of anti-inflammatory medication requires blood circulation to ameliorate nerve tissue irritation (Hill 2001; Julius and Basbaum 2001; Charlton 2005).

Some pain theorists (e.g., Melzack, 2001; Moseley, 2003) contend that there is a link between pain and movement in that both stem from a common multi-system process; pain perception and localisation of pain occur concurrently with the generation of impulses leading to motor action serving to resolve the perceived threat. Wall (1999)

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\(^1\) Nociception is a stimulus arising from a Nociceptor, defined as “A receptor preferentially receptive to a noxious stimulus or a stimulus which would become noxious if prolonged” (Merskey & Bogduk, 1994, pp 213). This definition should be contrasted to the definition of pain, which is “An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (Merskey & Bogduk, 1994, pp 210)

\(^2\) Predominantly associated with chemical nociception of inflammatory mediators. Often termed ‘inflammatory soup’ inflammatory mediators include bradykinin, histamine, serotonin, nitric oxide (NO), nerve growth factor (NGF) K, H and the prostaglandins. Collectively these mediators serve to sensitize normally high-threshold nociceptors so that they respond to normally innocuous stimulation (Chapman, Tuckett, & Song, 2008).
suggested that pain may be resolved through a specific motor process, and that this appropriate response would manifest in an instinctual motor pattern. Using movement, such as passive movement of joints (eg mobilisation/articulation) or soft-tissues (eg massage techniques) and exercise prescription to reduce pain levels and to improve function, is not a new concept to manual therapists. Historically, the way manual therapists treat musculoskeletal dysfunction can be expressed simplistically; they either move – massage, articulation or manipulation – or stretch their patient’s tissues or offer advice regarding useful movements or positions patients can employ themselves in order to treat pain or dysfunction (Long, Donelson, & Fung, 2004; Silvernail, 2006). When a therapist prescribes a ‘correct movement’ for a musculoskeletal problem, there is the potential for unexpected outcomes; the patient may not respond to the movement associated with the diagnosis, or may respond to a movement unrelated to treatment of the tissue causing symptoms (Long, Donelson, & Fung, 2004). Authors have questioned the utility of prescribing tissue-specific exercise programmes; even given a non-specific exercise program it is common for patients to have reduced pain (Long, Donelson, & Fung, 2004). Returning to the premise of Wall (1999) that pain may be relieved using specific instinctual motor patterns generated in response to perception of pain, then the need for a practitioner to identify or prescribe the correct movement patterns becomes redundant; the capacity must be present within the patient to express the correct/corrective movement, and as such the difficulty for the practitioner becomes learning how to encourage the expression of this movement (Dorko, 2003).

**Chronic Pain**

Chronic pain may be defined as “Pain that persists for extended periods of time (i.e., months or years), that accompanies a disease process (e.g., rheumatoid arthritis), or that is associated with an injury that has not resolved within an expected period of time” (Turk & Melzack, 2001 pp. 4). Precisely when the healing phase comes to an end is problematic to define, and as such clinical practice tends to use standard time periods as markers, with chronic pain being defined as pain that persists at the 6 month point after the initial occurrence (Apkarian, Bailiki, & Geha, 2009). Such time
frames, however, tend to be arbitrary markers and may not directly represent the actual underlying mechanisms of pain development (Apkarian, Baliki & Geha, 2009).

Somatic manifestations of chronic pain are seldom simple, with often several tissues being observed to contribute to the overall clinical picture (Apkarian, Baliki & Geha, 2009). Apkarian et al., (2009) use the example of chronic low back pain as an example of a notoriously complex clinical picture, with relative involvement of tissues such as nerve and muscle tissue or processes such as joint degeneration having varying amounts of contribution to the overall dysfunctional pattern. In cases of chronic low back pain it is generally difficult to ascertain which tissue is injured or dysfunctional (Apkarian, Baliki & Geha, 2009). Similarly, in cases of chronic neck pain there is little evidence of specific pathology in the majority of cases, with nociception potentially originating from the cervical analogues of tissues and structures described for low back pain (Bogduk & Barnsley, 2000). Neck pain is therefore commonly labelled as pain of unknown origin or non-specific neck pain (Bogduk & Barnsley, 2000).

There are many models for the development of chronic pain, with some authors implicating anatomical (e.g., Pye et al., 2004), biomechanical (e.g., Okuda et al., 2004), or genetic (e.g., MacGregor, Andrew, Sambrook, & Spector, 2004; Sambrook, MacGregor, & Spector, 1999) factors predicting the occurrence of chronic pain. Neural models influencing the development of chronic pain are also well explored. For example, Hagelberg et al., (2004) examined the role of dopamine in the CNS in cases of chronic pain, suggesting that the degree to which dopamine is bound to D2 receptors in the basal ganglia could be used as a marker for diagnosis of chronic pain. Another study of neural theories of pain conducted by Apkarian et al., (2009) proposes a model of neurological reorganisation, in which the transition from acute to chronic pain is characterised by a reorganisation of neural pathways, the medial and lateral spinothalamic tracts, over time. The conclusion of this model is that the shift from acute to chronic pain is accompanied with a shift in perception of pain, with the perception of pain becoming a sign of an internalised disease state as opposed to a sign of external threat.
Cognitive behavioural theories relating to the development of chronic pain are also salient when considering a multifactorial model. One such theory is that of fear avoidance behaviour as a factor in the development of persistent disability. This cognitive behavioural model stresses the role of catastrophisation of the pain experience, leading to subsequent hypervigilance\(^3\) (Boersma et al., 2004). Added to this fear is avoidance of activity perceived to be associated with pain, fuelled by the idea that such activity will exacerbate the pain or will cause injury (Vlaeyen & Linton, 2000). This theory has support from research. Back pain studies have shown that due to fear of re-injury, patients over-predict the pain a back-stressing movement will produce and that when exposed to these movements patients corrected their expectations of pain and harm (Crombez, Vervaet, Lysens, Eelen, & Baeyens, 1996; Goubert, Francken, Crombez, Vansteenwegen, & Lysens, 2002). Research also shows that there is a strong association between disability and pain-related fear in patients with chronic pain (Crombez, Vlaeyen, Heuts, & Lysens, 1999; Vlaeyen, Kole-Snijders, Boeren, & H, 1995; Vlaeyen, Kole-Snijders, Rotteveel, Ruesink, & Heuts, 1995) and interestingly that pain-related fear is a predictor of future disability (Fritz & George, 2002; Klenerman et al., 1995). The implications of such research are that fear-avoidance behaviour is likely to play an important role in not only maintenance of chronic pain but also its development. Further, treatment which takes into account not only anatomical aspects of pain but also psychosocial aspects may be beneficial to many sufferers of chronic pain.

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**Instinctual ‘Ideomotor’ Movement**

The existence of non-conscious movement patterns has been relatively well identified within psychology and physiology (Hyman, 1999). An early description of instinctual motor patterns was made by Carpenter and reprinted in The Proceedings of the Royal Institution (Carpenter, 1852). Carpenter identified three categories of instinctual or non-conscious motor behaviour: excitomotor (e.g., swallowing or breathing); sensorimotor (e.g., blinking); and the third, and relevant to the current review,

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\(^3\) Hypervigilance can be defined as “abnormally increased arousal, responsiveness to stimuli, and scanning of the environment for threats” (Dorland & Newman, 2003)
ideomotor behaviour, the non-conscious motor patterns. Subsequent experiments into ideomotor behaviour have been summarised by Spitz (1997). The studies Spitz describes demonstrate an apparent muscle movement based on a non-conscious desire toward an apparent movement state. Examples of this include the subject being asked to imagine falling and manifesting movements designed to catch their balance such as swaying, or when asked to imagine lifting an object, subjects showed contraction of muscles in the arm associated with that lifting movement (Spitz, 1997). It should be noted that while ideomotor movements tend to be slow, larger range movements of the trunk and neck - at least within a therapeutic context- ideomotor behaviour may not always be easily visible (Rickards & Lucas, 2009), given the complex interaction of functional units needed to initiate movement.

Further examples of ideomotor behaviour are the involuntary moments that make up non-verbal communication, such as facial expression or body posture (popularly labelled as ‘body language’) (Spitz, 1997), yawning or postural correction when seeking to avoid discomfort – such as moving weight-bearing from foot to foot or shifting in a chair (Lehmann, 1979). McCarthy, Rickards & Lucas (2007) suggest this last example is descriptive of ideomotor activity as being a part of homeostatic or corrective functions. Interestingly, a good deal of the literature relating to ideomotor activity are found within the realms of illusory experiences (McCarthy, Rickards, & Lucas, 2007) such as dowsing, the ouija board, or pendulum diagnosis where ideomotion has been used as the scientific rationale for the events observed (Klinger 1971; Spitz 1997; Hyman 1999; Hall 2003). Further, ideomotion has been nominated as one of the potential mechanisms of action for therapeutic techniques such as energy work (Hall, 2003; Hyman, 1999) and may provide an explanation for the palpatory phenomenon described in osteopathy in the cranial field (OCF) or craniosacral therapy (Hartman & Norton, 2002).

Subsequently, the role of ideomotor activity may best be defined as the motor movements necessary to resolve the cognitive non-conscious need to reach a state of comfort (Rosenbaum, Meulenbroek, & Vaughan, 2001; Rosenbaum, van Heugten, & Caldwell, 1996; Short & Cauraugh, 1997), a feed-forward and feed back mechanism (Kunde, Elsner, & Keisel, 2007). Given the discussion presented above, it is not difficult to conceive of a situation in which awareness or imagining the desired end
state, such as the resolution of pain (Moseley, 2003; Wall & Melzack, 1999) could generate ideomotor behaviour which includes the correct or corrective movement needed to reach a state of comfort (Spitz, 1997) - the pain free state.

**Ideomotor Movement as Therapy**

As a therapeutic tool, ideomotion is a relatively new development based upon a foundation of psychological/physiological research and theory. Barrett Dorko (2003), building on this background literature of ideomotion, hypothesised that reduction in pain symptoms could be achieved by removing inhibition/suppression of instinctual motor patterns and encouraging these ideomotor patterns to emerge (Dorko, 2003, n.d.-b). *Simple Contact* is the name used by Dorko to describe the manual therapeutic technique designed to facilitate an environment where ideomotor movements may freely occur (Dorko, n.d.-b). As a form of therapy, *Simple Contact* attempts to utilise the ideomotor theory. Its application by the practitioner is intended to encourage and facilitate the emergence of the instinctual motor patterns required to resolve simple mechanical pain (Dorko, 2003). This is based upon the premise offered by foundational theorists such as James (1890) suggesting that ideomotion is expressed maximally unless a concurrent antagonistic impulse exists in the mind. Dorko (2003) proposed that such expression of movements may well have become culturally or socially unacceptable. They are limited by what one may reasonably expect to be permitted to do in a given social situation and thereby inhibited. Thus demands required of the social environment may generate simultaneous antagonistic representation. Interestingly, Dorko (n.d-b) also suggests that such concurrent inhibition of the ideomotor impulse may manifest as isometric muscle contraction. Where traditional manual therapeutic approaches aim to relax this contracted tissue through the use of stretching, exercise or manipulation (McCarthy, Rickards, & Lucas, 2007), Dorko (n.d-b). proposes that encouragement of the expression of instinctual motor behaviour resulting in isotonic contraction may be more appropriate. Given the potential for ideomotor behaviour to have been repressed through a process of growing awareness of social norms, Dorko (2003) suggests that the role of the practitioner becomes one of providing the appropriate environment necessary for
ideomotion to occur. *Simple Contact* employs many of the same handholds as may be utilised in other indirect techniques described in contemporary texts of manual technique such as Ward (2006). The technique employs light touch to facilitate the expression of ideomotor patterns together with verbal communication (Dorko, n.d.-a). This is similar to the approach used by psychotherapists while employing Authentic Movement, an encouraged expression of ideomotion designed to explore psychological pain through generating an understanding of the link between the psyche and soma (Wyman-McGinty 1998; Steckler 2006).
Epidemiology, prognosis and treatment of neck pain

Whilst no published literature exists for the epidemiology of neck pain in New Zealand, data obtained from the Accident Compensation Corporation (ACC) of New Zealand suggests that from July 2003 until July 2007 there were 12,723 new claims for pain relating to neck injuries, with ongoing (chronic) claims increasing over the period of five years from 4,198 in 2003 to 4,941 in 2007 (Accident Compensation Corporation, 2008). Of these claimants, the gender ratio was approximately equal, and most claims were made by people within an age range of 19-60 years of age (Accident Compensation Corporation, 2008). Costs Incurred by ACC for neck injury claims for the four year time period described was up to $533,210.

Outside of New Zealand, there is data to indicate that up to two thirds of people will suffer from neck pain in their lifetimes (Cote, Cassidy, & Carroll, 2003), and in the United States, neck pain is the second most common reason manipulative therapy is sought after low back pain (Clark & Haldeman, 1993). Perhaps the best source of data regarding neck pain comes from a recent study commissioned by the United Nations and World Health Organisation. The Bone and Joint Decade 2000-2010 Task Force on Neck Pain and its Associated Disorders (2008) conducted an exhaustive study into epidemiology, course\(^4\), and prognostic factors for neck pain within the general population. They found that the 12-month prevalence of neck pain ranged from 12.1% to 71.5% in the general population, and from 27.1% to 47.8% in workers, and between 50% and 85% of those who experience neck pain at an initial point reporting neck pain again 1 to 5 years later (Carroll et al., 2008). Findings regarding prognosis clearly indicated the multifactorial nature of chronic neck pain. Younger age was associated with a better prognosis, while prior neck pain and poorer general health were associated with a worse prognosis (Carroll et al., 2008). Interestingly, Carroll et al., (2008) also found that there was an association between becoming angry and frustrated and worrying, poorer psychological health and a poorer

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\(^4\) The term “course” was used by the review in preference to the term “natural history” which is generally understood to mean the course of the disease in the absence of intervention, and the authors state that it was unclear in many of the articles reviewed whether intervention took place.
prognosis. A better prognosis was associated with a self-assured coping style and greater optimism and less need for socialisation (Carroll et al., 2008).

Carroll et al., (2008) included in their systematic review an analysis of the benefits of different modalities of non-surgical treatments. Mobilisation, manual therapy, educational videos appeared to be more effective than what they described as usual care and alternative or sham treatments for neck pain, however, no single modality appeared any more effective than any other (Carroll et al., 2008). They conclude that more research into modifiable risk factors and new and innovative treatment for neck pain is clearly required (Carroll et al., 2008).

**Single System Design**

Within clinical research a general hierarchy of levels of evidence in relation to research designs exists. (Evans, 2003) Topmost in that hierarchy are systematic reviews of literature, followed by randomised controlled trials. These two designs are considered to be the most powerful of clinical research designs. Lower on the list are observational studies, useful for example when an historical case exists to be studied. The single system research design (SSRD), whilst not appearing on any of the standard hierarchies, would appear still lower on the design hierarchy. Due to its prospective nature the SSRD would likely place above the case study, but lacking controls such as case control, would appear below observational studies. Given the emergent nature of manual therapy utilising ideomotion, there is still much ground to be covered in order to investigate effectiveness. The SSRD, providing a quasi-experimental method to investigate the effectiveness of an intervention upon an individual, is often a useful design to achieve this end (Moran, 2005). While relatively weak in comparison to an explanatory randomised controlled trial (RCT) in which patients are selected for homogeneity and variables are controlled in such a way as to make results generalisable to a larger population, the SSRD is still weakly capable of controlling for some extraneous variables such as co-intervention. Whilst any results gained from an SSRD may not be generalised nor are predictive, they will at least objectively document outcomes of the single patient studied (Domholdt, 2005; Moran, 2005; Sanders, 2003) and may be capable of providing enough evidence to justify undertaking more powerful studies later.
Quasi-experimental research designs such as the SSRD are utilised to investigate effectiveness of a clinical treatment in a ‘real-life’ or pragmatic setting, and may be conducted in a clinical setting with small numbers of ‘real’ patients. Single system design experiments allow customisation of treatment frequency, content and duration, such that any harm to subjects from events such as sub-optimal or inappropriate treatment is minimised (Sim, 1994). In comparison, the design of explanatory randomised controlled trials requires selection of patients based on homogeneity and feature treatment interventions which have been predetermined and are standardised for all subjects, such that there is increased likelihood of suboptimal treatment due to the lack of intervention being targeted to specific individual case (Sim, 1994). Further, randomised controlled trials make assumptions based on aggregate data which may not be representative of any individual subject examined in the experiment, whilst an SSRD is able to offer predictions of possible responses based upon a set of observed clinical features presented by the individual (Rogan, Hickman, Harris, & Heriza, 2008).

There are several important limitations of SSRDs. The major limitation is the weak control they provide over extraneous variables. Internal validity may be threatened where extraneous variables may influence the dependent variable. An SSRD cannot account for the placebo effect due to its lack of control group, such that the appearance of recovery in a subject may be due to their belief in the effectiveness of the intervention rather than the actual effectiveness of the intervention itself. Limitations also exist in the analysis of data, which is typically simplistic involving graphical representation only (Bithell, 1994). Assumptions, such as independence of data, are required to be able to employ inferential statistics. Such independence of data cannot be fulfilled in the SSRD. Serial dependence- where data points are strongly related- due to frequent recording for example may exist (Bithell, 1994). Treatment effects of one intervention session may be overstated, while subsequent treatment may have less apparent impact and thus be marginalised as less effective (Bithell, 1994). Benefits and limitations of the SSRD are summarised below in Table 1.
Table 1: Benefits and limitations of the SSRD (After Fletcher, 2006; Sim, 1994)

<table>
<thead>
<tr>
<th>Benefits of SSRD</th>
<th>Limitations of SSRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducted in a clinical setting</td>
<td>History, maturation and frequent measures are known to alter the behaviour of the subjects, thus may have weak internal validity</td>
</tr>
<tr>
<td>Do not require large numbers of participants</td>
<td>Weak external validity</td>
</tr>
<tr>
<td>Treatment customised to individual patient minimizing harm</td>
<td>Results may not be statistically analysed</td>
</tr>
<tr>
<td>No control group, therefore no need to withhold treatment</td>
<td>Lack of scientific credibility</td>
</tr>
<tr>
<td>Can be used for rare conditions</td>
<td>Hard to determine stable baseline</td>
</tr>
<tr>
<td>Through use of replication and meta-analysis, some evidence as to a group response can be obtained</td>
<td>Simplistic graphical representation</td>
</tr>
<tr>
<td></td>
<td>Poor control over extraneous variables such as the placebo effect</td>
</tr>
</tbody>
</table>

**Previous Research**

Published research into the use of ideomotor-based therapy as a clinical therapeutic tool is limited. One SSRD by McCarthy, Rickards & Lucas (2007) exists investigating the effectiveness of ideomotor therapy- *Simple Contact*- in a patient with chronic neck and shoulder-girdle pain. Their findings were of a decrease in pain intensity and perceived disability concurrent with the introduction of ideomotor-based therapy, which they attributed as being due to the intervention (McCarthy, Rickards, & Lucas, 2007). The authors also discussed the fact that providing basic education of pain neurophysiology may have influenced the outcome (McCarthy, Rickards, & Lucas, 2007). At the time of writing the current work, one other unpublished SSRD series exists investigating the use of ideomotion as a therapeutic tool to address chronic pain (Rickards & Lucas, 2009). In their research, Rickards & Lucas (2009) examine 4 patients with chronic neck and low back pain. Their results were consistent with the findings of McCarthy, Rickards & Lucas (2007), with 3 of 4 of the subjects studied recording clinically important decreases in disability, negative affect and pain intensity scores (Rickards & Lucas, 2009).

Given the findings of the two studies described above the present study is clearly warranted, particularly given only two previous studies exist, and these are conducted
by the same research group. With the cost associated with the case of chronic pain patients and the lack of clinical evidence of effectiveness of manual treatment previously discussed, new methods of treatment with proven effectiveness are needed. It is apparent that the occurrence of ideomotor behaviour employed in a clinical setting using *Simple Contact* requires evaluation.
Chapter 2: Methods
**Research Aims**

To investigate the effect of ideomotor movements in patients chronic neck pain through the use of *Simple Contact*.

**Research Objectives**

To explore the potential for the reduction of pain symptoms and increase of function and quality of life.

**Research Design**

A prospective A-B-C SSRD was used to investigate the effectiveness of ideomotion in the treatment of patients with chronic neck pain. Each individual study was of nine (in one case 10) weeks duration with each phase being of three weeks duration and following the preceded phase without intermission. Phase A consisted of a three week baseline period in which multiple measures were collected, including quadruple visual analogue scale (QVAS), neck disability index (NDI), patient specific functional scale (PSFS), Tampa scale for kinesiophobia (TSK) and fear-avoidance beliefs questionnaire (FABQ). These measures are further described below in the ‘outcome measures’ section. No active treatment was employed during the baseline phase.

Phase B was an intervention phase of three weeks duration. During this phase a total of three, thirty minute treatment sessions employing *Simple Contact* to facilitate ideomotor movement expression took place at weekly intervals. Self management was also encouraged, and consisted of daily *homework* sessions of ideomotor movements. Each *homework* session was recommended to be of at least twenty minutes duration. During phase B measurements took place in the form of pain intensity (QVAS), neck disability (NDI), functional ability (PSFS), fear of movement causing (re)injury (TSK and FABQ) being recorded three times weekly. In addition a *Pain Right Now* visual analogue scale was recorded before and after each treatment session.
Phase C was a period of three weeks of self-management, during which the daily homework sessions of ideomotor movements continued. Measurements during phase C were recorded using the same instruments. No treatment was provided in this last phase.

**Subjects**

Subjects were recruited after a leaflet drop within suburbs surrounding the Mount Albert campus of Unitec New Zealand.

**Inclusion Criteria**

Subjects were to be between the ages of 18 to 60 years, and reported experiencing neck pain for at least six months duration, and were available to participate over the nine weeks scheduled for the study.

**Exclusion Criteria**

Subjects were excluded if they reported neck pain attributable to diagnosed disc pathology or other spinal pathology such as cancer, fracture, infection, rheumatological disease or any other medical condition. Neck pain due to ongoing tissue damage, inflammatory conditions or nerve-root involvement was also an exclusion criterion.

**Consent and Withdrawal Criteria**

Subjects were presented with an information sheet describing the study and the requirements for measurement and attendance, and were requested to refrain from any other form of treatment for their pain during the nine week trial. Ethics approval was granted by the Unitec Research Ethics Committee (Approval number 2007-789). Satisfied that they were fully informed as to the process of the research, subjects were then presented with a consent form to sign.
Enrolled subjects had the right to withdraw without notice or giving any reason at any point during the trial, and could withdraw their data up until two weeks following the conclusion of the trial. Subjects were also to be withdrawn should side effects develop during the course of the treatment, including worsening of symptoms or the manifestation of any of the exclusion criteria detailed above.

**Intervention**

*Simple Contact* was used to facilitate the expression of ideomotor movements in each subject. In using *Simple Contact*, the technician does not seek to choreograph or suggest any particular movement or movements sets, but rather serves to facilitate the patient’s awareness of the potential for their own spontaneous movement such that they are able to allow it to occur (Dorko, n.d). Rickards and Lucas (2009) describe the application of simple contact as needing to be of sufficient pressure to be barely detectable by the subject. As the subject begins to move the practitioner merely ‘follows’ the movements with their own hands and body (Rickards & Lucas, 2009). Hand holds utilised in the current study included contact with the head in the regions of frontal and occipital bones. Contact with subjects’ shoulders at the region of the acromio-clavicular joint was also used, and occasionally contact was made with the pelvis at the level of the iliac crests bilaterally.

Typically, treatment with *Simple Contact* takes place with the subject positioned in standing, seated or supine. While the subject is seated or standing there is a greater freedom of movement, such that larger amplitude movements of the neck or trunk may be observed (Rickards & Lucas, 2009). When the subject is supine such large scale movements are restricted, however, smaller movements, while not necessarily visible, may be palpated by the practitioner (Rickards & Lucas, 2009).
**Outcome Measures**

The tools used to measure outcomes of the study are described in Table 2.

<table>
<thead>
<tr>
<th>Table 2: Description of Outcome Measures</th>
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<tbody>
<tr>
<td><strong>Neck Disability Index (NDI)</strong></td>
</tr>
<tr>
<td><strong>Quadruple Visual Analogue Scale (QVAS)</strong></td>
</tr>
<tr>
<td><strong>Patient Specific Functional Scale (PSFS)</strong></td>
</tr>
<tr>
<td><strong>Tampa Scale for Kinesiophobia (TSK) and Fear-Avoidance Beliefs Questionnaire</strong></td>
</tr>
</tbody>
</table>
Chapter 3: Subject Vignettes
Subject Vignettes

Subject 1

Subject 1 was a 24 year old female part-time office administrator, enrolled in the study after fulfilling the inclusion criteria and giving informed written consent. She described the onset of her neck pain as occurring during a music concert when she was elbowed in the neck by an enthusiastic listener. This occurred when she was 16 years of age. Subject 1’s pain initially improved at the time of first onset, but had subsequently worsened, and at the time of recruitment was unchanging or possibly worsening. The distribution of neck pain was bilateral shoulders, especially the left, and the “base of the neck” up into the “where the head joins”. Pain was aggravated by sustained sitting postures and bending forward and relieved by medication or sometimes breathing exercises or stretches. Headache was a feature associated with her neck pain, with the subject in addition suffering from migraine severe enough to require hospitalisation on some occasions. She described herself as being “dependent” on codeine-based medication such as Mercyndol® containing codeine, paracetamol and doxylamine succinate, or Panadeine®, taking these drugs daily. This was sometimes supplemented with Nurofen® Plus® or Panadol®. In addition when suffering from migraine she self medicated with Imigran®, a sulphonamide drug based on sumatriptan and taken for migraine headache. Her general practitioner had also prescribed her Citalopram®, a selective serotonin reuptake inhibitor (SSRI) for depression, Amitriptyline for pain control and migraine and Diazepam®, a benzodiazepine tranquiliser possibly prescribed for sleep or as a muscle relaxant. Sleep patterns were disturbed, and the subject reported using a moulding pillow and lying on her left side were the most comfortable way to sleep. Previous treatment had included chiropractic, osteopathy and most recently acupuncture. The subject displayed good sitting and standing posture, with minimally impaired cervical movements in protrusion, retraction flexion, extension, sidebending right and left and rotation right and left.

5 See Appendix 8 for bodychart
Subject 2

Subject 2 was a 40 year old female telemarketer, enrolled in the study after fulfilling the study inclusion criteria giving informed written consent. Twenty-one years ago subject 2 had been swimming at a surf beach and collided with a surfer, with the surfboard hitting her neck “high on the right”. The subject reported that pain levels had remained unchanged since the accident. The distribution of the pain was described by the subject as “the entire right side of the neck and behind the eyes⁶”, and was aggravated by sitting- her neck feeling “compressed” in this position- and relieved by hanging upside-down or by Nurofen®. There was no headache associated with the neck complaint. Medication used were Nortriptyline hydrochloride, a tricyclic antidepressant, and Inhibase Plus®, containing the angiotensin-converting enzyme inhibitor cilazapril, and hydrochlorothiazide for diuresis to control hypertension. She also self medicated with 120ml of Noni juice for pain. The subject described her sleep as being “disturbed”, often waking in the night, and she mainly sleeping on her right side and back and using one feather pillow. Previous treatment for her neck pain included chiropractic, which provided relief at the time of treatment but had very short longevity, and energy work “off and on” since the onset of the pain. Observation of the subject revealed a protruded head in both sitting and standing positions. Cervical extension was moderately impaired, protrusion and retraction minimally impaired. Flexion was full and free from restriction. Rotation was moderately impaired both right and left, and sidebending was minimally impaired both right and left.

⁶ See Appendix 9 for bodychart
Subject 3

Subject 3 was a 29 year old mother of 3 who was due to return to her job as a helpdesk manager during the trial, after having been on maternity leave “for some months”. She was recruited to the study after fulfilling the study inclusion criteria and giving informed written consent. The initial onset of subject 3’s pain was during a period with her company 2 ½ years ago where her workload had been at an unprecedented high and she reported her pain levels had remained unchanging since this time. The distribution of the pain was on “both sides” of her neck around the “bottom of the skull” and often resulted in a headache which typically moved forward to be felt behind her eyes. The neck pain was aggravated by “leaning her head backwards” or sitting for sustained periods, and was relieved by massage and heat. Subject 3 did not take any medication for her pain, although she described recently ceasing to take paracetamol prescribed following a caesarean section during the birth of her youngest child. There was a pattern of disturbed sleep and subject 3 reported sleeping for only 2 hours per night. She was unsure what factors caused such a disturbance, and suggested she was aware of her neck pain upon waking but did not think the pain was what was causing her to wake. Previous treatment had been limited to the “occasional massage”. The subject was not sure how frequently she received massages. Examination revealed a protruded head posture in both sitting and standing positions. There was significant cervical movement impairment in retraction and minimal movement impairment in protrusion and sidebend right and left.

\(^7\) See Appendix 10 for bodychart
Subject 4

A 25 year old female student of osteopathy, subject 4 was enrolled in the study after fulfilling the study inclusion criteria and giving informed written consent. The subject began noticing some neck pain while working on highschool computers, but was unsure precisely when she first noticed this neck pain. She had her first notable episode at 18 years of age while working as an office secretary- a job she continued with until 24 years of age. Since this first episode she described her pain as worsening over time. The areas effected by pain were the right side of her neck where it “joined her skull” and “at the base”, and the “left side” felt “tight”\(^6\). She reported suffering from headache, and while this was not present during every episode of neck pain it did not arise independent of the neck pain. The distribution of the headache was in the frontal region of the head, always unilateral and always on the right. The neck pain was aggravated by cervical extension and relieved by warmth, and had been treated with chiropractic and osteopathic manipulation, which provided relief for 3-4 days. She was unsure when she had received her first treatment and how frequently these treatments had occurred. Subject 4 tended to sleep well, getting around 8 hours per night, unless she was engaged in extended computer work at which time sleeping hours decreased. She used a medium sized pillow, and slept on her back. Medication was limited to dietary supplements of iron and zinc. Physical examination revealed a minimally protruded head during sitting and standing positions. There was minimal impairment in cervical retraction, flexion, extension, sidebend left and rotation left, and moderate impairment in sidebend right.

\(^6\) See Appendix 11 for bodychart
Subject 5

Subject 5 was a 49 year old female computer operator, enrolled in the study after fulfilling the study inclusion criteria and giving informed written consent. Her neck pain began during a long-haul flight from Ireland to New Zealand in 1999, and since that time has been worsening, particularly noticeable when seated working for long periods. The hours spent working were erratic, and subject 5 was required to work for up to 12 hours per day for a changing roster of days. These hours would vary from daytime to night-time and in number depending on the shift roster. This intensive work schedule would be followed by extended periods with no work at all. The distribution of the pain was described as “across both shoulders” and “up into the neck all the way to the head”, aggravated by rotation both directions with right being worse than left, and relieved by analgesic medication. Such medication was Panadol®, Nurofen® and Paramax®, containing paracetamol and metoclopramide hydrochloride. The Paramax® was used to control headache which was usually right sided, beginning at the “back of the head” and moving anterolaterally into the temporal and retro-orbital regions. This headache was often accompanied by nausea and vomiting, but no photophobia, phonophobia or visual disturbance was experienced. Headaches did not coincide with neck pain. Sleeping patterns experienced by the subject tended to be good, however could become disturbed during periods of work, where shifts necessitated either sleeping during the day or changeable working hours precipitating inconsistent daily patterns. At these times sleep was often interrupted after about 2 hours, becoming fitful. Subject 5 used a thick pillow, and found it most comfortable to sleep on her back. Previous treatment included chiropractic, which the subject recalled “maybe helped a bit”. The subject was unsure as to the frequency of previous treatment, and described it as “occasional”. Observation revealed a forward (protruded) head posture, in sitting and standing positions. Both cervical sidebend left and right were moderately impaired and all other ranges (protrusion, retraction, flexion and rotation right and left) excluding extension were minimally impaired. There was no movement impairment in cervical extension.

* See Appendix 12 for bodychart
Chapter 4: Results
Results

The following data plots show recorded results obtained during the three phases of the current study. Phase A was a baseline phase, with no intervention applied. Phase B, the intervention phase, included the application of the intervention Simple Contact by the practitioner in once-weekly clinical sessions, and prescribed daily homework sessions of ideomotor movements. It was suggested these homework sessions be of 20 minutes duration. Phase C was the follow-up phase, in which the weekly clinical Simple Contact sessions were withdrawn but the subjects were encouraged to maintain their daily homework sessions of ideomotor movements. In each of the three phases the five outcome measures (see Methods) were employed to record any changes. Results were varied between subjects studied, with few clinically important changes recorded and variable data not amenable to prediction of trends. This was particularly evident in baseline phases (phase A), where the few data points were highly variable. Participant compliance with scheduled data submission days was poor in three of the five subjects, and data recorded from all subjects was rendered less robust as a result.
**Subject 1 (S1)**

**S1 Quadruple Visual Analogue Scale (QVAS)**

QVAS\(^{10}\) scores for subject 1 over the baseline, treatment and follow-up phases are summarised in Figure 1. The *Pain Right Now* score is the most variable of the four scores; the data recorded in phase A is highly variable making it difficult to establish the baseline *Pain Right Now* score for S1. Phase B and C have less data variability and show a general decrease in *Pain Right Now* mean intensity. *Typical/Average Pain* reports are also variable during the baseline period leading up to intervention when reported pain becomes lower and less variable (Phase B and C). The range of pain reported (*Pain At Best and Pain at Worst scores*) shows no meaningful change during the 10 week period.

![Figure 1.0 QVAS Pain Intensity Scores](image)

Figure 1.0 QVAS Pain Intensity Scores pertaining to four subscales of pain intensity measured three times weekly for the duration of the trial. X axis is labelled phase (Week) of Study. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self-directed intervention is applied. During phase C clinical treatment is withdrawn but home based self directed intervention remains.

\(^{10}\) Quadruple Visual Analogue Scale measures pain levels, where subscales *Pain Right Now* record pain level at the time of measurement, *Typical/Average Pain* records pain levels typically experienced at any time, *Pain At Best* records the level of pain at its least at any time and *Pain at Worst* record pain levels at their highest at any time.
Table 3 shows mean and standard deviation scores for each pain scale of the QVAS during each phase of the trial. The mean (SD) score for *Pain Right Now* decreased from 4.4 (2.2) during phase A to 1.1 (1.1) in phase B, and 1.3 (1.1) in phase C. The change from phase A to phase B and change from phase A to phase C exceeds the minimum clinically important difference (MCID)\(^{11}\) of 1.5 on the current scale for QVAS, suggesting a possible beneficial effect. *Typical/Average Pain* decreased from 3.2 (0.9) during phase A to 2.1 (0.3) in phases B and C, indicating a possible beneficial effect due to the intervention, albeit not of clinically important magnitude. *Pain at Best* decreased from 1.4 (0.5) during phase A to 1.0 (0.0) in phases B and C, indicating minimal beneficial effect, though such an effect is not clinically important.

<table>
<thead>
<tr>
<th>Table 3: SQVAS Pain Scale Mean and Standard Deviation</th>
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<tbody>
<tr>
<td><strong>Right Now</strong></td>
</tr>
<tr>
<td>Phase A Mean</td>
</tr>
<tr>
<td>Phase A Stdev</td>
</tr>
<tr>
<td>Phase B Mean</td>
</tr>
<tr>
<td>Phase B Stdev</td>
</tr>
<tr>
<td>Phase C Mean</td>
</tr>
<tr>
<td>Phase C Stdev</td>
</tr>
</tbody>
</table>

\(^{11}\) The Minimum Clinically Important Difference is the minimum level of change of an outcome measure that is considered to be clinically relevant.
S1 Neck Disability Index (NDI)

Figure 1.1 summarises the NDI\textsuperscript{12} scores for subject 1 over the baseline, treatment and follow-up phases. Scores across all three phases are variable. There is a trend (solid black line) for decreasing scores across the ten week period of the trial (Phase A,B and C). This could indicate that the decreasing NDI scores reported by S1 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect NDI for S1. The $R^2$ value (0.7739) on the trendline fit supports a linear relationship. An additional trendline is fitted to data points from phases B and C (dotted grey line, $R^2 = 0.4614$). The slopes of these trendlines are not clearly different further supporting the hypothesis that the interventions are not affecting the NDI scores recorded by S1. Mean scores are 45.8 for phase A, 36.0 for phase B, and 31.3 for phase C. The MCID for NDI is 19 percentage points (Cleland, Childs, & Whitman, 2008). Difference in mean scores falls within this minimum, suggesting any change was not of sufficient magnitude to be clinically important.

\textsuperscript{12}NDI measures disability in activities relating to daily living due to neck pain
Figure 1.1 NDI Scores pertaining to perceived disability in daily activity due to neck pain, measured twice weekly during phase A, three times weekly during phase B, and once weekly during phase C. X axis is labelled phase (Week) of Study. $R^2$ value surrounded by solid black box describes fit of solid black trendline to data from phases A, B, and C. $R^2$ value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home-based self-directed intervention remains. Gaps in the line are due to this variation of frequency of measurement.
S1 Patient Specific Functional Scale (PSFS)

Figure 1.2 illustrates the PSFS\textsuperscript{13} scores for subject 1 over the three phases of the trial; baseline, intervention and follow-up. The overall trend (solid black line, $R^2 = 0.7005$) for the entire ten weeks of the trial was an increase, and the fit supports a linear relationship, suggesting a lack of effect of the intervention. No convincing linear trendline can be drawn across the data recorded in phase B and C (dotted grey line).

\textsuperscript{13}Patient Specific Functional Scale attempts to measure functional status limitation most important to the subject.
**S1 Tampa Scale for Kinesiophobia (TSK)**

Figure 1.3 summarises TSK\(^{14}\) scores for subject 1 over the baseline, treatment and follow-up phases. Scores throughout the ten weeks of the trial show high variability. It is not possible to infer from this data whether or not an effect on TSK occurred after intervention.

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**Figure 1.3: TSK Scores pertaining to perceived fear relating to (re)injury due to movement.** X axis is labelled phase (Week) of Study. Measurements were recorded once weekly during phases A and C and three times weekly during phase B. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.

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\(^{14}\) Tampa Scale for Kinesiophobia measures fear of movement (re)injury in chronic pain patients.
S1 Fear Avoidance Beliefs Questionnaire (FABQ)

Figure 1.4 summarises FABQ scores for subject 1 over the baseline, treatment and follow-up phases. The subscale for physical activity has a mean (SD) of 10.0 (4.2), (95% CI = 1.77 to 18.23), and while limited data points in phase A may indicate a decrease in this phase, variability of data in subsequent phases do not allow conclusions to be drawn as to effect or lack of effect by the interventions of Phase B and C. With the scale for work related activity having variable data and a mean (SD) of 11.5 (4.7), (95% CI = 2.29 to 20.71) and all data points being encompassed within the confidence interval, any conclusions drawn would likewise be weak.

Figure 1.4: FABQ Scores pertaining to beliefs relating to fear of (re)injury related to movement. X axis is labelled phase (Week) of Study. Measurements were recorded once weekly during phases A and C and three times weekly during phase B. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.

15 Fear Avoidance Beliefs Questionnaire measures beliefs relating to fear of movement (re)injury in chronic pain patients.
S1 Intervention Phase Immediately ‘Before and After’ Treatment
Visual Analogue Scale (VAS)

Figure 1.5 shows a visual analogue scale for *Pain Right Now* taken before and after clinical treatment with *Simple Contact* during the three weeks intervention period, phase B. This additional pain rating was recorded in order to ascertain whether there was any short term effect of the intervention on *Pain Right Now* levels. Pain levels before the intervention was applied are constant across the three-week period, with pain levels after treatment decreasing by half during the first two treatment sessions, and becoming completely absent after the third. The decrease from 2 to 0 on the treatment day in the third week of intervention exceeds the MCID of 15 percentage points. Such results may indicate a short term positive effect of the intervention in this subject.

Figure 1.5: Intervention Phase ‘Before and After’ VAS Scores pertaining to perceived *Pain Right Now* recorded immediately before and after *Simple Contact* intervention/treatment
S1 Response Compliance

Figure 1.6 summarises responses compliance\(^{16}\) scores for subject 1 over the baseline, treatment and follow-up phases. Grouped responses (responses for multiple scheduled days submitted on the same day) are recorded 6 times, increasing dependence of data. Late responses occur 61 times, ranging from 1 day to 21 days late also weakening the reliability of the data. Only seven responses were submitted on the scheduled date by S1.

![Response Compliance](image)

\(^{16}\) Response Compliance meaning the degree to which subjects submitted measurement data on the dates scheduled. Tardy or early responses indicate a lack of compliance.
Subject 2 (S2)

S2 Quadruple Visual Analogue Scale (QVAS)

QVAS\textsuperscript{17} scores for subject 2 over the baseline, treatment and follow-up phases are summarized in Figure 2.0. The Pain Right Now scale is the most variable of the four scales, making it difficult to establish a baseline for phase A. Variability increases leading up to and into phase B. Phase C is less variable than either of the preceding two phases, however overall variability of Pain Right Now data does not allow assumptions as to any effect occurring. Typical/Average Pain demonstrates an apparent decrease from phase A to phases B and C, but variability of data would preclude a good fit of any trendlines. As such no conclusion regarding effect may be drawn for this subscale. Pain at Best remains constant at 8 throughout the trial, suggesting no effect of the intervention. Pain at Worst decreases from 2 in the first measurement to 1 in the second, where it remains throughout the remainder of the trial.

\textsuperscript{17} Quadruple Visual Analogue Scale measures pain levels, where subscales Pain Right Now record pain level at the time of measurement, Typical/Average Pain records pain levels typically experienced at any time, Pain At Best records the level of pain at its least at any time and Pain at Worst record pain levels at their highest at any time.
Figure 2.0: QVAS Pain Intensity Scores pertaining to four subscales of pain intensity measured three times weekly for the duration of the trial. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self-directed intervention is applied. During phase C clinical treatment is withdrawn but home based self directed intervention remains.
Table 4 shows mean and standard deviation scores for each scale during each phase of the 9 week trial. *Pain Right Now* shows an increase in mean (SD) from phase A to phase B, changing from 2.3 (1.2) to 3.6 (1.5), decreasing to 2.2 (0.7) in phase C. These changes do not exceed the MCID\(^{18}\) of 15 percentage points, suggesting changes occurring were not clinically important. Means for *Typical/Average Pain* decrease in phases B and C in comparison to phase A, but do not exceed 15 percentage points required for the MCID, suggesting changes recorded were not of clinically important magnitude.

<table>
<thead>
<tr>
<th></th>
<th>Right Now</th>
<th>Typical/Average</th>
<th>At Best</th>
<th>At Worst</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase A Mean</strong></td>
<td>2.3</td>
<td>2.7</td>
<td>1.1</td>
<td>8.0</td>
</tr>
<tr>
<td><strong>Phase A Stddev</strong></td>
<td>1.2</td>
<td>0.7</td>
<td>0.3</td>
<td>0.0</td>
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<td><strong>Phase B Mean</strong></td>
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<td>1.0</td>
<td>8.0</td>
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<tr>
<td><strong>Phase B Stddev</strong></td>
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<td>0.7</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Phase C Mean</strong></td>
<td>2.2</td>
<td>1.3</td>
<td>1.0</td>
<td>8.0</td>
</tr>
<tr>
<td><strong>Phase C Stddev</strong></td>
<td>0.7</td>
<td>0.5</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

\(^{18}\)The Minimum Clinically Important Difference is the minimum level of change of an outcome measure that is considered to be clinically relevant.
S2 Neck Disability Index (NDI)

NDI\(^{19}\) scores for subject 2 over the baseline, treatment and follow-up phases are summarised in Figure 2.1. There is a trend (solid black line) for increasing scores across the nine week period of the trial (Phase A, B and C). This could indicate that the increasing NDI scores reported by S2 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect NDI for S2. The R\(^2\) value (0.2308) is low, but suggests the relationship between X and Y variables may be linear. A second trendline (dotted grey line) was plotted for data occurring in phase B and C. The R\(^2\) value (0.043) is too low to be able to conclude whether there was an effect due to the intervention. Mean (SD) scores increase from 48.0 (4.7) in phase A to 52.2 (2.5) and 50.7 (2.3) in phases B and C respectively, not exceeding the MCID of 19 percentage points, such that any change subsequent to phase A must be considered trivial.

\(^{19}\)NDI measures disability in activities relating to daily living due to neck pain
Figure 2.1: NDI Scores pertaining to perceived disability in daily activity due to neck pain, measured twice weekly during phase A, three times weekly during phase B, and once weekly during phase C. X axis is labelled phase (Week) of Study. $R^2$ value surrounded by solid black box describes fit of solid black trendline to data from phases A, B and C. $R^2$ value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains. Gaps in the line are due to this variation of frequency of measurement.
S2 Patient Specific Functional Scale (PSFS)

PSFS\textsuperscript{20} scores for subject 2 over the baseline, treatment and follow-up phases are summarized in Figure 2.2. There is a trend (solid black line) for decreasing scores across the nine week period of the trial (Phase A,B and C). This could indicate that the decreasing PSFS scores reported by S2 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect PSFS for S2. The $R^2$ value ($R^2 = 0.292$) is weak but suggests a linear relationship between X and Y variables. A trendline (dotted grey line) is fitted to data from phases B and C, but its low $R^2$ value ($R^2 = 0.292$) does not allow conclusions as to whether there was an effect.

\textsuperscript{20}Patient Specific Functional Scale attempts to measure functional status limitation most important to the patient.
Figure 2.2: PSFS Scores pertaining to change in perceived ability to perform selected daily tasks. Measurements were recorded three times weekly in all phases of the trial. Vertical lines mark changes in phase. $R^2$ value surrounded by solid black box describes fit of solid black trendline to data from phases A, B and C. $R^2$ value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.
S2 Tampa Scale for Kinesiophobia (TSK)

TSK\textsuperscript{21} scores for subject 2 over the baseline, treatment and follow-up phases are summarised in Figure 2.3. There is a trend (solid black line, $R^2 = 0.6486$) for increasing scores across the nine week period of the trial (Phase A,B and C). This could indicate that the increasing TSK scores reported by S2 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect TSK for S2. The $R^2$ value of 0.6486 suggests a linear relationship between X and Y variables. A trendline fitted to phase B and C data (dotted grey line, $R^2 = 0.6519$) does not demonstrate a difference in slope of sufficient magnitude to suggest an effect of the intervention, supporting the hypothesis that change in scores for TSK is independent of the intervention, an no effect occurred.

\textsuperscript{21} Tampa Scale for Kinesiophobia measures fear of movement (re)injury in chronic pain patients
Figure 2.3: TSK Scores pertaining to perceived fear relating to (re)injury due to movement. Measurements were recorded once weekly during phases A and C and three times weekly during phase B. Vertical lines mark changes in phase. $R^2$ value surrounded by solid black box describes fit of solid black trendline to data from phases A, B, and C. $R^2$ value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.
S2 Fear Avoidance Beliefs Questionnaire (FABQ)

FABQ\(^{22}\) scores for subject 2 over the baseline, treatment and follow-up phases are summarised in Figure 2.4. Variable data occurring in all phases and in both subscales of the measure preclude interpretation and subsequent conclusion as to whether an effect was present. Further, the lack of data points falling outside the phase A confidence interval (95% CI = 9.86 to 25.54) may suggest that all data points in phases B and C occurred by chance, whether or not an effect occurred.

Figure 2.4: FABQ Scores pertaining to beliefs relating to fear of (re)injury related to movement. Measurements were recorded once weekly during phases A and C and three times weekly during phase B. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self-directed intervention remains.

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\(^{22}\)Fear Avoidance Beliefs Questionnaire measures beliefs relating to fear of movement (re)injury in chronic pain patients
S2 Intervention Phase Immediately ‘Before and After’ Treatment Visual Analogue Scale (VAS)

Figure 2.5 shows a visual analogue scale for Pain Right Now taken before and after clinical treatment with Simple Contact during the three weeks intervention period, phase B. This additional pain rating was recorded in order to ascertain whether there was any short term effect of the intervention on Pain Right Now levels. Before scores decrease from 4 in week one to 3 and 2 in weeks two and three respectively. After scores are 2 in both weeks one and two, and 1 in week three. The difference in score recorded in week 1 from before to after exceed the MCID of 15 percentage points for VAS. The change in before scores from week 1 to week 3 also exceeds the MCID of 15%. It is thus possible that there is a short term beneficial effect attributable to the intervention.
S2 Response Compliance

Responses compliance\textsuperscript{23} scores for subject 1 over the baseline, treatment and follow-up phases is summarised in Figure 2.6. Grouped responses occurred once, and there were two submissions occurring after the scheduled date, one of 1 day and one of 2 days. It is likely that inaccurate submission will have affected accuracy of scores collected subsequent to late submission, rendering conclusions drawn weaker.

\textsuperscript{23}Response Compliance meaning the degree to which subjects submitted measurement data on the dates scheduled. Tardy or early responses indicate a lack of compliance.
Subject 3 (S3)

S3 Quadruple Visual Analogue Scale (QVAS)

QVAS\textsuperscript{24} scores for subject 3 over the baseline, treatment and follow-up phases are summarised in Figure 3.0. Variability is evident in all phases for all subscales, but is particularly apparent in the phase C. Trendlines fitted to data recorded in figure 3.0 would have a poor fit due to the variability in phase C and for this reason such analysis is not warranted. Visual inspection suggests Typical/Average Pain decreased at the end of phase B and early in phase C, before increasing. It is not possible to ascertain whether or not an effect is represented in the results reproduced in this figure.

![Figure 3.0: QVAS Pain Intensity Scores](image)

Figure 3.0: QVAS Pain Intensity Scores pertaining to four subscales of pain intensity measured three times weekly for the duration of the trial. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self-directed intervention is applied. During phase C clinical treatment is withdrawn but home based self directed intervention remains.

\textsuperscript{24} Quadruple Visual Analogue Scale measures pain levels, where subscales Pain Right Now record pain level at the time of measurement, Typical/Average Pain records pain levels typically experienced at any time, Pain At Best records the level of pain at its least at any time and Pain at Worst record pain levels at their highest at any time.
Table 5 shows mean and standard deviations calculated for each pain scale during each phase of the nine week trial. Mean (SD) scores for Typical/Average Pain 5.1 (1.6) in phase C from 7.2 (0.4), (95% CI = 6.42 to 7.98) in phase A. In phase C, seven data points fall below the phase A confidence interval, while in phase B one does. The difference in mean scores seen in the Typical/Average Pain subscale occurring in excess of 15 percentage points (1.5 on the current scale) from phase A to phase C suggests a clinically important change. The event of points falling outside the phase A confidence interval for the Typical/Average Pain subscale suggest these values did not occur by chance, however it is not possible to suggest this is an effect of the intervention.

<table>
<thead>
<tr>
<th></th>
<th>Right Now</th>
<th>Typical/Average</th>
<th>At Best</th>
<th>At Worst</th>
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<tbody>
<tr>
<td>Phase A Mean</td>
<td>8.1</td>
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<td>Phase A Stdev</td>
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<td>Phase B Mean</td>
<td>7.3</td>
<td>6.9</td>
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<tr>
<td>Phase B Stdev</td>
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<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Phase C Mean</td>
<td>7.2</td>
<td>5.1</td>
<td>3.8</td>
<td>8.3</td>
</tr>
<tr>
<td>Phase C Stdev</td>
<td>0.7</td>
<td>1.6</td>
<td>1.3</td>
<td>0.5</td>
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</tbody>
</table>
S3 Neck Disability Index (NDI)

NDI\textsuperscript{25} scores for subject 3 over the baseline, treatment and follow-up phases are summarised in Figure 3.1. Scores across all three phases are variable. There is a trend (solid black line) for decreasing scores across the nine week period of the trial (Phase A,B and C). This could indicate that the decreasing NDI scores reported by S3 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect NDI for S3. The $R^2$ value (0.4914) on the trendline fit supports a linear relationship between X and Y variables. An additional trendline is fitted to data points from phases B and C (dotted grey line, $R^2 = 0.2963$). The slopes of these trendlines are not clearly different which would support the hypothesis that the intervention is not affecting the NDI scores recorded by S3, however the low $R^2$ value of phase B and C data does not allow a conclusion as to the presence or absence of an effect. Further, decreases in mean (SD) scores in phase A of 38.3 (4.1) to 33.6 (3.4) in phase B and 26.7 (2.3) in phase C do not exceed the MCID of 19% indicating any change in disability levels recorded were not clinically important.

\textsuperscript{25}NDI measures disability in activities relating to daily living due to neck pain
Figure 3.1: NDI Scores pertaining to perceived disability in daily activity due to neck pain, measured twice weekly during phase A, three times weekly during phase B, and once weekly during phase C. $R^2$ value surrounded by solid black box describes fit of solid black trendline to data from phases A, B, and C. $R^2$ value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatment sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains. Gaps in the line are due to this variation of frequency of measurement.
S3 Patient Specific Functional Scale (PSFS)

PSFS\textsuperscript{26} scores for subject 3 over the three phases of the trial; baseline, intervention and follow-up are illustrated in Figure 3.2. There is a trend (solid black line) for decreasing scores across the nine week period of the trial (Phase A, B and C). This could indicate that the decreasing PSFS scores reported by S3 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect PSFS for S3. The $R^2$ value ($R^2 = 0.0424$) weak and does not suggest a linear relationship between X and Y variables. A trendline (dotted grey line) is fitted to data from phases B and C, but due to its low $R^2$ value ($R^2 = 0.2497$) it is not possible to suggest whether there is effect due to the intervention.

\textsuperscript{26} Patient Specific Functional Scale attempts to measure functional status limitation most important to the patient.
Figure 3.2: PSFS Scores pertaining to change in perceived ability to perform selected daily tasks. Measurements were recorded three times weekly in all phases of the trial. Vertical lines mark changes in phase. $R^2$ value surrounded by solid black box describes fit of solid black trendline to data from phases A ,B and C. $R^2$ value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.
S3 Tampa Scale for Kinesiophobia (TSK)

TSK\textsuperscript{27} scores for subject 3 over the baseline, treatment and follow-up phases are summarised in Figure 3.3. Scores across phases B and C are variable. There is a trend (solid black line) for decreasing scores across the nine week period of the trial (Phase A, B and C). This could indicate that the decreasing TSK scores reported by S3 are independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect TSK for S3. The $R^2$ value (0.0079) on the trendline fit does not suggest a linear relationship between X and Y variables. An additional trendline is fitted to data points from phases B and C (dotted grey line, $R^2 = 0.2704$). $R^2$ values are too low to make conclusions as to the presence of an effect.

\textsuperscript{27}Tampa Scale for Kinesiophobia measures fear of movement (re)injury in chronic pain patients.
Figure 3.3: TSK Scores pertaining to perceived fear relating to (re)injury due to movement. Measurements were recorded once weekly during phases A and C and three times weekly during phase B. Vertical lines mark changes in phase. $R^2$ value surrounded by solid black box describes fit of solid black trendline to data from phases A, B and C. $R^2$ value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.
S3 Fear Avoidance Beliefs Questionnaire (FABQ)

FABQ\textsuperscript{28} scores for subject 3 over the baseline, treatment and follow-up phases are summarised in Figure 3.4. Variable data occurring in all phases and in both subscales of the measure preclude interpretation and subsequent conclusion as to whether an effect occurred.

\begin{figure}[ht]
\centering
\includegraphics[width=\textwidth]{fabc.png}
\caption{FABQ Scores pertaining to beliefs relating to fear of (re)injury related to movement. Measurements were recorded once weekly during phases A and C and three times weekly during phase B. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.}
\end{figure}

\textsuperscript{28} Fear Avoidance Beliefs Questionnaire measures beliefs relating to fear of movement (re)injury in chronic pain patients.
S3 Intervention Phase Immediately ‘Before and After’ Treatment
Visual Analogue Scale (VAS)

Figure 3.5 shows a visual analogue scale for *Pain Right Now* taken before and after clinical treatment with *Simple Contact* during the three weeks intervention period, phase B. This additional pain rating was recorded in order to ascertain whether there was any short term effect of the intervention on *Pain Right Now* levels. In the first week, scores before and after treatment were 8. In both subsequent weeks, scores decreased to 7 before and after treatment. This decrease is not sufficient to exceed the MCID of 15% for VAS pain scales, and it is not possible to allude to a short-term treatment effect.

![Figure 3.5: Intervention Phase ‘Before and After’ Scores pertaining to perceived Pain Right Now recorded immediately before and after Simple Contact intervention/treatment](image)

Figure 3.5: Intervention Phase ‘Before and After’ Scores pertaining to perceived *Pain Right Now* recorded immediately before and after *Simple Contact* intervention/treatment
**S3 Response Compliance**

Responses compliance\(^{29}\) scores for subject 3 over the baseline, treatment and follow-up phases are summarised in Figure 3.6. Grouped responses occurred six times. Responses were submitted late 54 times, ranging from 1 to 6 days late. Early responses occurred twice, each 4 days ahead of the scheduled date. Such a lack of compliance will have undermined integrity of data recorded. This result will have implications upon conclusions as to effect of the intervention.

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\(^{29}\)Response Compliance meaning the degree to which subjects submitted measurement data on the dates scheduled. Tardy or early responses indicate a lack of compliance.
Subject 4 (S4)

S4 Quadruple Visual Analogue Scale (QVAS)

QVAS\textsuperscript{30} scores for subject 4 over the baseline, treatment and follow-up phases are summarised in Figure 4.0. Pain Right Now scores are variable and a data point is missing in phase B. Typical/Average Pain is constant over phase A but becomes variable in the proceeding two phases. Pain at Best does not vary over the nine weeks of the trial. Pain at Worst, after initially decreasing by 1 point, stays level through the remainder of the trial. Due to variability of data it is not possible to draw conclusions as to the presence or absence of an effect for any subscale.

\textsuperscript{30} Quadruple Visual Analogue Scale measures pain levels, where subscales Pain Right Now record pain level at the time of measurement, Typical/Average Pain records pain levels typically experienced at any time, Pain At Best records the level of pain at its least at any time and Pain at Worst record pain levels at their highest at any time.
Figure 4.0: QVAS Pain Intensity Scores pertaining to four subscales of pain intensity measured three times weekly for the duration of the trial. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is applied. During phase C clinical treatment is withdrawn but home based self directed intervention remains.
Table 6 shows mean and standard deviation scores calculated for each pain scale during each of the three phases of the 9 week trial. None of the mean scores have variation of sufficient magnitude to exceed the 15 percentage points required to reach the MCID\textsuperscript{31}.

Table 6: S4 QVAS Pain Scale Mean and Standard Deviation

<table>
<thead>
<tr>
<th></th>
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<th>Typical/Average</th>
<th>At Best</th>
<th>At Worst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A Mean</td>
<td>2.7</td>
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<td>Phase A Stdev</td>
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<tr>
<td>Phase B Mean</td>
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<td>1.8</td>
<td>0.0</td>
<td>3.0</td>
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<tr>
<td>Phase B Stdev</td>
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<td>Phase C Mean</td>
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<td>Phase C Stdev</td>
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<td>0.0</td>
</tr>
</tbody>
</table>

\textsuperscript{31}The Minimum Clinically Important Difference is the minimum level of change of an outcome measure that is considered to be clinically relevant
S4 Neck Disability Index (NDI)

NDI\textsuperscript{32} scores for subject 4 over the baseline, treatment and follow-up phases are summarised in Figure 4.1. Data within phase A was the most variable of the three phases, although variable data was apparent in every phase. This variability suggests the fit of trendlines would be poor and does not allow conclusions to be drawn regarding existence of an effect. The mean (SD) for phase A was 23.7 (3.9), (95% CI = 16.06 to 31.34) for phase B 19.8 (1.7) and for phase C 20.7 (1.2). Decreases satisfying an MCID\textsuperscript{33} of 19 percentage points were not achieved such that any change observed is not clinically important.

\textsuperscript{32} NDI measures disability in activities relating to daily living due to neck pain

\textsuperscript{33} The Minimum Clinically Important Difference is the minimum level of change of an outcome measure that is considered to be clinically relevant
Figure 4.1: NDI Scores pertaining to perceived disability in daily activity due to neck pain, measured twice weekly during phase A, three times weekly during phase B, and once weekly during phase C. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains. Gaps in the line are due to this variation of frequency of measurement.
S4 Patient Specific Functional Scale (PSFS)

PSFS scores for subject 4 over the three phases of the trial; baseline, intervention and follow-up are summarised in Figure 4.2. Scores recorded in phases A and B are variable, while phase C shows less variability. There is a missing data point in phase B. A trendline fitted to this data would be of a poor fit, and it is not possible to conclude whether an effect occurred.

![PSFS Scores](image)

Figure 4.2: PSFS Scores pertaining to change in perceived ability to perform selected daily tasks. Measurements were recorded three times weekly in all phases of the trial. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.

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Patient Specific Functional Scale attempts to measure functional status limitation most important to the patient.
S4 Tampa Scale for Kinesiophobia (TSK)

TSK\textsuperscript{35} scores for subject 4 over the baseline, treatment and follow-up phases are summarised in Figure 4.3. There is a trend (solid black line) for increasing scores across the nine week period of the trial (Phase A,B and C). This could indicate that the increasing TSK scores reported by S4 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect TSK for S4. The $R^2$ value (0.091) is too low to allow comparison to be made, however second trendline (dotted grey line $R^2 = 0.8138$) plotted for data occurring in phase B and C suggests a decrease in scores after an apparent increase over phase A.

![Figure 4.3: TSK Scores pertaining to perceived fear relating to (re)injury due to movement. Measurements were recorded once weekly during phases A and C and three times weekly during phase B. Vertical lines mark changes in phase. $R^2$ value surrounded by solid black box describes fit of solid black trendline to data from phases A,B and C. $R^2$ value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.](image)

\textsuperscript{35} Tampa Scale for Kinesiophobia measures fear of movement (re)injury in chronic pain patients.
S4 Fear Avoidance Beliefs Questionnaire (FABQ)

FABQ\textsuperscript{36} scores for subject 4 over the baseline, treatment and follow-up phases are summarised in Figure 4.4. There is a trend (solid grey line, $R^2 = 0.3142$ for the *Work Related Activity* Subscale, dotted black line, $R^2 = 0.1346$ for the *Physical Activity* subscale) for increasing scores across the nine week period of the trial (Phase A, B and C). This could indicate that the increasing FABQ scores reported by S4 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect subscales for FABQ for S4. The $R^2$ value of 0.314 for the *Physical Activity* subscale suggests a linear relationship between X and Y variables. Trendlines are also fitted to phase B and C data (dotted grey line, $R^2 = 0.0953$ for the *Physical Activity* subscale and solid black line $R^2 = 0.2905$ for the *Work Related Activity* subscale). The low $R^2$ values for both subscales do not allow for a conclusion as to whether or not there was an effect.

\textsuperscript{36} Fear Avoidance Beliefs Questionnaire measures beliefs relating to fear of movement (re)injury in chronic pain patients.
Figure 4.4: FABQ Scores pertaining to beliefs relating to fear of (re)injury related to movement. Measurements were recorded once weekly during phases A and C and three times weekly during phase B. Vertical lines mark changes in phase. $R^2$ value surrounded by solid grey box describes fit of solid grey trendline to data from phases A, B and C for the Work Related Activity subscale. $R^2$ value surrounded by a dotted black line describes fit of dotted black trendline to data from phases A, B and C for the Physical Activity subscale. $R^2$ value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C for the Physical Activity subscale. $R^2$ value surrounded by a solid black line describes fit of trendline to data from phases B and C for Work Related Activity subscale. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.
S4 Intervention Phase Immediately ‘Before and After’ Treatment Visual Analogue Scale (VAS)

Figure 4.5 shows a visual analogue scale for Pain Right Now taken before and after clinical treatment with Simple Contact during the three weeks intervention period, phase B. This additional pain rating was recorded in order to ascertain whether there was any short term effect of the intervention on Pain Right Now levels. Results showing no change across the three weeks of the intervention phase indicate that there was no short-term effect of the intervention for this subject.

Figure 4.5: Intervention Phase ‘Before and After’ Scores pertaining to perceived Pain Right Now recorded immediately before and after Simple Contact intervention/treatment
S4 Response Compliance

Responses compliance\textsuperscript{37} scores for subject 4 over the baseline, treatment and follow-up phases are summarised in Figure 4.6. Grouped data occurred three times. Fifty-three late responses were recorded, occurring between 1 and 10 days late. There was also one missed submission. Such errors in submission of measures decrease integrity of recorded data, rendering conclusions drawn potentially inaccurate.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{response_compliance.png}
\caption{Response Compliance; indicating the scheduled (target) day of the trial each set of measurements was to be submitted plotted against the actual (recorded) day each response was submitted. Multiple lines converging on 1 recorded point (grouped data) indicates multiple days’ worth of measurement data submitted on one day. Inclined lines indicate late responses. Declined lines indicate early responses. Steeper slopes indicate a longer time before or after the target date responses were submitted.}
\end{figure}

\textsuperscript{37}Response Compliance meaning the degree to which subjects submitted measurement data on the dates scheduled. Tardy or early responses indicate a lack of compliance.
**Subject 5 (S5)**

**S5 Quadruple Visual Analogue Scale (QVAS)**

QVAS\(^{38}\) scores for subject 5 over the baseline, treatment and follow-up phases are summarised in Figure 5.0. *Pain Right Now* and *Typical/Average Pain* subscales demonstrate variability over the first two phases, but both subscales become more stable in phase C. Due to variability of data it is not possible to draw conclusions as to whether or not an effect occurred.

Figure 5.0: QVAS Pain Intensity Scores pertaining to four subscales of pain intensity measured three times weekly for the duration of the trial. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is applied. During phase C clinical treatment is withdrawn but home based self directed intervention remains.

\(^{38}\) Quadruple Visual Analogue Scale measures pain levels, where subscales Pain Right Now record pain level at the time of measurement, Typical/Average Pain records pain levels typically experienced at any time, Pain At Best records the level of pain at its least at any time and Pain at Worst record pain levels at their highest at any time.
Table 7 summarises mean and standard deviation calculated for each subscale during each phase of the nine week trial. The mean (SD) for phase A for subscales *Pain Right Now*, *Typical/Average Pain* and *Pain at Worst* are 1.0 (1.2), 1.6 (0.7) and 8.6 (0.7), (95% CI = 0.00 to 3.35; 0.23 to 2.97; 7.23 to 9.97). No subsequent phase mean in any subscale exceeds 15 percentage points required to obtain the MCID\(^{39}\), such that any decrease in levels recorded is not of sufficient magnitude to be considered clinically important.

<table>
<thead>
<tr>
<th></th>
<th>Right Now</th>
<th>Typical/Average</th>
<th>At Best</th>
<th>At Worst</th>
</tr>
</thead>
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<tr>
<td>Phase A Mean</td>
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<td>1.6</td>
<td>0.0</td>
<td>8.6</td>
</tr>
<tr>
<td>Phase A Stdev</td>
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<td>0.0</td>
<td>0.7</td>
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<tr>
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<td>1.3</td>
<td>0.1</td>
<td>9.0</td>
</tr>
<tr>
<td>Phase B Stdev</td>
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<td>0.7</td>
<td>0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Phase C Mean</td>
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<td>0.0</td>
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</tr>
<tr>
<td>Phase C Stdev</td>
<td>0.4</td>
<td>0.3</td>
<td>0.0</td>
<td>0.9</td>
</tr>
</tbody>
</table>

\(^{39}\)The Minimum Clinically Important Difference is the minimum level of change of an outcome measure that is considered to be clinically relevant
S5 Neck Disability Index (NDI)

NDI\(^{40}\) scores for subject 5 over the baseline, treatment and follow-up phases are summarised in Figure 5.1. Due to variability in scores across all phases any trendline plotted would not fit data well, and as such was excluded. Variability of data precludes ascertaining whether any effect is present. The mean (SD) for phase A is 22.0 (2.8), (95%CI = 16.51 to 27.49) to 16.7 (3.1) in phase C. This decrease in mean is not sufficient to satisfy an MCID\(^{41}\) of 19 percentage points, such that the decrease in mean NDI scores cannot be considered clinically important.

Figure 5.1: NDI Scores pertaining to perceived disability in daily activity due to neck pain, measured twice weekly during phase A, three times weekly during phase B, and once weekly during phase C. Vertical lines mark changes in phase. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains. Gaps in the line are due to variation of frequency of measurement.

\(^{40}\) NDI measures disability in activities relating to daily living due to neck pain

\(^{41}\) The Minimum Clinically Important Difference is the minimum level of change of an outcome measure that is considered to be clinically relevant
S5 Patient Specific Functional Scale

PSFS\(^{42}\) scores for subject 5 over the three phases of the trial; baseline, intervention and follow-up are illustrated in Figure 5.2. There is a trend (solid black line, \(R^2 = 0.061\)) for increasing scores across the nine week period of the trial (Phase A, B and C). This could indicate that the increasing PSFS scores reported by S5 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect PSFS for S5. A trendline (dotted grey line, \(R^2 = 0.3529\)) is fitted to data from phases B and C. The low \(R^2\) value of both lines does not allow for the presence or absence of an effect to be identified.

Figure 5.2: PSFS Scores pertaining to change in perceived ability to perform selected daily tasks. Measurements were recorded three times weekly in all phases of the trial. Vertical lines mark changes in phase. \(R^2\) value surrounded by solid black box describes fit of solid black trendline to data from phases A, B and C. \(R^2\) value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self-directed intervention remains.

\(^{42}\)Patient Specific Functional Scale attempts to measure functional status limitation most important to the patient.
S5 Tampa Scale for Kinesiophobia (TSK)

TSK\textsuperscript{43} scores for subject 5 over the baseline, treatment and follow-up phases are summarised in Figure 5.3. There is a trend (solid black line, $R^2 = 0.7133$) for decreasing scores across the nine week period of the trial (Phase A,B and C). This could indicate that the decreasing TSK scores reported by S5 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect TSK for S5. The $R^2$ value of 0.7133 suggests a linear relationship between X and Y variables. A trendline fitted to phase B and C data (dotted grey line, $R^2 = 0.4093$) does not demonstrate a difference in slope of sufficient magnitude to suggest an effect of the intervention, supporting the hypothesis that change in scores for TSK is independent of the intervention and no effect was observed.

\textsuperscript{43}Tampa Scale for Kinesiophobia measures fear of movement (re)injury in chronic pain patients.
Figure 5.3: TSK Scores pertaining to perceived fear relating to (re)injury due to movement. Measurements were recorded once weekly during phases A and C and three times weekly during phase B. Vertical lines mark changes in phase. $R^2$ value surrounded by solid black box describes fit of solid black trendline to data from phases A, B and C. $R^2$ value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.
S5 Fear Avoidance Beliefs Questionnaire (FABQ)

FABQ\textsuperscript{44} scores for subject 5 over the baseline, treatment and follow-up phases are summarised in Figure 5.4. Variable data precluded conclusions as to the presence or absence of an effect for the \textit{Work Related Activity} subscale. For the \textit{Physical Activity} subscale there is a trend (solid black line, $R^2 = 0.3878$) for decreasing scores across the nine week period of the trial (Phase A,B and C). This could indicate that the decreasing FABQ scores reported by S5 is independent of the intervention, i.e. the solid black trendline represents the hypothesis that the interventions of Phase B and C do not affect FABQ for S5. The $R^2$ value of 0.3878 suggests a linear relationship between X and Y variables. A trendline fitted to phase B and C data (dotted grey line, $R^2 = 0.0132$) does not have a high enough $R^2$ value to be able to determine whether or not an effect occurred.

\textsuperscript{44}Fear Avoidance Beliefs Questionnaire measures beliefs relating to fear of movement (re)injury in chronic pain patients.
Figure 5.4: FABQ Scores pertaining to beliefs relating to fear of (re)injury related to movement. Measurements were recorded once weekly during phases A and C and three times weekly during phase B. Vertical lines mark changes in phase. \( R^2 \) value surrounded by solid black box describes fit of solid black trendline to data from phases A, B and C for the Physical Activity subscale. \( R^2 \) value surrounded by dotted grey line describes fit of dotted grey trendline to data from phases B and C for the Physical Activity subscale. Phase A is baseline, where no intervention is applied. Phase B is the intervention phase, where once weekly clinical treatments sessions occur and home, self-directed intervention is required. During phase C clinical treatment is withdrawn but home based self directed intervention remains.
S5 Intervention Phase Immediately ‘Before and After’ Treatment Visual Analogue Scale (VAS)

Figure 5.5 shows a visual analogue scale for *Pain Right Now* taken immediately before and after clinical treatment with *Simple Contact* during the three weeks intervention period, phase B. This additional pain rating was recorded in order to ascertain whether there was any short term effect of the intervention on *Pain Right Now* levels. Both ‘before’ and ‘after’ scores are 0 in the first week. During the second and third weeks they occur at 1 for the ‘before’ score and 0 for the ‘after’ score, indicating there may be a short term positive effect of the intervention for this subject. Any effect however is not clinically important as it does not reach 15 percentage points required to fulfil the MCID\(^{45}\).

Figure 5.5: Intervention Phase ‘Before and After’ Scores pertaining to perceived *Pain Right Now* recorded immediately before and after *Simple Contact* intervention/treatment

\(^{45}\) The Minimum Clinically Important Difference is the minimum level of change of an outcome measure that is considered to be clinically relevant.
S5 Response Compliance

Responses compliance\(^{46}\) scores for subject 5 over the baseline, treatment and follow-up phases are summarised in Figure 5.6. One grouped response was recorded. There were 5 late responses, ranging from 1 to 2 days late. While responses were for the most part compliant with scheduled dates, as with previous subjects late responses did occur, rendering subsequent entries more prone to error. Interpretation of data is thus less reliable.

Figure 5.6: Measurement Responses; indicating the scheduled (target) day of the trial each set of measurements was to be submitted plotted against the actual (recorded) day each response was submitted. Multiple lines converging on 1 recorded point (grouped data) indicates multiple days’ worth of measurement data submitted on one day. Inclined lines indicate late responses. Declined lines indicate early responses. Steeper slopes indicate a longer time before or after the target date responses were submitted.

\(^{46}\)Response Compliance meaning the degree to which subjects submitted measurement data on the dates scheduled. Tardy or early responses indicate a lack of compliance.
Chapter 5: Summary of Findings in Individual Subjects
Summary of Findings in Individual Subjects

In this section, important findings pertaining to individual subjects will be briefly summarised. The discussion initiated in this section will then be further explored in Chapter 6.

During the baseline phase, no intervention was applied. In most cases the small number of data points collected during the baseline phase make it difficult to confidently identify trends. The next phase is initiated by the application of the intervention *Simple Contact* by the practitioner. This intervention is continued in once-weekly clinical sessions, and prescribed daily twenty-minute *homework* sessions of ideomotor movements. Data recorded in the intervention phase is often variable making analysis difficult. However, two subjects recorded less variable data on the Tampa Scale for Kinesiophobia (TSK). This data suggests there was no effect of the intervention on kinesiophobia for two out of five subjects (S2 and S5). The data is inconclusive for other subjects. In contrast, Visual Analogue Scale (VAS) *Pain Right Now* scores recorded immediately before and after clinical treatment sessions with the intervention *Simple Contact* suggests short-term beneficial effects of the intervention in three subjects (S1, S2 and S5). Data recorded regarding compliance with scheduled dates for submission of results by subjects identified a general lack of compliance, with two subjects (S1 and S3) exhibiting very low compliance. This suggests that all conclusions from this study need to be treated cautiously.

The third phase was the follow-up phase, in which the weekly clinical *Simple Contact* sessions were withdrawn but the patients were encouraged to maintain their daily *homework* sessions of ideomotor movements. Results in this phase also tended to be variable, making it difficult to identify trends or conclude whether or not an effect was present.
Subject 1

Results for subject 1 were characterised by an inability to infer whether or not there was an effect on data recorded in the intervention and follow-up phases due to the Simple Contact intervention. However, a clinically important decrease in pain intensity (Pain Right Now) was recorded after intervention. A decrease was also evident in Typical/Average Pain and Pain at Best subscales, although these reductions were not of clinically important levels. While it was not possible to confidently infer causality of the intervention due to variability of the baseline data, these results do suggest the possibility that the intervention could have decreased pain intensity levels for subject 1. Further study is required, perhaps with more data gathered to confidently establish the baseline. Although this does have ethical implications as denying treatment for an extended period of time may potentially harm the subject (Sim, 1994).

Neck disability scores demonstrated a decrease over all three phases of the trial, and a hypothesis that this decrease was not due to the intervention was supported by a trendline fitted to data from all three phases. The result may appear contrary to what interpretation based purely upon visual inspection might suggest. Intervention and follow-up data points appeared to be decreasing, perhaps suggesting the intervention had a beneficial effect. However, such a decrease was also apparent in the baseline phase, in which no intervention was present. The rate (or slope of the trendline) at which the decrease occurred when the intervention was applied is not apparently different to that of the baseline data, suggesting that if no intervention had been applied this decrease in score would still have occurred. Thus it is possible to suggest that the intervention had no effect of neck disability levels for subject 1.

Data recorded immediately before and after clinical intervention sessions showed a clinically important change in Pain Right Now scores. This suggests that there may be a short term beneficial effect associated with the intervention Simple Contact. This finding may warrant further investigation into potential short-term benefits of the intervention, however the result must be viewed with some caution. The results being

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47 The Minimum Clinically Important Difference is the minimum level of change of an outcome measure that is considered to be clinically relevant.
recorded immediately prior to and following treatment, the clinician was present in the room with the patient, although did not observe the results until termination of the intervention phase. The subject however was not blinded to their results and results recorded following the treatment were not independent of those recorded prior to treatment; it is likely that with the short 30 minute duration of treatment that the subject would have remembered what the response was prior to intervention. Further it must be noted that the patient may have indicated an improvement due to a wish to please the clinician. It has been documented that outcomes from treatment including reported symptomatic improvement may be influenced by patients wishing to appear to be ‘good patients’ (Evans, Collins, & Grundy, 2006; Sudak, 2006).

An aspect which may have compromised the integrity of the results is the fact that subject 1’s compliance with scheduled dates for submission of outcome measurement was particularly poor. Late submission of all measured outcomes is likely to have negatively impacted internal validity of the current work. Also, multiple days-worth of measurements submitted as a group will have cause data to be dependent. As such, all results recorded for subject 1 must be interpreted with caution. Further discussion of compliance data is presented in chapter 6.
Subject 2

While subject 1 appeared to be generally improving, subject 2 was not improving and on most scores, levels appeared to worsen. Results for subject 2, similar to subject 1, were characterised by a general inability to infer whether or not there was an effect on due to the intervention Simple Contact. Limited and variable baseline data points render analysis difficult. Results obtained in three of the measurement categories do however warrant discussion; Neck Disability Index (NDI), TSK and VAS recorded immediately before and after clinical intervention during the intervention phase.

For the NDI, weak data and poor $R^2$ values of trendlines fitted to all three phases of the trial compared with intervention and follow-up phases did not allow conclusions as to the presence or absence of an effect due to the intervention. Visual inspection of data may be more interesting. Whilst the trendline fitted to all three phases weakly suggests a possible linear relationship between the $x$ and $y$ variables, visual inspection suggests other interpretations are possible. For instance, the data appears to plateau during the follow-up phase. Analysis of data by application of trendlines attempts to model a relationship between $x$ and $y$ variables, and where the fit of data to trendlines is good one may assume that the relationship is linear (Steyerberg et al., 2001). Thus in the case of subject 2, the apparent visual trend for a plateau of data and the poor fit of the trendline suggest that a relationship of variables other than a linear one may exist.

Results obtained for TSK measurement suggest that the intervention did not affect apparent rising levels of kinesiophobia. Visual inspection could suggest a decreasing baseline (however, this is based on only three data points). This is followed by an apparent increase over the subsequent phases of the trial indicating the possibility of a negative effect of the intervention. However, a trendline for all three phases shows a convincing incline, suggesting that the increase was not due to the intervention and that this subject’s kinesiophobia is increasing independently. A trendline fitted to the post-intervention data is not apparently different, further supporting the hypothesis that the trend is independent of the intervention. From visual inspection of this data it may be tempting to suggest a detrimental effect.
Another point worthy of discussion is data recorded in the VAS measure. *Pain Right Now* levels immediately prior to and following *Simple Contact* sessions during the intervention phase decreased from levels recorded prior to treatment, and the magnitude of decrease was clinically important. This suggests that the intervention was beneficial to subject 2 in the short-term. However as with subject 1, blinding did not occur for this measurement, and interpretation of the result must be with the possibility of the subject’s possible wish to please the clinician in mind (Evans, Collins & Grundy, 2006; Sudak, 2006). Interestingly, the subject described changes in affect following the weekly contact for treatment, mentioning feelings of elation, increase in hopefulness and increase in energy levels. Unfortunately the current study did not include a measure of psychosocial factors. An instrument such as the “Life Orientation Test” developed by Scheier & Carver (1985) which measures dispositional optimism would have been useful in the case of patient 2.

Compliance for subject 2 was better than for subject 1. Generally speaking results were submitted when they were scheduled, however some late responses did occur.
Subject 3

Results for subject three are particularly variable, and it was not possible to ascertain whether or not an effect was present in any of the measurements recorded. There is one set of results that does merit some discussion for subject 3. Compliance data for scheduled submission of responses was notably poor in this subject. As with subject 1, there were more instances of late submissions than there were of submission occurring on the scheduled date. This means that the internal validity of data recorded for subject one must be considered particularly weak. Even if one assumes a minimal effect of this documented poor compliance upon internal validity, allowing estimates accuracy of recall of pain levels being reliable for up to one week (Jantsch et al., 2009), the fact that submission twice occurred before the scheduled date must cause inaccuracy in results. Further, multiple responses submitted as a group imply dependence of that data, an additional threat to internal validity. Further discussion regarding compliance data is presented in chapter 6.

It may be pertinent to make some comment regarding variability of data for subject 3. Week 6 marks her return to work after having been on maternity leave for some time (personal communication, subject 3, 13 September 2008). Prior to this point in the trial, subject 3 had completed activities largely comprised of cooking and minding her newborn and an older child, and despite leading the very busy life of a mother, she described having time to take a break when her pain required. Thus the period of the trial encompassed two major changes which potentially affected her pain: the aforementioned return to work and the paradigm shift of responding to her pain with movement- as required by the intervention- rather than stasis. Subject 3’s occupation being computer related requires her to be seated for much of her day, likely the ‘victim’ of those cultural aspects described by Dorko (2003) requiring she repress any urges to instinctual movement that might arise. This return to work may go some way to help explain the variable pattern of data recorded following weeks 6, particularly in the Quadruple Visual Analogue Scale (QVAS) and Fear Avoidance Beliefs Questionnaire (FABQ).
Subject 4

Subject 4-recorded data, which precluded the possibility of inferring whether or not any change observed, was due to the intervention. One exception may be in the scores recorded for kinesiophobia (TSK measurement instrument). It was not possible to suggest that change occurring in this measurement was due to an effect, however visual inspection revealed baseline scores which apparently increased over the three week period, while a steady decrease in scores was evident over the subsequent 6 weeks. A trendline fitted to data from intervention and follow-up phases had a high $R^2$ value, such that had there been more data points in the baseline phase it is tempting to suggest that the decrease in kinesiophobia evident in intervention and follow-up phases may have been due to the intervention. Note however, that while a decrease in scores did occur, the actual magnitude of the decrease was negligible.

Compliance with scheduled submission days for subject 4 was also poor further compounding an inability to draw conclusions from this data. While not as poor as other subjects enrolled in the study, grouped responses and late submission of data were common with this subject. The internal validity of this data is therefore questionable.
Subject 5

Recorded data for 5 was similar to that of other subjects enrolled in the study, in that it is difficult to conclude whether or not the intervention has an effect. This was largely due to high variability of the limited baseline data causing analysis of data from subsequent phases to be difficult. An exception to this was evident in the TSK measure, measuring kinesiophobia.

Kinesiophobia scores demonstrate an apparent decrease over all three phases of the trial, and a hypothesis that this decrease was not due to the intervention is supported by trendlines fitted to data from all three phases compared with data from the intervention and follow-up phases. The result may appear contrary to what interpretation based purely upon visual inspection might suggest. Intervention and follow-up data points appear to be decreasing, perhaps suggesting the intervention had a beneficial effect. However, such a decrease is also apparent in the baseline phase before intervention occurred. The rate (or slope of the trendline) at which the decrease occurred when the intervention was applied is not apparently different to that of the baseline data, suggesting that this decrease in score was independent of the intervention.

Subject 5 also recorded results which suggest a short term effect of the intervention on pain intensity levels. *Pain Right Now* levels recorded immediately prior to and following clinical intervention with *Simple Contact* during the intervention phase show a decrease in level after treatment in the second and third weeks of the phase. This decrease was not of sufficient magnitude to be considered clinically important, but in the light of similar results occurring for other subjects in the trial it is worth considering.

The fact that subject 5 had such low starting scores, particularly in the VAS measure described in the previous paragraph may have served to mask an important reduction. When a minimum clinically important level must be exceeded, where a starting score is low there is not a lot of room for improvement. In some of the figures plotted, follow-up phase data is recorded at lower levels than data in previous phases. It is
possible that low starting values may risk the interpretation the results as being unimportant or trivial, when for the subject such changes may represent a significant change. Recall that responses to items of measurement instruments are subjective, and that pragmatically a change from a maximum point of 3/10 to a minimum of 0/10, whilst small in magnitude, may represent a meaningful change to the individual concerned.

It is important to note is the fact that subject 5 commented that she had been able to discontinue her use of analgesia during the intervention and follow-up phases of the trial (personal communication, subject 5, 1 November 2008). Previously she had been using it daily whenever she was working and often when she was not. Clearly without data recording this decrease in use it is not plausible to admit this as supporting effectiveness of the intervention. In future studies it would be useful to also collect data on medication use.

Compliance for subject 5 was better than either subjects 1 or 3, with most submissions occurring when scheduled. However some late responses were recorded.
Chapter 6: General Discussion
General Discussion

This section of the document will discuss results obtained in the current study, highlighting difficulties with interpretation of data such as variability and limited baseline points. Methods used to interpret data will also be discussed. The single system research design will be explored, and aspects of its design relating to the current work and more generally will be outlined. Findings of the present work regarding subjects’ lack of compliance with submission of self-report measures will be discussed as a potential methodological weakness of the single system design. A section will be presented discussing measurement of change in studies such as the current work, before comparisons are made between the current study and similar research. After areas for future improvement are outlined, a final section will make concluding statements.

Analysis of data

To facilitate visual inspection of data plots, trendlines (also termed linear regression lines) were fitted to data plots where visual inspection suggested a possible change occurring subsequent to the baseline phase (Bithell, 1994). Where such a change was observed, two trendlines were fitted. One was fitted to data from all three phases, and a second to data in the intervention and follow-up phases. This allowed comparison of slopes, where a change in slope for the trendline fitted to intervention and follow-up phases indicated a possible positive or negative effect of the intervention.

In general, because of poor fit of trendlines to data, it was not possible to confidently determine whether an effect was present. However the TSK measure in subjects 2 and 5 had a fit sufficient to allow some conclusions to be drawn. In these two cases the conclusion is that the intervention had no effect. $R^2$ values for these two plots were of sufficient magnitude to suggest simple linear relationship between $x$ and $y$ variables (Steyerberg et al., 2001), and represented a hypothesis that the interventions of the intervention and follow-up phases did not effect TSK scores for the particular subjects. A trendline fitted to data from the intervention and follow-up phases did not display sufficient difference in slope to suggest the intervention had an effect on changing scores; that is, the intervention had no effect. In cases where low $R^2$ values
occurred the poor fit of trendlines precluded comparison of change in slopes between trendlines fitted to all three phases and to data from intervention and follow-up phases, and suggested that the relationship between \( x \) and \( y \) variables is not accurately described by a linear equation.

Several factors were present that detracted from the accuracy of trendlines fitted to the data obtained in this trial. It has been stated that at least seven data points are necessary in the baseline phase in order to accurately identify trends occurring in this phase (Bithell, 1994). There should also be an equal number of points in subsequent phases (Bithell, 1994). This was only the case for the QVAS and PSFS measures. This lack is detrimental to the robustness of data and its subsequent analysis, as it not possible to achieve stability in baseline data or to ascertain whether there is a clear trend (Bithell, 1994). The decision to decrease measurement frequency was made after consideration of the possibility of serial dependency.

Serial dependency occurs where data points are closely related- in this case occurring within close temporal proximity- they become predictive of one another; successive observations occurring in series tend to be strongly related (Bithell, 1994). Serial dependency also has wider implications for the selection of statistical tests for analysis of data in this study. The issue of serial dependency was one reason to increase measurement intervals and thus decrease data points collected.

Inferential errors such as Type I, where the experimental hypothesis is supported when false, and Type II – where the hypothesis is rejected as false when it is in fact true are common errors when analysing results in single system designs, as is also true for other, more robust, methodological designs including controlled trials (Evans, 2003; Bithell, 1994). A central assumption in the use of inferential statistical tests is that data groups are independent (Backman & Harris, 1999). Given the likelihood of serial dependency occurring in single subject designs such as the present study, such an assumption of independence is not plausible, and indeed the requirement for serial independence cannot be met in SSRDs. Were analysis such as inferential statistics to be applied to data that is dependent, results would tend to overestimate the significance of any differences observed between phase data in the trial (Bithell, 1994). Furthermore, the use of parametric tests such as the t-test requires data be
normally distributed (Sanders, 2003). It is unlikely that small data groups such as is common with single system designs are normally distributed. Increasing the number of data points would go some way to resolving this issue, however, the implication for the single system design is extending the trial period, including the baseline period, or increasing the number of observations. Not only would increasing the number of data points increase the likelihood of serial dependence occurring, there are also ethical considerations in doing so. By withholding treatment for a longer period of time, any undesirable or detrimental effects due to lack of treatment may become more pronounced. Patient welfare and wellbeing must be of paramount concern, and it would be unethical to expose a patient to pain or discomfort they might not have suffered had they not been part of a study (Sim, 1994).

Without the benefit of the use of the statistical tests mentioned above and where low $R^2$ values are recorded, visual inspection of data trends has been advocated as a viable method of analysis (Backman & Harris, 1999). Research indicates that visual inspection of data may provide similar inferences as statistical methods of analysis were they applicable (Bobrovitz & Ottenbacher, 1998). Unfortunately there are also drawbacks to relying on visual inspection to interpret results. For example, in a study of single system design, Kazdin describes a potential for effective treatments to be discarded prematurely where apparent visual impact is poor (Kadzin, 1982).

It is evident that there are inherent difficulties with statistically analysing single system data. There is an overall reliance upon visual analysis of results and given the variability of data recorded in this trial such visual analysis can be difficult. For this reason, 95% confidence intervals were calculated for baseline phase data of some plots as an aid in clarification as to whether a treatment effect was present. In the context of the current study, application of confidence intervals did, in some cases, indicate some effect, however, with variable or limited baseline phase data it was in some cases not possible to assume that these points occurring outside the confidence interval for the baseline phase were due to the intervention or an extraneous factor. Such extraneous factors may have been events such as S3’s return to work after maternity leave.
**Single system methodology**

The single system design was selected for the current research for two main reasons: i) the emergent nature of the topic, and ii) the utility of the design within a pragmatic, clinical setting. Within the hierarchy of research designs, the SSRD features towards the low end (Evans 2003) and is a method appropriate for developing a foundation of evidence for an emergent topic (Moran, 2005). Within manual therapy, the application of ideomotion and *Simple Contact* is an emergent therapeutic approach. Very little published literature exists regarding effectiveness of ideomotion as a treatment for acute or chronic pain. The SSRD is also a useful design by virtue of its being a pragmatic approach to research, with results immediately useful in a clinical context; results obtained from a single system design more closely resemble typical clinical experience compared to explanatory controlled trials.

**Suitability of SSRD subtype**

The application of phases varies within SSRD studies. This work employed an A-B-C design, where phase A is a baseline phase, B intervention, and C follow-up phase. Due to the requirement of continued practise of ideomotion by each subject up until the end of the study, alternative variations such as an A-B-A design, where the final phase is a return to conditions experienced within the baseline phase, was deemed inappropriate. Neither did the current study employ a multiple baseline method.

The multiple baseline method staggers the length of the baseline period so that each subject commences the intervention stage of the study at a different time. This method is intended to control threats to internal validity, such as environmental factors and the possibility of spontaneous recovery – maturation bias – such that it is possible to cautiously infer causality (Domholdt, 2005; Keating et al., 1985). Given the inclusion criteria required that subjects in the study reported neck pain duration of 6 months or longer, it was considered to be unlikely that maturation bias would be an issue which would impact upon the validity of results. Environmental aspects effecting symptoms were likewise considered to be of minimal threat. This said, when interpreting results it is important to consider the possibility that internal validity may have been affected by the factors aforementioned.
External validity

The extent to which results obtained in a single system design are generalisable to wider populations is the subject of debate (Sim, 1994). Standing on its own, this work is not sufficient to be able to generalise results outside of the small population studied. A novel idea to overcome this intrinsic weakness of the SSRD has been proposed by Ottenbacher & Hinderer (2001). By aggregating SSRD experiments investigating a similar question and synthesising results a more substantive body of clinical knowledge may be pooled. This form of meta-analysis would be a useful way of overcoming issues of limited generalisability. Such a method could usefully be applied to the current work; at the time of writing, one other unpublished SSRD series investigating the effects of ideomotor therapy on chronic neck pain exists (Rickards & Lucas, 2009).

The low number of data points, particularly in the baseline period has been raised previously as an issue commonly experienced in single system design research. Data recorded in the study is particularly prone to error due to this failure of the work to employ a baseline period of sufficient duration to attain stability (reasons for this are discussed later). With few exceptions, plots of recorded data show a volatile baseline period, and the absence of a stable baseline makes it difficult to conclude causal relationships between outcomes and intervention (Bithell, 1994). By extending the baseline period more data points could be obtained, increasing the resolution of results. In addition to the problem of increasing serial dependence, there is also a logistical difficulty with such a solution. By extending the baseline period the duration of time for which treatment is withheld becomes longer. The ethical issues of withholding treatment have been mentioned in previous sections. Further to these issues is the degree to which a trial such as the current work impacts on the life of the subjects under study. This study was of 9 weeks, and in the case of one subject, 10 weeks duration. Nine weeks of commitment to a research project is a major undertaking for participants. Several undesirable effects including increased subject dropouts and general ambivalence towards accuracy of reporting on measures and
increased difficulty in recruitment of subjects may be resultant from extending the period of the study.

A further consideration in adding further data points is the timing and intensity of measurement. The study employed five measurement instruments with varying frequency of completion for each. In the interests of regular collection of results and fulfilling the minimum period to which each instrument is sensitive to change it was decided that there would be three weekly returns of measurements occurring 48 hours apart (with the exception of one interval by necessity being longer at 72 hours due wishing to maintain the same days of measurement each week). During the intervention period all five instruments were employed for each scheduled response period. Requiring this degree of commitment for 9 weeks was considered to be too onerous for subjects, an opinion shared by the Unitec Research Ethics Committee (UREC) during the ethical review process. This consideration necessitated a reduction in the frequency to which some measures were reported. This reduction further decreased the number of data points available for the baseline and follow-up phases of the trial. Thus the difficulty in obtaining enough measurement points to provide a stable baseline was clearly present in this work, and presented challenges in interpretation of results.

In spite of the intrinsic difficulties associated with increasing the time period of the trial, it is clear that it would be useful to increase the baseline and follow-up periods. The raw data in the current study are not easily interpreted, and generally it was not possible to attribute observed change as being due to the intervention. Interpretation of results in the current study was compromised by the inability to determine trends in baseline data to compare to intervention data. Increased numbers of data points would have rendered more results easier to interpret, provided the nature of the relationship between \( x \) and \( y \) variables were represented by a linear equation. Similarly, were the trial to continue longer by increasing the length of the follow-up period, results more similar in nature to those obtained in a clinical setting- where the duration of treatment is not limited by a pre-agreed timeframe- may have been obtained. Such an improvement would of course be reliant on the subject maintaining their practise of the intervention and its being performed correctly and effectively, an
assumption which is problematic given the degree of non-compliance to clinical advice common in patients (Kravitz et al., 1993)

Given the frequency with which trendlines poorly fitted data it is not appropriate to extrapolate observed rates of change to predict future levels. Extrapolation of baseline trends may be a useful way of generating context with which to examine the possibility of a treatment effect in intervention and follow-up phases. The difficulty with such an extrapolation is that it would likely be prone to error. Not only is this due to the poor fit of trendlines previously mentioned, but it also assumes that trends observed will be linear. For example, if the baseline trend of disability and pain levels was increasing, linear extrapolation would predict that eventually disability would become total and pain would reach the worst level possible. This is not likely, particularly in cases of chronic pain where pain and disability levels have tended to remain constant. For this reason baseline extrapolation was not employed in the current study.

A further important point must be raised regarding the use of trendlines for data analysis. The use of linear regression trendlines as aids to analysis of data clearly assumes that change in measured variables, whether due to the intervention or not, will progress in linear fashion. The current work also attempted interpretation of data based on this assumption of linear change. Some results obtained in the current study indicate that change in measured variables may not be linear in function (e.g., figure 2.1) and as such, linear analysis may have underestimated any effects of intervention present.

Accuracy of scheduled reporting

Single system design studies rely upon the goodwill of the subjects to respond honestly and accurately to measures selected for the particular subject of interest. SSRDs typically employ patient self-report measures using paper forms for measurement, assuming that responses acquired from subjects have been penned on a selected date and preferably at a similar time of day for each response. When analysing and interpreting results, the assumption is made that the data collected
occurred on the scheduled date, and conclusions are made accordingly. The use of electronic data collection methods in this study allowed for an evaluation of subject adherence to the measurement schedule. Evaluation of the adherence data indicates the assumption that subjects respond when they are scheduled to is often flawed.

In an effort to simplify recording and help blind subjects to their previous results, an online collection system was used for subjects to record and submit their responses for each outcome measure. Upon submission of the results, a time and date stamp was added by the electronic survey system making it possible to know exactly when the response was received. Many responses were submitted on the scheduled date, however, it is apparent that measures were frequently submitted after the scheduled time. Not only did submissions occur late, in two cases results were recorded before the scheduled date (figure 3.6). It is not possible to know whether such extremes in reporting times were due to subjects misunderstanding their schedules or simply making mistakes, or whether the onerous nature of frequent recording caused apathy in subjects which precluded accurate measurement. It is also possible, but less likely, that such delays came about due to errors with the electronic database used, or personal computer technical errors. It was no surprise to encounter submission delays of 1, 2 or even 3 days, time periods which while less than ideal, it is still conceivable that subjects may recall their relative ratings for that day. With delays occurring over three days late it becomes increasingly unlikely that recorded results are representative of the levels experienced. Obviously results obtained before the scheduled date cannot be considered representative of actual levels on scheduled recording days.

Conditioning studies demonstrate that memory of a painful stimulus persists for up to one month in animals, demonstrated by avoidance behaviour occurring even when the painful stimulus had been withdrawn (Hummel, Lu, Cummons, & Whiteside, 2008). Such findings illustrate the potential for a persistent memory of pain up to a month after it is experienced. There is a small body of literature regarding the accuracy of recall for pain ratings and what time periods may be involved before memory of actual pain levels becomes unreliable. Linton & Gotestam (1983) reported that when patients were asked to recall previous episodes of pain they significantly overestimate the level of pain which occurred. It has also been suggested that present pain levels
experienced by patients may influence the memory of previous episodes of pain (Eich, Reeves, Jaeger, & Graff-Radford, 1985). A more recent study of experimentally induced pain found that accurate memory of pain levels persisted for a week after the painful stimulus (Jantsch et al., 2009). Psychological research into short-term recall contends that time delay does not affect recall ability, but that interference during acquisition of memory items and interference during recall of memory affects the accuracy of items recalled (e.g., Lewandowsky, Duncan, & Brown, 2004; Oberauer & Lewandowsky, 2008; Portrat, Barrouillet, & Camos, 2008). Three points, delay duration (the time past acquisition of memory), the effect of present pain on pain memory, and interference emerge for discussion in reference to this evidence. Regarding delay, it appears possible that the integrity of pain memory retains its fidelity for up to a week (Jantsch et al., 2009). However, the effect of longer durations on recall of pain, such as recorded in the current work, may be more likely to cause erroneous estimation by subjects, such as reported by Linton & Gotestam (1983). The current study recorded delays in response of up to three times that studied by Jantusch et al., (2009) and both anecdotal and personal experience would suggest that the clarity of recollection diminishes the further one gets from the date of the painful event. Thus it does not appear likely that long delays in responding would be lead to accurate recollection of pain ratings. Further, most of the instruments used measured variables other than pain, such as disability or functional status. There does not appear to be any literature relating to recall of functional status, but one would contend that it seems even less likely to be memorable than pain. Also, the level of pain experienced by subjects at the time of recording measurements may have caused them to overestimate the past intensity of pain. As such, Pain Right Now levels recorded retrospectively may have been magnified. Interference may have affected recall; everyday events such as telephones ringing, children requiring attention, housemates, emails arriving in the inbox- particularly relevant due to the method of the current study requiring computer use when submitting measurements- to name but a few, are very likely to have been a distraction to subjects while they were engaged in filling out measurement forms, further decreasing integrity of results submitted.

These findings regarding the extent to which reporting of measures lacked accuracy is a clear weakness of the present study. Furthermore, the findings may illustrate an
important methodological weakness of the single systems study reliant on self-report measures using methods that may be edited/altered at times other than those scheduled. Not only are results less likely to be accurate due to late (or even early) recording, but multiple days’ results recorded concurrently – another factor observed in the current work – clearly lack independence.

Interestingly, a review of studies investigating the use of electronic devices in the collection of data from research subjects suggests that despite potential drawbacks associated with technical malfunction, results were generally of superior quality when collected digitally (Lane, Heddle, Arnold, & Walker, 2006). Lane, Heddle, Arnold & Walker (2006) also contend that patient compliance to instructions regarding recording and submission of data was superior when electronic devices were used (Lane, Heddle, Arnold, & Walker, 2006). Thus the potential for error with self report measures seems increased in studies where electronic submission was not used, particularly given the error encountered with compliance to submission in the current study.

Additional tools for outcome measurement

Another weakness of the current study was the absence of a medication diary. Whilst only three of the five subjects included in the trial used medication to control pain, it would have been useful to record the daily intake of those who did as an additional measure of change. Subject 5 verbally reported being able to discontinue her use of analgesia by the end of her trial. This highlights the fact that the current study cannot know the impact of medication usage on the results obtained from subjects.

The extent to which patients comply to advice offered by clinicians regarding home exercise is well documented (e.g., Christensen, 2000; Milroy & Oneil, 2000) and barriers to compliance and methods of increasing adherence are also well studied (e.g., Lew, 2001; Merritt, 2001; Milroy & Oneil, 2000). The current study required independent sessions of ideomotion to be completed daily by subjects, and it is likely that varying levels of compliance occurred. The level of compliance is likely to influence the rate of change experienced, where more frequent practise is likely to be
more beneficial than irregular practise. A daily practise diary was excluded in the design of the study because it was considered that subjects already had a high load of measures to complete. Having accurate data as to the amount of time spent by each subject completing ideomotor movements would have been very useful alongside data of rates of change.

**Blinding and application of the intervention**

One final weakness to the present work must be documented. Due to logistical difficulty, the practitioner administering *Simple Contact* during the intervention phase was also the study investigator. This biases the results of the study due to decreased objectivity. Further, *Pain Right Now* VAS scores collected immediately before and after clinical sessions of *Simple Contact* were done in the presence of the investigator. Neither subjects nor the author were blinded to the score obtained prior to treatment during recording of the score following treatment. It is also possible that relative inexperience in the use of *Simple Contact* by the practitioner decreased rates of response of subjects to ideomotor movements.
Measurement of change

This study set out to investigate the effects of ideomotor movements on neck pain, with a view to reduction in pain levels and improving quality of life. In order to assess whether the intervention had any effect, it is necessary to attempt to measure and quantify change. In a clinical setting, ‘meaningful change’ could mean a variety of things, from pain levels to functional ability, freedom and range of movement. These same definitions of ‘meaningful change’ apply in a research setting. Beaton (2000) highlights that in terms of outcomes within manual medicine, the most relevant impact of treatment is in symptom relief, quality of life and functional status. It is with this in mind that the five measurement tools were chosen.

Having decided which measurement tools are most appropriate to answer the clinical (or in this case research) question, the next question to be answered is what will be the most meaningful method of interpreting the results recorded. While the use of inferential statistics is a common way of interpreting data in quantitative clinical research, this approach may lack utility in describing clinical relevance of observed changes (Beaton, 2000). In clinical terms, a small but ‘statistically significant’ change may not be important to patients and practitioners, rather, interpretation of results in terms of ‘meaningful’ change is more helpful.

A more useful way of evaluating change is to utilise quantified levels of ‘clinically important change’ – where change not only occurs but occurs to a degree which is meaningful to patients, practitioners or third party payers (Beaton, 2000). Measurement instruments with well established reliability and validity such as the NDI (Vernon, 2008) commonly have an associated level of important change, known as the ‘minimum clinically important difference’ (MCID). For example, the MCID for mechanical neck pain measured by the NDI is 19 percentage points (Cleland, Childs, & Whitman, 2008). It is important to realise that this MCID applies only to a particular condition being measured – in the case of the current work, mechanical neck pain. For example, the MCID associated with the NDI in cases of cervical radiculopathy has been calculated to be seven percentage points (Cleland, Fritz, Whitman, & Palmer, 2006). Thus conclusions as to whether changes in neck pain
were clinically important as recorded by the NDI in the current study apply only to mechanical neck pain, and not other associated factors, such as freedom of neck movement, for example.

It is also important to mention another point discussed by Beaton (2000) related to clinically important change; the fact that change must be anchored to a real life ‘marker’, termed the ‘construct of change’. Beaton (2000) cites Riddle et al (1998) as selecting attainment of treatment goals as being a useful marker of change for their study. Thus the amount of change that is considered important is not only related to a specific type or aspect of dysfunction, but is also rooted in a specific context of change. We can therefore make no firm conclusions, even with a measure of clinically important change, as to whether meaningful change for the patient has occurred on a level that is important to them. With this in mind, whilst results indicate that with obvious notable exceptions changes recorded were not clinically important, they may still have been of sufficient magnitude to be meaningful on levels not accounted for by the measurement tools used.

A final point illustrated by Beaton (2000) is relevant for discussion here. Some subjects enrolled in this study exhibited baseline levels as being relatively low. Riddle et al., (1998, cited in Beaton 2000) discovered that meaningful cut-off points of important change would vary depending on the level their subjects reported during baseline phases. If the subject reported less disability, they concluded a smaller amount of change would be an important threshold, where subjects with higher baseline scores required a higher level of change to be considered important. For instance, subject 5 had decreasing mean levels on the NDI measurement from the baseline to follow-up phase of the trial. These decreases did not satisfy the MCID of 19 percentage points, however, scores during baseline and throughout the study were relatively low. Perhaps in the case of subject 5 an MCID of 19 percentage points is too large, and a conclusion that no important change occurred should be considered cautiously.
Comparisons with similar research

At the time of writing, only one published study investigating the concept of ideomotor therapy used for the treatment of mechanical pain exists. The author is aware of a second SSRD series currently in the process of being edited for publishing (personal communication, L Rickards, 17 January 2008).

Table 8 summarises key points of comparison between the three pieces of work. Key differences between the current study and those of McCarthy, Rickards & Lucas (2007) and Rickards & Lucas (2009) are evident firstly in the choice of outcome measures. Both studies employed a depression anxiety and positive outlook scale (DAPOS), while the study by Rickards & Lucas (2009) also measured the level of disability due to low back pain, and as such employed the revised Oswestry pain questionnaire. The study by Rickards & Lucas (2009) was also of longer duration, and employed a multiple baseline design. Notably, McCarthy et al, (2007) also elected to provide their subject with basic education regarding pain neurophysiology. Such education was not employed in either the current study or that of Rickards & Lucas (2009).

Having completed the study, it is clear that a measure of psycho-emotional change would have been useful in this work. Pincus, Burton, Vogel & Field (2002) conducted a systematic review examining the role of psychological factors within chronic pain, suggesting that they are an important predictor of chronicity. Comments by subject 2 (discussed earlier) regarding changes in affect may have been present in other subjects, and data regarding such change would have been valuable. Given clinically important changes recorded on the DAPOS measure by Rickards & Lucas (2009), the addition of a measure for mood state would have been useful in the current study.

Both other studies were also able to conclude a positive relationship between the introduction of ideomotion-based therapy and a change in scores measured. However, Rickards & Lucas (2009) report that one of the four subjects studied in their series did not respond as positively as the other three, and discussed the possibility of
the existence responders and non-responders to ideomotor-based therapy. It is possible that subjects who demonstrated a beneficial effect could be placebo responders. Consideration of placebo effects would require comparing Simple Contact with a placebo intervention in a clinical trial. It must be noted that the inclusion by McCarthy et al., (2007) of subject education in pain neurophysiology upon intake may well have had an effect on results obtained in that study. As McCarthy et al., (2007) point out, such education has been shown to alter cognition associated with pain, and may also have an immediate effect, increasing physical performance (Moseley, 2004; Moseley, Nicholas, & Hodges, 2004). The exclusion of such an influencing factor by this study and that of Rickards & Lucas (2009) will likely have aided in identifying effects due to the intervention.

The data collected during the baseline phase of the study by Rickards & Lucas (2009) was limited to four points, collected once weekly. Whilst this decreases the likelihood of serial dependency it is important to consider that, similar to the current study, insufficient baseline data does not allow the establishment of baseline trend, and thus conclusions of beneficial effect in subsequent phases due to the intervention are rendered less robust. Data recorded by Rickards & Lucas (2009) demonstrates less variability than the current study however, and visual inspection of data trends in intervention and follow-up phases does suggest a beneficial effect of the intervention.

A further possibility which could potentially explain the fact that the current study did not completely emulate the results of previous studies is the possibility that ideomotion did not emerge in all subjects studied in this research. As with the studies by Rickards (2009) and McCarthy et al., (2007), subjects involved in the current study reported surprise at the emergence of movements they considered to have been non-volitional. Such feelings of disassociation from movement have been described as common characteristics of ideomotor movements (Spitz, 1997; Hyman, 1999). If this experience is indeed confirmation of the presence of ideomotor behaviour, then it appears likely that ideomotor movements did occur.
Table 8: Comparison of Studies of Ideomotion

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</thead>
<tbody>
<tr>
<td>Design</td>
<td>SSRD series, A-B-C</td>
<td>SSRD Series, A-B-C multiple baseline</td>
<td>SSRD, A-B-C</td>
</tr>
<tr>
<td>Duration</td>
<td>9 weeks</td>
<td>11-12 weeks</td>
<td>9 weeks</td>
</tr>
<tr>
<td>Outcome measures</td>
<td>QVAS, NDI, FABQ, TSK, PSFS</td>
<td>DAPOS*, PSFS, NDI, QVAS, ROM** ROPQ***</td>
<td>DAPOS*, NDI, QVAS, FABQ, PSFS</td>
</tr>
<tr>
<td>Subjects educated with basic pain neurophysiology</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Findings</td>
<td>Few clinically important changes, reductions observed not clearly attributable to intervention</td>
<td>Positive clinically important changes in function, disability, active range and mood</td>
<td>Positive clinically important changes in disability and function</td>
</tr>
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Notes
*Depression Anxiety and Positive Outlook Scale
**Ranges of Motion (Cervical Spine)
***Revised Oswestry Pain Questionnaire

Areas for improvement in future studies

Previous sections have highlighted several weaknesses of this study. Two basic faults, ones easily rectified, were the absence of measures for medication use, and home practice. As discussed, data regarding medication intake would be a useful concurrent measure of improvement, and knowledge as to how much time was spent practising ideomotor movements, assuming diary records were accurate, would help contextualise change in scores recorded in outcome measures. Future work should include both these diaries. An area of difficulty experienced in conducting this research has been in balancing the need to collect useful data without overloading subjects. From the perspective of the researcher, more information is better, but this may detract from accuracy of recorded data and result in subjects dropping out. Careful attention must be paid to selection of outcome measures. For example, the current work utilised two measures of fear avoidance. Perhaps one of these could be discarded in future work in favour of an affective measure such as DAPOS used by other studies reviewed, or a measure of dispositional optimism such as the “Life Orientation Test” (Scheier & Carver, 1985).
Methodological weaknesses have also been discussed. Collecting enough data to facilitate accurate analysis but without introducing serial dependence and denying treatment for extended periods of time has proved a difficult trade-off. One way to work around this may be to limit measurement during the intervention and follow-up phases to once or perhaps twice weekly whilst measuring three times weekly during baseline. Regarding the length of each period, unpublished work by Rickards & Lucas (2009) had a time period of 11-12 weeks total. Care should be taken to avoid creating ethical issues by denying treatment for an extended period of time during baseline, however, an additional week may not be excessive in light of the long term presence of the complaint, and would certainly render data over this period more robust. Extending the length of the follow-up period would be less ethically challenging, and whilst perhaps not as useful as extending the baseline period in terms of validity of inferences, would provide important information regarding recovery rates. Decreasing frequency of measurement during the follow-up period would limit the burden of measurement for subjects.

A major methodological weakness encountered by this work was the lack of compliance by subjects with scheduled dates for submission of results, even though they were sent email reminders by the researcher. Such inaccuracy in reporting on scheduled dates may decrease the accuracy of the data recorded and threaten the internal validity of the study. Future work must find ways to maximise accuracy in order to achieve acceptable internal validity.
Chapter 7: Conclusions
Conclusions

The aim of this study was to examine the effectiveness of utilising ideomotor movements in subjects with chronic neck pain with a view to reduction of symptoms and increasing quality of life. Limited baseline data rendered data recorded in subsequent phases difficult to interpret, and in general it was not possible to attribute any changes observed as being due to the intervention. $R^2$ values of sufficient magnitude to suggest a linear relationship between $x$ and $y$ variables represented an hypothesis that the manipulated variable of the intervention and follow-up phases did not affect levels experienced by the subjects. Trendlines fitted to intervention and follow-up phase data did not demonstrate sufficient $R^2$ values to confidently support a conclusion that the intervention had a beneficial or detrimental effect on measured variables. In two instances trendlines fitted to intervention and follow-up data had good $R^2$ values, however the difference in slope between the two trendlines was minor, suggesting the intervention did not affect the variable (kinesiophobia) measured. Data recording *Pain Right Now* intensity levels immediately prior to and following clinical intervention sessions during the intervention phase suggests a potential short-term beneficial effect of *Simple Contact* on pain intensity.

The results of this study do not replicate work undertaken by McCarthy et al., (2007) and Rickards & Lucas (2009), who were able to conclude that clinically important changes were brought about by the expression of ideomotor movements in subjects with chronic neck pain. It should be noted that whilst changes represented in their research suggest a decrease in levels of pain and disability and increases in functional status, baseline phase data is limited to a maximum of four points. As such the possibility exists that their conclusions have over-estimated the magnitude of change in levels due to the effect of the intervention. If such an overestimation has occurred it may be due to the failure to establish sufficient pre-intervention trends.

Perhaps the most important finding of this work relates to the accuracy of reporting by subjects, with measures being submitted in a range from -4 to +21 days around the scheduled reporting dates. These findings highlight a methodological weakness, not only for this study, but all previous SSRDs that used subject self-reported measures. Whilst the single system design is a good model for this type of research, the error
associated in tardy (or early) recording of responses may compromise the integrity of the data obtained.
Chapter 8: References
References


Chapter 9: Appendices
Appendix 1: Subject Information Sheet

The use of ideomotor therapy in the treatment of chronic neck pain: A single systems research design

Information Sheet

You are invited to take part in a research project being undertaken as a part of the Masters of Osteopathy Degree. The research involves investigating the effect of a novel manual therapy approach for chronic pain. This information sheet is designed to provide information regarding the nature of the research, and what will happen should you decide to participate. We currently need people who have suffered from neck pain for six months or longer and who are aged between 18 to 60 years. Unfortunately, if your neck pain is known to be due to diagnosed disc damage or is due to diseases such as cancer, obvious medical conditions, ongoing tissue damage, inflammatory conditions or nerve-root involvement you cannot be included.

The Researchers

The researcher is Jesse Mason, with supervision from Dr Craig Hilton and Robert Moran.

What will participation involve?

• Attending a brief initial appointment to ensure that you are eligible for this project.
• Discussing the procedures, and being informed of what happens in the research. After you have had time to consider participating you will be invited to sign the consent form.
• Being available for nine weeks during the trial, involving one thirty minute contact session per week for three weeks at the Unitec Osteopathic Student Clinic. The study process will last for 9 weeks and is fairly simple. For the first 3 weeks your only commitment will be to fill in a few questionnaires regarding your pain levels and function. These forms will be filled out about once per week for the duration of the study. The next 3 weeks you will receive treatment lasting for 30 mins once per week and will be asked to do some home management practice for approximately 20-30 mins per day. In the remaining 3 weeks you be asked to maintain your home management practice and will need to continue to fill out the forms as in the weeks prior.
What is the nature of the intervention and outcome measure?

- The developer of this approach calls the technique *Simple Contact* because it involves only a very light manual contact of the skin by the therapist in an effort to make people aware of and fully express their own ongoing instinctive movement responses to painful sensation. The technique has been found very effective by therapists all over the world, however only limited research on the approach has been done yet.

- The outcome measures will be not only your relative pain levels, but also how limited you feel you are in completing common day to day activity, with some of these- the ones you find most difficult to do because of your pain-nominated by you. In addition we are interested in your thoughts and beliefs about how your pain affects the way in which your body moves.

Potential Risks to Research Participants

There are no known published data that suggests any risk associated with this research. However, the researcher accepts that it is possible that there may be some undetermined risks involved in the research process. In the case that any potential risk or harm is identified, for any of the research participants, it will be treated on an individual basis. In any such case the research process will be halted immediately.

Confidentiality

Confidentiality and your anonymity will be protected in the following ways:

- All consent forms and completed questionnaires will be seen only by the researchers.
- All hard copies and information will be stored in a locked file in a secured room. Only the researchers will have access to this file.
- Only anonymous data will be presented in reports related to this research.
- Electronic files will be protected with an electronic password.

You have the right not to participate, or to withdraw from this research project within two weeks of your final data collection. This can be done by contacting Jesse Mason or Dr Craig Hilton by telephone or email, or by verbally informing either of them upon contact that you no longer wish to participate.

A final report containing the information from this study will be available at the Unitec Main Library upon completion.

Information and Concerns

For further information or concerns please contact the researchers by phone or email.

Jesse Mason
School of Health and Community Studies
Unitec New Zealand
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Or

Dr Craig Hilton
School of Health and Community Studies
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Telephone: (09) 815 4321  Ext 8601
Email: chilton@unitec.ac.nz
Appendix 2: Subject Consent Form

The use of ideomotor therapy in the treatment of chronic neck pain: A single systems research design.

Consent Form

This research is being undertaken by Jesse Mason from Unitec New Zealand, with supervision from Dr Craig Hilton and Robert Moran.

Name of Participant: .............................................................................................................

I have seen the Information Sheet for people taking part in the research project that is investigating the effect of Simple Contact on chronic neck pain. I have had the opportunity to read the contents of the information sheet and to discuss the project with the project team, and I am satisfied with the explanations I have been given. I agree that raw data from this research project can be held indefinitely for the purposes of future analysis and research. I understand that taking part in this project is voluntary (my choice) and that I may withdraw from the project if necessary.

I understand that I can withdraw from the project at any time up until a fortnight following the termination of the trial, for any reason.

I understand that my participation in this project is confidential and that no material from which I might be identified will be used in any reports on this project.

I have had enough time to consider whether I want to take part.

I know whom to contact if I have any questions or concerns about the project.

The principal researcher and first contact for this project is:
Jesse Mason  
Master of Osteopathy student  
4 Wolseley Street, Morningside, Auckland  
(09) 846 5453  
(021) 771715  
mrjessemason@gmail.com

Signature……………………………………………………….participant  …….(date)

Project explained by…………………………………………..

Signature……………………………………………………….  ………..(date)

This study has been approved by the Unitec Research Ethics Committee from (date) to (date). If you have any complaints or reservations about the ethical conduct of this research, you may contact the Committee through the Secretary (ph: 09 815-4321 ext 8041). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.
Appendix 3: Quadruple Visual Analogue Scale (QVAS)

<table>
<thead>
<tr>
<th>QUADRUPEL VISUAL ANALOGUE SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Name: __________________</td>
</tr>
<tr>
<td>Date: _________________________</td>
</tr>
</tbody>
</table>

Please read carefully:

Instructions: Please circle the number that best describes the question being asked.

Notes: If you have more than one complaint, please answer each question for each individual complaint and indicate the score for each complaint. Please indicate your pain level right now, average pain, and pain at its best and worst.

Example:

<table>
<thead>
<tr>
<th>No pain</th>
<th>Headache</th>
<th>Neck</th>
<th>Low Back</th>
<th>worst possible pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

1 – What is your pain RIGHT NOW?

<table>
<thead>
<tr>
<th>No pain</th>
<th>worst possible pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

2 – What is your TYPICAL or AVERAGE pain?

<table>
<thead>
<tr>
<th>No pain</th>
<th>worst possible pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

3 – What is your pain level AT ITS BEST (How close to “0” does your pain get at its best)?

<table>
<thead>
<tr>
<th>No pain</th>
<th>worst possible pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

4 – What is your pain level AT ITS WORST (How close to “10” does your pain get at its worst)?

<table>
<thead>
<tr>
<th>No pain</th>
<th>worst possible pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

OTHER COMMENTS:


129
Appendix 4: Neck Disability Index (NDI)

**Neck Disability Index**

This questionnaire has been designed to give you information as to how your neck pain has affected your ability to manage everyday life. Please answer every section and mark in each section only the one box that applies to you. We realize you may consider that two or more statements in any one section relate to you, but please just mark the box that most closely describes your position.

**Section 1: Pain Intensity**
- [ ] I have no pain at the moment
- [ ] The pain is mild at the moment
- [ ] The pain is moderate at the moment
- [ ] The pain is fairly severe at the moment
- [ ] The pain is the worst I have ever had

**Section 2: Personal Care (Washing, Dressing, etc.)**
- [ ] I can look after myself normally without causing extra pain
- [ ] I can look after myself normally but it causes extra pain
- [ ] It is painful to look after myself and I am careful
- [ ] I need some help but I manage most of my personal care
- [ ] I need help with most aspects of self care
- [ ] I do not get dressed, I wash with difficulties and stay in bed

**Section 3: Lifting**
- [ ] I can lift heavy weights without extra pain
- [ ] I can lift heavy weights but it gives extra pain
- [ ] Pain prevents me lifting heavy weights off the floor, but I can manage if they are conveniently placed, for example on a table
- [ ] Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned
- [ ] I can only lift very light weights

**Section 7: Work**
- [ ] I do as much work as I want to
- [ ] I can only do my usual work, but no more
- [ ] I can only do my usual work, but less
- [ ] I can only do my usual work, but less and less
- [ ] I can hardly do any work at all

**Section 9: Sleeping**
- [ ] I have no trouble sleeping
- [ ] My sleep is slightly disturbed (less than 30 times)
- [ ] My sleep is moderately disturbed (3-5 times)
- [ ] My sleep is commonly disturbed (more than 5 times and less than 5 times)
- [ ] My sleep is completely disturbed (7 or more times)

**Section 4: Reading**
- [ ] I can read as much as I want to without pain in my neck
- [ ] I can read as much as I want to with slight pain in my neck
- [ ] I can read as much as I want to with moderate pain in my neck
- [ ] I can't read as much as I want because of moderate pain in my neck
- [ ] I can't read at all because of severe pain in my neck
- [ ] I can't read at all

**Section 5: Headaches**
- [ ] I have no headaches at all
- [ ] I have slight headaches, which come infrequently
- [ ] I have moderate headaches, which come infrequently
- [ ] I have moderate headaches, which cause frequently
- [ ] I have headaches almost all the time

**Section 6: Concentration**
- [ ] I can concentrate fully when I want to without pain in my neck
- [ ] I can concentrate fully when I want to with slight pain in my neck
- [ ] I have a fair degree of difficulty in concentrating when I want to
- [ ] I have a moderate degree of difficulty in concentrating when I want to
- [ ] I have a great deal of difficulty in concentrating when I want to
- [ ] I cannot concentrate at all

**Section 8: Driving**
- [ ] I can drive my car without neck pain
- [ ] I can drive my car as long as I want with slight pain in my neck
- [ ] I can drive my car as long as I want with moderate pain in my neck
- [ ] I can't drive my car as long as I want because of moderate pain in my neck
- [ ] I can hardly drive at all because of severe pain in my neck
- [ ] I can't drive my car at all

**Section 10: Recreation**
- [ ] I am able to engage in all my recreational activities with no neck pain at all
- [ ] I am able to engage in all my recreational activities, with some pain in my neck
- [ ] I am able to engage in all my recreational activities, with less pain in my neck
- [ ] I am able to engage in all my recreational activities, with moderate pain in my neck
- [ ] I can hardly do any recreational activities because of pain in my neck
- [ ] I can't do any recreational activities at all

---

**Score:** ___/60  **Transform to percentage score x 100 = ___%**

*Scoring: For each section the total possible score is 5 if the first statement is marked the section score = 5, if the last statement is marked the section score = 0. If all ten sections are completed the score is calculated as follows: Example: 33 (total scored) / 60 (total possible score) x 100 = 55%*

Minimum discountable change (90% confidence): 5 points or 10% points

Appendix 5: Patient Specific Functional Scale (PSFS)

The Patient-Specific Functional Scale

This useful questionnaire can be used to quantify activity limitation and measure functional outcome for patients with any orthopaedic condition.

Clinician to read and fill in below: Complete at the end of the history and prior to physical examination.

Initial Assessment:

I am going to ask you to identify up to three important activities that you are unable to do or are having difficulty with as a result of your ______________ problem. Today, are there any activities that you are unable to do or having difficulty with because of your ______________ problems? (Clinician show scale to patient and have the patient rate each activity).

Follow-up Assessments:

When I assessed you on (state previous assessment date), you told me that you had difficulty with (read all activities from list at a time). Today, do you still have difficulty with (read and have patient score each item in the list)?

**Patient-specific activity scoring scheme (Point to one number):**

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to perform activity</td>
<td>Able to perform activity at the same level as before injury or problem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Date and Score)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
<tr>
<td>Additional</td>
<td></td>
</tr>
</tbody>
</table>

Total score = sum of the activity scores/number of activities
Minimum detectable change (90%CI) for average score = 2 points
Minimum detectable change (90%CI) for single activity score = 3 points


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Appendix 6: Tampa Scale for Kinesiophobia (TSK)

Tampa Scale for Kinesiophobia
(Miller, Kori and Todd 1991)

1 = strongly disagree
2 = disagree
3 = agree
4 = strongly agree

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I’m afraid that I might injury myself if I exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. If I were to try to overcome it, my pain would increase</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. My body is telling me I have something dangerously wrong</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. My pain would probably be relieved if I were to exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. People aren’t taking my medical condition seriously enough</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. My accident has put my body at risk for the rest of my life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Pain always means I have injured my body</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Just because something aggravates my pain does not mean it is dangerous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I am afraid that I might injure myself accidentally</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Simply being careful that I do not make any unnecessary movements is the safest thing I can do to prevent my pain from worsening</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I wouldn’t have this much pain if there weren’t something potentially dangerous going on in my body</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Although my condition is painful, I would be better off if I were physically active</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Pain lets me know when to stop exercising so that I don’t injure myself</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. It’s really not safe for a person with a condition like mine to be physically active</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. I can’t do all the things normal people do because it’s too easy for me to get injured</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Even though something is causing me a lot of pain, I don’t think it’s actually dangerous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. No one should have to exercise when he/she is in pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reprinted from:
Copyright (1995) with permission from International Association for the Study of Pain.
Appendix 7: Fear Avoidance Beliefs Questionnaire (FABQ)

Here are some of the things which other patients have told us about their pain. For each statement please circle any number from 0 to 6 to say how much physical activities such as bending, lifting, walking or driving affect or would affect your back pain.

<table>
<thead>
<tr>
<th>(1) My pain was caused by physical activity………………………….</th>
<th>Completely disagree</th>
<th>Unsure</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Physical activity makes my pain worse…………………………</th>
<th>Completely disagree</th>
<th>Unsure</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Physical activity might harm my back………………………….</th>
<th>Completely disagree</th>
<th>Unsure</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. I should not do physical activities which (might) make my pain worse………</th>
<th>Completely disagree</th>
<th>Unsure</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. I cannot do physical activities which (might) make my pain worse………..</th>
<th>Completely disagree</th>
<th>Unsure</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The following statements are about how your normal work affects or would affect your back pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. My pain was caused by my work or by an accident at work ……………</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

| 7. My work aggravated my pain………………… | Completely disagree | Unsure | Completely agree |
| 0                                                                                   | 1                  | 2      | 3               |
| 1                                                                                   | 4                  | 5      | 6               |

| 8. I have a claim for compensation for my pain………………………… | Completely disagree | Unsure | Completely agree |
| 0                                                                                   | 1                  | 2      | 3               |
| 1                                                                                   | 4                  | 5      | 6               |

| 9. My work is too heavy for me………………………………. | Completely disagree | Unsure | Completely agree |
| 0                                                                                   | 1                  | 2      | 3               |
| 1                                                                                   | 4                  | 5      | 6               |

| 10. My work makes or would make my pain worse…………………………… | Completely disagree | Unsure | Completely agree |
| 0                                                                                   | 1                  | 2      | 3               |
| 1                                                                                   | 4                  | 5      | 6               |

| 11. My work might harm my back……………………………………….. | Completely disagree | Unsure | Completely agree |
| 0                                                                                   | 1                  | 2      | 3               |
| 1                                                                                   | 4                  | 5      | 6               |

| 12. I should not do my normal work with my present pain…………… | Completely disagree | Unsure | Completely agree |
| 0                                                                                   | 1                  | 2      | 3               |
| 1                                                                                   | 4                  | 5      | 6               |

| 13. I cannot do my normal work with my present pain………………… | Completely disagree | Unsure | Completely agree |
| 0                                                                                   | 1                  | 2      | 3               |
| 1                                                                                   | 4                  | 5      | 6               |

| 14. I cannot do my normal work till my pain is treated…………………… | Completely disagree | Unsure | Completely agree |
| 0                                                                                   | 1                  | 2      | 3               |
| 1                                                                                   | 4                  | 5      | 6               |

| 15. I do not think that I will be back to my normal work within 3 months. | Completely disagree | Unsure | Completely agree |
| 0                                                                                   | 1                  | 2      | 3               |
| 1                                                                                   | 4                  | 5      | 6               |

| 16. I do not think that I will ever be able to go back to that work………… | Completely disagree | Unsure | Completely agree |
| 0                                                                                   | 1                  | 2      | 3               |
| 1                                                                                   | 4                  | 5      | 6               |

Scoring
Scale 1: fear-avoidance beliefs about work – items 6, 7, 9, 10, 11, 12, 15.
Scale 2: fear-avoidance beliefs about physical activity – items 2, 3, 4, 5.

Source: Gordon Waddell, Mary Newton, Iain Henderson, Douglas Somerville and Chris J. Main, A Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability, Pain, 52 (1993) 157 – 168, 166.
Appendix 8: Subject 1 Bodychart

SYMPTOMS
Appendix 9: Subject 2 Bodychart
Appendix 10: Subject 3 Bodychart
Appendix 11: Subject 4 Bodychart
Appendix 12: Subject 5 Bodychart
Appendix 13: Unitec Research Ethics Committee (UREC) Approval

Jesse Mason
4 Wolseley St
Morningside

December 14, 2007

Dear Jesse,

Your file number for this application: 2007.789

Title: The use of ideomotor therapy in the treatment of chronic low back pain: A single systems research design

Your application for ethics approval has been reviewed by the Unitec Research Ethics Committee (UREC) and has been approved for the following period:

Start date: 12 December 2007
Finish date: 31 December 2009

Please note that:
1. the above dates must be referred to on the information AND consent forms given to all participants
2. you must inform UREC, in advance, of any ethically-relevant deviation in the project. This may require additional approval.

This letter has been copied to the Principal Supervisor for Unitec student research projects.

You may now commence your research according to the protocols approved by UREC. We wish you every success with your project.

Yours sincerely,

Portia Richmond
Deputy Chair, UREC

RMOL ref#: 1068

cc: Craig Hilton
Carla Sutton
Appendix 14: Unitec Research Ethics Committee (UREC) Amendment Approval

Jesse Mason
4 Wolseley Street
Morningside
Auckland
3 June 2008

Dear Jesse

Your application number for this application: 2007-790
Your application to make changes to your research project so that it will involve pain in the neck region rather than the lower back has been reviewed by the Unitec Research Ethics Committee (UREC) and has been approved.

Please note that you must inform UREC, in advance, of any further ethically relevant deviation in the project. This may require additional approval.

Yours sincerely

[Signature]

Deborah Rolland
Deputy Chair, UREC