



Spinal Manipulation for the Treatment of Back and Neck Pain

A PATIENT GUIDE

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Back and Neck Pain

Why should we pay attention?

- ⇒ Are the first and fourth most disabling health complaints worldwide (1).
- ⇒ Are expensive to treat and a burden to healthcare systems (1).
- ⇒ Costs billions in lost working productivity (2).
- ⇒ Affect approximately 1 billion people worldwide (1, 3, 4).
- ⇒ Costs and disability continue to rise (5).

What is back and neck pain?

- ⇒ Back pain and neck pain are common “life symptoms” (5-8).
- ⇒ Most people will experience an episode or more during their lifetime (5-8).
- ⇒ Despite the best efforts of modern science, the causes of back and neck pain are not fully understood (4-7).
- ⇒ The severity of back or neck pain does not always reflect the seriousness of the problem (5).
- ⇒ The majority of pain will improve on its own. However, in one third of people it is likely to reoccur within six months to a year (7).
- ⇒ Less than 5% of back pain is caused by a serious condition like cancer, infection or arthritis (5).
- ⇒ Back and neck pain are associated with other diseases and conditions (9).
- ⇒ The causes of back and neck pain are complex, some of these include the spinal discs, joints, ligaments, muscles and nerves (5, 6).
- ⇒ Research tells us that in many cases of back or neck pain the physical cause is not clear. Some pain arises in absence of clear physical causes, this is called non-specific back or neck pain (5, 6).



Interesting pain facts

- ⇒ Different people have different sensitivities and express pain differently.
- ⇒ Pain is unique to each individual, much like an emotion is uniquely expressed.
- ⇒ Pain is multidimensional and comprises of biological, psychological and social factors (10, 11). (See Table 1)
- ⇒ Pain is not always related to the amount tissue damage or injury, sometimes people have pain without damage (5).

Biological Factors	Psychological Factors	Social Factors
⇒ Age, gender	⇒ Fear of movement	⇒ Social support
⇒ Tissue health (ligament, muscle, joint, disc strains)	⇒ Magnifying and thinking the worst	⇒ Interpersonal relationships
⇒ Genetic and physiological factors	⇒ Depression	⇒ Previous pain experiences
	⇒ Anxiety	⇒ Cultural factors
	⇒ Beliefs and expectations	

Table 1: Pain Influences (12)

How can we improve back and neck pain?

The good news

Now that we understand that pain is not all to do with tissue damage, we can apply different treatment methods to best suit the individual. We call this “patient centred care,” and the good news is that if we understand all the factors involved in a person’s pain we can formulate a treatment plan best suited to them. If we apply these methods early on we can prevent back pain from becoming persistent. Early detection equals prevention.

Complex and persistent back and neck pain may require the expertise of more than one profession. We call this multidisciplinary care.

The tricky part

Despite best science there are still front-line health professionals who advise and treat patients in unhelpful ways. This can lead to expensive and poor long-term outcomes for people with back and neck pain. Translating and disseminating best evidence and knowledge will play a key role in the future prevention of disabling back and neck pain (4, 5).

What you can do to help yourself?

The first thing you can do is to seek helpful advice. It is important to do your research and find a front-line healthcare provider who specialises in back and neck pain (chiropractor, physiotherapist, occupational therapist or osteopath).

Begin self-care with guidance from your practitioner, including: remaining active, applying heat to the affected area, remaining positive.

If your back pain is persistent or presents in a more complex way, your practitioner may advise a treatment option to manage your pain and get you moving early.

First line recommended treatments include: massage, acupuncture, spinal manipulation, cognitive behavioural therapy, exercise and anti-inflammatory medications (4).

Active healthcare strategies such as yoga and Pilates have also shown promising benefits.

More invasive measures such as steroid injections and surgery are considered only in persistent cases when first line treatments have failed (4)

Early advice for back and neck pain

- ➔ Consult an expert
- ➔ Remain active
- ➔ Apply heat to the area
- ➔ Keep positive
- ➔ Manage your stress
- ➔ Get good sleep and rest
- ➔ Remember that pain will get better

What is Spinal Manipulation?

There are a range of manual treatments that are well supported by the scientific community. More specifically the use of carefully directed manipulative techniques focused at restoring movement and alleviating painful regions in the spine.

Manual therapy. a variety of hands on treatment techniques (including mobilisation, soft tissue techniques, and manipulation) aimed to improve and restore function and reduce the burden of the many and varied complaints that arise from the human neuromusculoskeletal system.

Spinal manipulative therapy / spinal manipulation. A manual therapy technique involving passive joint motions, manipulation is a high speed, low force thrust directed at the joint beyond its normal physiological range of motion but within anatomical limits. This is often associated with an audible “click” or popping sound (13).



Spinal Manipulation

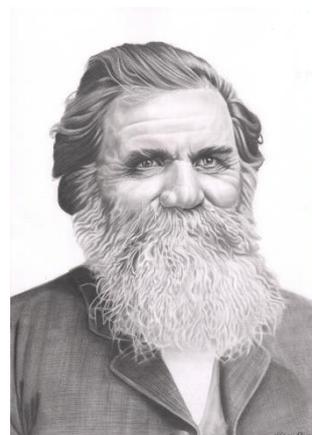
Chiropractic adjustment. “A range of techniques including the classic high velocity, low amplitude dynamic thrust through to very light forces or contact, and may also include instrument, or specialised table-assisted delivery. Adjustment may involve moving the joints of the spine and/or non-spinal articulations through an individual’s usual, and when indicated and appropriate, beyond the normal physiological range of motion, but within the limits of anatomical integrity.” (New Zealand Chiropractic Board, 2004).

Historical Origins

Spinal manipulation is an age-old “hands on” treatment commonly utilised in manual therapy practice. Historically, chiropractors and osteopaths were the principal practitioners sought for this intervention, however this has extended into contemporary physiotherapy practice, and at times it is used in specialised orthopaedic and musculoskeletal physician practice.

Chiropractic history dates from the late nineteenth century, with somewhat mystical origins whereby a so-called “magnetic healer” Daniel David Palmer applied a short lever high velocity thrust to the painful neck of a deaf patient. The result was the miraculous resolution of the man’s “deafness” (14).

This extraordinary intervention led to the development of a theory that all manner of ills could be resolved by removing interference in the spine of messages travelling from the brain to the body. It proposed that all disease was a manifestation of obstruction to the flow of neural impulses from brain to body (14).



Daniel David Palmer

Current scientific understandings largely debunk this theory. However, the foundation of the chiropractic profession was grounded in the application of a skillset that targeted restoration of spinal motion and “alignment” dysfunction (14).

Chiropractic theory developed a unique terminology in relation to the principles of their philosophy of healing. In respect to the techniques applied, the term “spinal adjustment” was coined (14): a term that is still used interchangeably with spinal manipulative therapy, vertebral manipulation, spinal manipulation and chiropractic manipulation.

Controversy

Despite its 130-year-old history, the chiropractic profession still struggles with integration into accepted mainstream healthcare. This largely stems from the continued propagation of old and unscientifically based philosophical ideals within the profession. Whilst some within the profession continue to adhere to the old ideas, there is a growing trend to move to an evidence-based model (14).

Critics of manual therapy and spinal manipulation argue a lack of scientific evidence, and concerns about safety are limiting factors that continue to stall mainstream integration of these practices. Further criticism highlights a lack of understanding as to how exactly spinal manipulation works (14).

Fortunately, significant progress has been made, and there is an encouraging body of research that highlights the safety and efficacy of spinal manipulation.

How Does Spinal Manipulation Work?

Pain mechanisms are complex, and our understanding of treatment effects are no less so. The research into how spinal manipulation works has focused on three main areas:

1. Mechanical stimulus
2. Neurological mechanisms
3. Treatment context mechanisms

Likely Benefits of spinal manipulation

- ➔ Improved movement
- ➔ Reduced pain
- ➔ Improved muscle strength
- ➔ Improved reaction time
- ➔ Improved balance and control
- ➔ Reduced distress

Chiropractors and manual therapists use a range of hands-on techniques to move the body, including stretching tissues and moving joints to improve tissue mobility and motion.

In manual therapy practice we like to say, “motion is lotion”. Moving the tissues helps to improve the way the tissues and joints slide and glide and reduces mechanical stress on the human frame.

Spinal manipulation is a specific manual therapy technique that delivers a very controlled, rapid stretch to the joints and soft tissues of the spine.

1. Mechanical Stimulus

How does spinal manipulation improve mechanical stress?

- ➔ When we manipulate a painful or restricted joint we are stretching it This opens the joint surfaces and helps to reduce tension and improve range of motion (15-17).
- ➔ Stretching the segments of the spine also influences the discs of the spine, and may help to increase the water content of the disc (18).
- ➔ Some studies have shown that spinal manipulation improves the flexibility of the nerves exiting the spine (19, 20).

2. Neurological Mechanisms

How does spinal manipulation reduce pain and improve function?

- ➔ **Chemical effects.** Studies have shown that certain inflammatory chemicals are reduced following spinal manipulation (21-26).
The brain also produces its own chemicals to inhibit and regulate nerve transmission. Spinal manipulation appears to stimulate the release of pain-relieving chemicals from the brain (26-28). These chemicals also produce some of the euphoric effects we may feel after physical exercise.
- ➔ **Movement reduces pain.** Stretching joints and muscles decreases and alters the flow of pain signals from spinal cord to brain (28-37).
- ➔ **Improved strength.** Muscle strength improves following spinal manipulation (38-40).

- **Improved balance and movement control.** Brain activity changes following spinal manipulation, and this may lead to better balance and more refined movement control (41).
- **Reaction times.** There is some evidence that spinal manipulation improves reaction times and reflex control (42).
- **Brain effects.** Several studies have looked at the effects of spinal manipulation on the brain, with promising research indicating that spinal manipulation may help re-organise and reshape brain connections (39, 43).

3. Treatment and Contextual Mechanisms

Also referred to as meaning response, non-specific effect or placebo effect.

Whilst many undermine the term placebo as some sort of trick or sham treatment, research shows us that these effects are powerful influencers on pain and treatment outcomes. Recent changes in the language we use in reference to placebo are gaining momentum in an attempt to change the perception that its effects are somewhat deceiving and undermine an effective and meaningful component of treatment.

- The act of placing hands on a patient has a powerful treatment effect.
- Placebo effects are highly beneficial components to any treatment and we are all susceptible to their influences.
- Placebo effects should not be dismissed as a trick or an unwanted effect, rather a strong and relevant component to treatment.

We know that there are several aspects around treatment delivery and environment, as well as the beliefs and expectations of patients receiving treatment that deliver an effect. The following points summarise these:

- **Positive expectations.** We know that patients who approach treatment with an expectation and a belief that the treatment will work have more favourable outcomes and results (35, 44).
- **Practitioner characteristics.** Doctors and therapists with certain characteristics will enhance meaning responses, including behaviours, communication style, level of care and empathy and their own beliefs (44-46).
- **Patient characteristics.** Patient anxiety, beliefs and previous experiences of treatment can influence treatment outcomes (44, 47).
- **The patient/practitioner relationship.** Level of trust, engagement and mutual respect are some characteristics that may enhance treatment benefits (45).
- **The power of touch.** Studies have shown that a hands-on approach has a powerful effect on pain (45, 48, 49).
- **Treatment environment.** A safe, soothing and professional setting helps to strengthen expectations (44, 45).

Equally, factors surrounding treatment may influence and compromise its potential benefits - these are called “nocebo effects”. Awareness of this and limitation of these effects should be considered by health professionals (46, 50, 51).

Note should be made here that these effects are not unique to the manual therapy setting; they are strong and meaningful in every treatment encounter. Placebo should not be criticized as a “fake” or a “trick,” rather, an essential and important component that should be harnessed to provide maximum benefit for the patient (52).

An interesting factor with respect to spinal manipulation is a very unique interaction between what the patient feels is wrong with their spine (i.e. “my back is out”) and the delivery of a treatment that seems to correct the sensation of misalignment (i.e. the noise and the sensations that accompany the treatment). The “meaning response” of this association even though science tells us it doesn’t quite work like this may provide a strong effect regardless of the mechanisms (53).

Quick Summary

- The effects and mechanisms of spinal manipulation are complex.
- There is still much work to be done to define how it works.
- The benefits and mechanisms of action are likely a combination of factors.
- Benefits are likely to extend beyond pain relief and may improve quality of life.

Alternatives to spinal manipulation

Manual therapists use joint mobilisations, stretching techniques, soft tissue techniques, exercise prescription, lifestyle advice, pain education tools, hot and cold therapy, acupuncture and dry needling, and in some practices, ultrasound, laser therapy and other electrical modalities. These additions to treatment all have merit, and when combined can often produce significant benefits and accelerated recovery.

The chiropractic profession has been modelled on the use of spinal manipulation. However, this one treatment approach should only be applied when best suited to the patient's condition and specific needs.

It is also important to note that complex cases of back and neck pain often involve layers of psychological and social influences, and that these should be addressed alongside manual therapy, or as a complete alternative. Multi-disciplinary teams of practitioners, including psychologists, pain interventional specialists, GPs, occupational therapists and physiotherapists may all provide useful additions as part of a working team to address a patient's needs (58) .

Remember

- ➡ There is not one treatment for back and neck pain, this is why there is a huge healthcare industry involving multiple disciplines and practices to address this burden.
- ➡ Back and neck pain are complex phenomena and it is important that patients and different practitioners work together to find the best solution for the individual.

How to Get Best Results from Spinal Manipulation

A number of studies have shown that the benefits from spinal manipulation are enhanced when combined with other treatments. More specifically, the addition of prescribed home exercises and an overall increase in movement and exercise in general (54, 55). Recent reviews also indicate that chiropractic care in combination with usual medical care was superior to usual medical care alone (56).

Tips for best results

- Stay active during your treatment
- Follow advice
- Adhere to exercise prescription
- Be positive in your outlook
- Be open to treatment
- Be patient (results may take some time)
- Communicate effectively about your progress and give feedback

Equally, spinal manipulation is not an absolute remedy for back and neck complaints, there are a myriad of other treatment modalities that show promising results in the treatment of back and neck pain (4). It is also important to note that contemporary chiropractic and manual therapy practice utilises treatment tools best suited to the individual and the presenting complaint, whilst considering best practice guidelines and patient preferences (57).

Quick Facts Spinal Manipulation

- Is extensively researched and backed by evidence.
- Is widely accepted as safe, effective and cost effective.
- Is a drug free alternative treatment for back and neck pain.

Is Spinal Manipulation Effective for Back and Neck Pain?

Since pain is considered to be a multidimensional complex interaction of biological, psychological and social dimensions, it is important to remember that there is no one technique or treatment that satisfies all its aspects.

Some comprehensive systematic reviews (considered as the pinnacle of evidence) have not provided clear evidence that SM shows clear benefit over placebo (59, 60). However, there are a number recent reviews that are beginning to build a picture in favour of SM in the treatment of back and neck pain (55, 61-64).

Spinal Manipulation for back pain

- ➔ First-line
- ➔ Effective
- ➔ Safe

Despite historical criticism that the quality of evidence is poor for spinal manipulation, the recent momentum in favour of spinal manipulation as a first line approach with specific reference to back pain is compelling. This is illustrated in several best practice guidelines and high-level expert opinion pieces (3, 4, 63-66). A recent article in *The Lancet*, a prestigious medical journal, recommends spinal manipulation for the treatment of both acute and chronic back pain (4).

Although the body of literature is not as comprehensive for neck pain, similar recent recommendations and reviews advocate spinal manipulation (3, 63).

Comparative Effectiveness

Whilst there are several treatment approaches for neck and back pain, the research indicates that conservative measures should be utilised ahead of more invasive surgical and pharmaceutical treatments (4).

Commonly prescribed medications are not supported by strong evidence for back and neck pain.

The effectiveness of widely prescribed “first line” drugs such as anti-inflammatory medications (e.g. diclofenac or ibuprofen) have yet to be established. Recent substantive systematic reviews fail to highlight compelling benefits over placebo (67). These results are similar for other readily prescribed pain medications such as paracetamol (68). Other routine medical treatments such as steroid injections have yet to demonstrate superior efficacy (69).

A recent trial compared diclofenac to spinal manipulation and found “in a subgroup of patients’ spinal manipulation was significantly better than nonsteroidal anti-inflammatory drug diclofenac and clinically superior to placebo”(70).

Furthermore commonly prescribed drugs and surgeries have well documented side effects and adverse reactions (71).

Is Spinal Manipulation Safe?

Spinal manipulation has been viewed by some critics as an ineffective procedure that comes with serious potential risks (72, 73). Whilst adverse events have been reported following SM, the research highlights that serious events are rare (73, 74). Risks should also be weighed against the benefits of treatment, and patients should be given the opportunity to choose, based on the information provided to them about potential risk. (73, 75).



Adverse Events Following Spinal Manipulation

Many important and common treatments carry risks; however, these should be put into context. Spinal manipulation is not risk free.

However, whilst serious events are considered

very rare, the risks should be disclosed to patients prior to treatment (73).

Serious adverse events following spinal manipulation are rare.

The following is a basic overview.

- **Minor events;** usually involve a transient increase in symptoms, generally occurring within 24 hours of treatment. These include muscle soreness, tiredness, nausea, lightheadedness, tingling in the arms. These symptoms usually resolve within 24-48 hours and are reversible (73).
- **Moderate events;** including rib fractures, vertebral fractures and disc injuries. These are usually reversible but cause significant discomfort and distress. These are classified as rare to very rare (1 in 100 000 treatments)(73). Research also tells us that underlying and pre-existing problems are likely present prior to the event occurring - for example, a disc injury was present prior to treatment (76).
- **Major, serious events;** including spinal cord injury, stroke and blood vessel trauma. These are serious and may be irreversible, disabling, and in extremely rare cases, death has been reported (risk range is between 1 in 230 thousand to 1 in 3.8 million)

Research also tells us that underlying and pre-existing problems are likely present prior to the event occurring and symptoms of the injury or disease are present prior to delivery of treatment (73, 76-80).

Putting this into Context

Let's compare the risks of spinal manipulation with some common medications and medical procedures prescribed for back and neck pain.

Common pain medications and medical procedures have significant risk profiles

Medications

- Diclofenac (Voltaren®) Ibuprofen (Brufen®) are common pain-relieving/anti-inflammatory drugs readily prescribed for back and neck pain.
- Side effects and adverse events include kidney failure, heart complications, gastrointestinal bleeds and stroke (27). Some reports from the United States estimate 16 500 deaths as a direct consequence of anti-inflammatory medications (81, 82).
- One author suggests that for every \$1 spent on anti-inflammatories 0.66c was spent for treating the related adverse events (83).

Steroid Injections

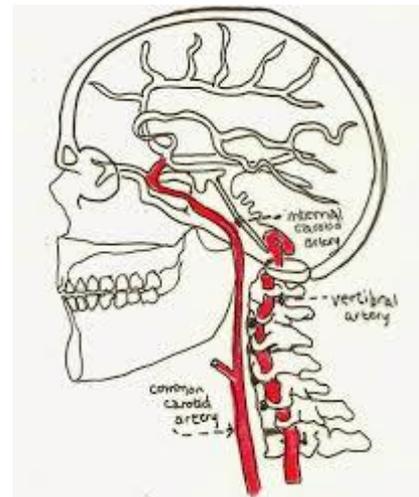
- Epidural corticosteroid injections are a commonly utilised medical intervention for back and neck pain. Whilst considered uncommon, these are significant (84).
- Severe adverse events for spinal injections include infection, spinal cord injury, blindness, brain bleeds, stroke, cardiac arrest, anaphylaxis and death (84).

The Stroke Issue

One commonly discussed topic is the risk of a stroke following spinal manipulation of the neck. This has led some to propose a complete ban on neck manipulation (72, 85).

What is the underlying mechanism?

Studies have linked damage to one of the main arteries in the neck to the development of a type of stroke. Some of these strokes have occurred following spinal manipulation. This type of stroke is a rare event, and this event is infrequently associated with spinal manipulation (1 in 228,050–1,000,000 manipulations (86). The concern raised however is that even though this is a rare event, the consequences could be severe, disabling, and at times life threatening (72, 85).



What the evidence tells us

Numerous studies have been conducted in large populations to assess the risk of stroke following neck manipulation (77-79, 87). This research demonstrates an association between spinal manipulation of the neck and stroke; however, when these researchers compared this to patients who had recently seen their general practitioner, they found the same association. In other words, strokes were equally associated with chiropractic visits and general practitioner visits (77-80, 87).

“There is no convincing evidence to support a causal link between chiropractic manipulation and stroke” (24)

What does this mean?

General practitioners do not perform neck manipulation, but they do consult patients for pain. Therefore, patients will consult either a GP or a manual therapist for pain. The most common symptoms of early onset of stroke are head and neck pain i.e. the symptoms of the event lead to the patient seeking care. This explains an association, not a direct cause and effect relationship (77-79, 87).

Further research on this topic has looked at the stress applied to the artery during spinal manipulation, and these authors found that stresses applied during spinal manipulation were lower than those produced during simple range of motion testing (88-90).

See a practitioner who

- Specialises and regularly practices spinal manipulation
- Keeps up to date with the current research and best practice guidelines
- Considers your preferences for treatment
- Is experienced

Procedure

An initial consultation at this practice involves a full assessment of your complaint and your reason for seeking care. This involves information gathering in the form of a questionnaire followed by a full relevant examination, typically of the spine and nervous system. Your practitioner will assess your condition based on the information gathered, give a working diagnosis, and provide a suitable individualised treatment plan based on the best evidence suited to the management of your specific condition.

Whilst manual therapy and in particular spinal manipulation are primary treatment methods at this clinic, we also utilise a range of other evidence-based approaches to patient care. These include: soft tissue therapy, joint mobilisation, western/medical acupuncture and dry needling. Equally, exercise prescription, lifestyle advice and relevant pain educational tools are utilised as primary management strategies. If, however, our services are not suited to your condition, we will refer you elsewhere.

A key focus at this clinic is to deliver patient centred care, involving a combination of your treatment preferences, the practitioner's experience and a current evidence-based approach to the management of your condition. We also aim to encourage self-efficacy beyond treatment by providing you with the tools to develop a healthier and more active lifestyle.

How will results be quantified and measured?

This clinic utilises validated measures to capture information and monitor patient progress. For lower back pain complaints, we use the Revised Oswestry Disability Index, and for neck pain we use the Neck Bournemouth Questionnaire. These measurement tools are commonly utilised in manual therapy settings and provide information across all dimensions of back and neck pain (91-94). Both of these tools have demonstrated effective measures at intake and at follow up. Furthermore, they have been shown to be sensitive, valid, reliable and responsive (91-93, 95). Completing these questionnaires is simple and time efficient (92, 93)

Chiropractic

- Chiropractic is a healthcare profession; it is not defined solely by the use of spinal manipulation.
- Chiropractors utilise spinal manipulation as one of their primary tools.
- Chiropractors are trained in the diagnosis and management of disorders of the neuromusculoskeletal system
- Chiropractic emphasis and specialisation is in spine care
- Chiropractic training and qualification is on par with medical training with many parallel subjects and an equivalent master's level degree.

What to expect during and after treatment

Spinal manipulation, mobilisation and soft tissue therapy involve movement of tissues to restore function. During treatment, there may be mild discomfort at times. This is considered to be part of treatment. However, most patients find the process relieving and understand this to be an important component of treatment. For some, there is considerable relief immediately following. However, if you are in significant discomfort please advise your practitioner, so they can modify their technique (we are all different in our preferences).

Whilst some may find significant appreciable relief following treatment, it is not uncommon to experience a transient increase in your symptoms in the first 24 to 48 hours following an appointment. This is not always a desirable effect; however, this slight aggravation or general soreness is very likely to be a sign that changes are occurring, and that you are responding favourably.

If you are concerned about any changes in pain or other symptoms, contact your practitioner. We do provide you with a mobile contact for after-hours advice and care.

It is also important to understand that meaningful changes in your symptoms may take time. This is particularly the case if you have experienced pain for an extended period of time. Remember, pain fluctuates, and some days will be better than others. This is normal.

What we notice is that when people improve, they have good and bad days, but that eventually over the course of time the good days outweigh the bad. Also, it is important to understand that back pain has a habit of returning, and many or most patients will experience further episodes in the future. The important thing to remember is not to panic or overthink it when pain returns. Seek help, remain active as best you can and stay positive.

From clinical experience we know that patients who do well with treatment often display the following characteristics

- They are optimistic and open to treatment.
- They are accepting of pain as a function of life.
- They challenge their pain and focus on the future.
- They comply with treatment recommendations and advice.
- They are active and have healthy sleep and dietary habits

Recovery points to remember

- Initially there may be some discomfort following treatment.
- Treatment for back and neck pain is a process, it can take time to recover fully.
- Pain comes and goes; some days are better than others.
- Pain may return in the future.
- Remain optimistic and positive about the future.

Policy

Information Gathering

To fully assess the nature of your health complaint and your reason for seeking care at this clinic, we will require you to complete a form to capture the information surrounding your condition as well as further general health information. Please be as honest and accurate as you can when completing this form. This information provides an essential tool in the assessment, diagnosis and prognosis of your problem. It ultimately helps us in predicting the outcome of your treatment, but also highlights considerations important to treatment suitability or outside referral.

***Note:** All personal and case information in this clinic is confidentially obtained and secured

Your role as health consumer

It is in your interest as the “health consumer” to give feedback to your practitioner through the treatment process to inform him/her of your progress and any new information about your condition. This feedback and communication between patient and practitioner are an essential component to balancing and modifying your treatment to improve the outcome.

If at any point in the treatment process you are uncomfortable with your progress or the delivery of treatment, you can choose to discontinue it, seek further information, or ask for alternative options or onward referral.

It is also your right to make a complaint if the standard of care you have received is inadequate or in breach of healthcare standards.

Health and Disability Commission (ref: <http://www.hdc.org.nz/>) (96)

The Practitioners Role

- To provide you the consumer with understandable, accurate, evidence informed information regarding the nature and management of your health concern.
- To listen to you and advise you in a non-judgemental manner, with dignity and with independence.
- To provide safe delivery of treatment that is appropriate for your condition.
- To refer you for further assessment and management if required.
- To allow you to have a support person present.
- To treat you fairly and with respect.
- To give you a choice about your care and support.

*(adapted from the Health and Disability Commissioner’s website <http://www.hdc.org.nz/disability/the-code-and-your-rights/>)

Communication

The treatment process involves an active exchange of information between patient and practitioner. Effective communication during the treatment process is extremely important, as not only does it relay pertinent information relevant to your case, but also serves to allay concerns between the two parties. Numerous contemporary studies highlight how efficacious this exchange can be in relation to the outcome. Reassurance and the educational components of treatment are extremely powerful and relevant (44, 45, 50).

Please inform your practitioner if he/she is unclear in their communication.

Informed Consent

Informed consent to treatment is the process by which you and your practitioner work through the options for your specific case. This involves a discussion and a “weighing up” of the potential benefits versus the potential risks of any treatment procedure (97, 98). To some degree, the efficacy of some methods may carry a slightly higher risk, but they may also provide a more effective outcome.

Your practitioner will discuss the nature and mechanisms of your condition and will also discuss (based on current scientific understandings) how an individual treatment may influence and relieve your symptoms to get you back to full function.

Information will also be discussed regarding the limitations of the treatment modality and a consideration that this may not fully restore or change the pattern of your condition. In such cases, referral to another specialisation may be required.

Whilst risks of the treatment modalities used in this clinic are reported to be extremely rare, it is important to understand that many forms of treatment come with some form of risk. These risks will be discussed, and you may be required to sign an informed consent to treatment form.

Informed consent to spinal manipulation and manual therapy

Please read this consent form, discuss it with your clinician if you would like to, and then sign where indicated at the bottom.

Clinicians who use spinal manual therapy techniques, such as joint adjustment or manipulation or mobilization for example, are required to inform patients that there are, or may be, some risks associated with such treatment. In particular:

- ⇒ Transient muscle soreness, tiredness, nausea, lightheadedness, tingling in the arms and mild headache. These symptoms usually resolve within 24-48 hours and are reversible.
- ⇒ Whilst rare, some patients have experienced muscle and ligament sprains or strains, or rib fractures following spinal manual therapy. These are considered uncommon (13 per 10 thousand - 1 per 2 million treatments) (86).
- ⇒ There have been reported cases of disc injuries following spinal manual therapy. However, no scientific study has ever demonstrated that such injuries are caused, or may be caused by adjustment or manipulative techniques; (rather symptoms leading to development of disc herniation) (i.e. back pain) are the reason patients seek chiropractic care (76).
- ⇒ There have been reported associations of vertebral artery dissection and neck adjustment, manipulation and mobilization. Such vertebral artery injuries may on rare occasions cause stroke, which may result in serious neurological injury

and/or physical impairment. This treatment association is extremely rare (1 in 230 000 to 1 in 3.8 million) (73).

Research also tells us that underlying and pre-existing problems are likely present prior to serious events occurring following spinal manipulative therapy, and that symptoms of the injury or disease are present prior to delivery of treatment (73, 76-80). In the case of stroke, the most common symptoms of early onset are head and neck pain i.e. the symptoms of the event can lead to the patient seeking care. This explains an association, not a direct cause and effect relationship (77-79, 87).

Treatments provided at this clinic, including spinal adjustment, manipulation and/or mobilization, have been the subject of much research conducted over many years, and have been demonstrated to be appropriate and effective treatments for many common forms of spinal pain, pain in the shoulders/arms/legs, headaches and other similar symptoms. Treatment provided at this clinic may also contribute to your overall well-being.

The risk of injury or complication from manual treatment is substantially lower than the risk associated with many medications (81-83) and other treatments and procedures frequently given as alternative treatments for the same forms of musculoskeletal pain and other associated syndromes.

Your clinician will evaluate your individual case, provide an explanation of care and a suggested treatment plan, or alternatively a referral for consultation and/or further evaluation if deemed necessary.

Acknowledgement: I acknowledge I have discussed, or have been given the opportunity to discuss, with my clinician the nature of chiropractic treatment in general and my treatment in particular, as well as the contents of this consent.

Consent: I consent to the chiropractic treatment(s) offered or recommended to me by my clinician, including joint adjustment or manipulation or mobilization to the joints of my spine (neck and back), pelvis and extremities (shoulder, upper limbs and lower limbs). I intend this consent to apply to all my present and future treatments at this clinic.

References

1. Vos T, Barber R, Bell B, Bertozzi-Villa A, Biryukov S, Bolliger I, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2015;386(9995):743-800.
2. Katz JN. Lumbar disc disorders and low-back pain: socioeconomic factors and consequences. *J Bone Joint Surg Am*. 2006;88 Suppl 2:21-4.
3. Chou R, Côté P, Randhawa K, Torres P, Yu H, Nordin M, et al. The Global Spine Care Initiative: applying evidence-based guidelines on the non-invasive management of back and neck pain to low- and middle-income communities. *European Spine Journal*. 2018:1-10.
4. Foster NE, Anema JR, Cherkin D, Chou R, Cohen SP, Gross DP, et al. Prevention and treatment of low back pain: evidence, challenges, and promising directions. *The Lancet*. 2018;391(10137):2368-83.
5. Hartvigsen J, Hancock MJ, Kongsted A, Louw Q, Ferreira ML, Genevay S, et al. What low back pain is and why we need to pay attention. *The Lancet*. 2018;391(10137):2356-67.
6. Hartvigsen J, Natvig B, Ferreira M. Is it all about a pain in the back? *Best Practice & Research Clinical Rheumatology*. 2013;27(5):613-23.
7. Hogg-Johnson S, van Der Velde G, Carroll L, Holm L, Cassidy JD, Guzman J, et al. The burden and determinants of neck pain in the general population - Results of the bone and joint decade 2000-2010 task force on neck pain and its associated disorders. *Eur Spine J*2008. p. S39-S51.
8. Carroll L, Hogg-Johnson S, Velde G, Haldeman S, Holm L, Carragee E, et al. Course and Prognostic Factors for Neck Pain in the General Population. *European Spine Journal*. 2008;17:75-82.
9. Green BN, Johnson CD, Haldeman S, Griffith E, Clay MB, Kane EJ, et al. A scoping review of biopsychosocial risk factors and co-morbidities for common spinal disorders.(Research Article). *PLoS ONE*. 2018;13(6):e0197987.
10. Melzack R. Introduction: the pain revolution. *Handbook of Pain Management*. Philadelphia: Churchill Livingstone; 2003. p. 1-9.
11. Moseley GL. A pain neuromatrix approach to patients with chronic pain. *Manual Therapy*. 2003;8(3):130-40.
12. Gliedt JA, Schneider MJ, Evans MW, King J, Eubanks JE. The biopsychosocial model and chiropractic: a commentary with recommendations for the chiropractic profession. *Chiropr Man Therap*. 2017;25.
13. Carlesso LC, Macdermid J, Santaguida P, Thabane L, Giulekas K, Larocque L, et al. Beliefs and Practice Patterns in Spinal Manipulation and Spinal Motion Palpation Reported by Canadian Manipulative Physiotherapists. *Physiother Can*. 2013;65(2):167-75.
14. Kaptchuk T, Eisenberg DM. Chiropractic - Origins, controversies, and contributions. *Arch Intern Med*1998. p. 2215-24.
15. Anderst WJ, Gale T, LeVasseur C, Raj S, Gongaware K, Schneider M. Intervertebral Kinematics of the Cervical Spine Before, During and After High Velocity Low Amplitude Manipulation. *Spine J*. 2018.

16. Millan M, Leboeuf-Yde C, Amorim M-A, Budgell B, Descarreaux M. The effect of spinal manipulative therapy on spinal range of motion: a systematic literature review. *Chiropractic and Manual Therapies*. 2012;20(1).
17. Colloca CJ, Keller TS, Harrison DE, Moore RJ, Gunzburg R, Harrison DD. Spinal manipulation force and duration affect vertebral movement and neuromuscular responses. *Clinical Biomechanics*. 2006;21(3):254-62.
18. Beattie PF, Arnot CF, Donley JW, Noda H, Bailey L. The immediate reduction in low back pain intensity following lumbar joint mobilization and prone press-ups is associated with increased diffusion of water in the L5-S1 intervertebral disc. *Journal of Orthopaedic and Sports Physical Therapy*. 2010;40(5):256-64.
19. Shankar Ganesh G, Mohanty P, Smita Pattnaik S. The immediate and 24-hour follow-up effect of unilateral lumbar Z-joint mobilisation on posterior chain neurodynamics. *Journal of Bodywork & Movement Therapies*. 2015;19(2):226-31.
20. Szlezak AM, Georgilopoulos P, Bullock-Saxton JE, Steele MC. The immediate effect of unilateral lumbar Z-joint mobilisation on posterior chain neurodynamics: A randomised controlled study. *Manual Therapy*. 2011;16(6):609-13.
21. Teodorczyk-Injeyan J, Injeyan S, Ruegg R. Spinal Manipulative Therapy Reduces Inflammatory Cytokines but Not Substance P Production in Normal Subjects. *Journal of Manipulative and Physiological Therapeutics*. 2006;29(1):14-21.
22. Teodorczyk-Injeyan J, McGregor M, Triano J, Injeyan S. Elevated Production of Nociceptive CC Chemokines and sE-Selectin in Patients With Low Back Pain and the Effects of Spinal Manipulation: A Nonrandomized Clinical Trial. *The Clinical Journal of Pain*. 2018;34(1):68-75.
23. Song X-J, Huang Z-J, Song WB, Song X-S, Fuhr AF, Rosner AL, et al. Attenuation Effect of Spinal Manipulation on Neuropathic and Postoperative Pain Through Activating Endogenous Anti-Inflammatory Cytokine Interleukin 10 in Rat Spinal Cord. *Journal of Manipulative and Physiological Therapeutics*. 2016;39(1):42-53.
24. Degenhardt BF, Johnson JC, Towns LC, Rhodes DCJ, Trinh C, McClanahan B, et al. Role of osteopathic manipulative treatment in altering pain biomarkers: A pilot study. *Journal of the American Osteopathic Association*. 2007;107(9):387-400.
25. Molina-Ortega F, Lomas-Vega R, Hita-Contreras F, Plaza Manzano G, Achalandabaso A, Ramos-Morcillo AJ, et al. Immediate effects of spinal manipulation on nitric oxide, substance P and pain perception. *Manual Therapy*. 2014;19(5):411-7.
26. Plaza-Manzano G, Molina-Ortega F, Lomas-Vega R, Martínez-Amat A, Achalandabaso A, Hita-Contreras F. Changes in biochemical markers of pain perception and stress response after spinal manipulation. *The Journal of orthopaedic and sports physical therapy*. 2014;44(4):231.
27. Skyba DA, Radhakrishnan JR, Rohlwing KJ, Wright KA, Sluka KA. Joint manipulation reduces hyperalgesia by activation of monoamine receptors but not opioid or GABA receptors in the spinal cord. *Pain*. 2003;106(12):159-68.
28. Bialosky JE, Bishop MD, Price DD, Robinson ME, George SZ. The mechanisms of manual therapy in the treatment of musculoskeletal pain: A comprehensive model. *Manual Therapy*. 2009;14(5):531-8.
29. Boal RW, Gillette RG. Central Neuronal Plasticity, Low Back Pain and Spinal Manipulative Therapy. *Journal of Manipulative and Physiological Therapeutics*. 2004;27(5):314-26.
30. Bialosky JE, George SZ, Horn ME, Price DD, Staud R, Robinson ME. Spinal Manipulative Therapy-Specific Changes in Pain Sensitivity in Individuals With Low Back Pain (NCT01168999). *Journal of Pain*. 2014;15(2):136-48.

31. Pickar JG, Bolton PS. Spinal manipulative therapy and somatosensory activation. *Journal of Electromyography and Kinesiology*. 2012;22(5):785-94.
32. Dishman JD, Ball KA, Burke J. First prize central motor excitability changes after spinal manipulation: A transcranial magnetic stimulation study. *Journal of Manipulative and Physiological Therapeutics*. 2002;25(1):1-9.
33. Koppenhaver SL, Fritz JM, Hebert JJ, Kawchuk GN, Childs JD, Parent EC, et al. Association between changes in abdominal and lumbar multifidus muscle thickness and clinical improvement after spinal manipulation. *The Journal of orthopaedic and sports physical therapy*. 2011;41(6):389.
34. Coronado R, Gay CW, Bialosky J, Carnaby G, Bishop MD, George S. Changes in pain sensitivity following spinal manipulation: A systematic review and meta-analysis. *J Electromyogr Kinesiol* 2012. p. 752-67.
35. Bialosky JE, Bishop MD, George SZ, Robinson ME. Placebo response to manual therapy: something out of nothing? *Journal of Manual & Manipulative Therapy*. 2011;19(1):11-9.
36. Bialosky JE, Bishop MD, Robinson ME, George SZ. The Relationship of the Audible Pop to Hypoalgesia Associated With High-Velocity, Low-Amplitude Thrust Manipulation: A Secondary Analysis of an Experimental Study in Pain-Free Participants. *Journal of Manipulative and Physiological Therapeutics*. 2010;33(2):117-24.
37. Bialosky JE, Bishop MD, Robinson ME, Zeppieri G, Jr., George SZ. Spinal manipulative therapy has an immediate effect on thermal pain sensitivity in people with low back pain: a randomized controlled trial.(Research Report)(Report). *Physical Therapy*. 2009;89(12):1292.
38. Christiansen TL, Niazi IK, Holt K, Nedergaard RW, Duehr J, Allen K, et al. The effects of a single session of spinal manipulation on strength and cortical drive in athletes. *Eur J Appl Physiol*. 2018;118(4):737-49.
39. Haavik H, Jochumsen M, Sherwin D, Flavel S, Türker K. Impact of Spinal Manipulation on Cortical Drive to Upper and Lower Limb Muscles. *Brain Sciences*. 2017;7(1):2.
40. Haavik H, Niazi IK, Jochumsen M, Ugincius P, Sebik O, Yilmaz G, et al. Chiropractic spinal manipulation alters TMS induced I-wave excitability and shortens the cortical silent period. *J Electromyogr Kinesiol*. 2018;42:24-35.
41. Holt KR, Haavik H, Lee AC, Murphy B, Elley CR. Effectiveness of Chiropractic Care to Improve Sensorimotor Function Associated With Falls Risk in Older People: A Randomized Controlled Trial. *J Manipulative Physiol Ther*. 2016;39(4):267-78.
42. Smith DL, Dainoff MJ, Smith JP. The effect of chiropractic adjustments on movement time: a pilot study using Fitts Law. *J Manipulative Physiol Ther*. 2006;29(4):257-66.
43. Lelic D, Niazi IK, Holt K, Jochumsen M, Dremstrup K, Yelder P, et al. Manipulation of Dysfunctional Spinal Joints Affects Sensorimotor Integration in the Prefrontal Cortex: A Brain Source Localization Study. *Neural Plast*. 2016;2016:3704964.
44. Testa M, Rossettini G. Enhance placebo, avoid nocebo: How contextual factors affect physiotherapy outcomes. *Manual Therapy*. 2016;24(C):65-74.
45. Nayak D, Patel P. Enhancing placebo effects in clinical care. *Psychiatric Annals*. 2014;44(2):94-8.
46. Benedetti F, Amanzio M. The placebo response: How words and rituals change the patient's brain. *Patient Education and Counseling*. 2011;84(3):413-9.
47. Blasi ZD, Harkness E, Ernst E, Georgiou A, Kleijnen J. Influence of context effects on health outcomes: a systematic review. *The Lancet*. 2001;357(9258):757-62.

48. Kautz DD. The power of touch. *Journal of the Australasian Rehabilitation Nurses Association*. 2013;16(1):5-8.
49. Mancini DF, Beaumont DA-L, Hu DL, Haggard DP, Iannetti DGD. Touch inhibits subcortical and cortical nociceptive responses. *PAIN*. 2015;156(10):1936-44.
50. Abhishek A, Doherty M. Understanding placebo effects in rheumatology. 2015. p. 222.
51. Dieppe P, Goldingay S, Greville-Harris M. The power and value of placebo and nocebo in painful osteoarthritis. *Osteoarthritis and Cartilage*. 2016;24(11):1850-7.
52. Sanders L. Rebranding placebos: knowable magazine; 2017 [Available from: https://www.knowablemagazine.org/article/mind/2017/rebranding-placebos?utm_campaign=crowdfire&utm_content=crowdfire&utm_medium=social&utm_source=twitter].
53. Perle S, Newell D, Reggers J, Raven T. *icarechirocast Podcasts | COCA 2018* [Available from: <https://www.coca.com.au/professional-development/podcasts/>].
54. Miller J, Gross A, Amp, Apos, Sylva J, Burnie SJ, et al. Manual therapy and exercise for neck pain: A systematic review. *Manual Therapy*. 2010;15(4):334-54.
55. Gross A, Langevin P, Burnie SJ, Bedard-Brochu MS, Empey B, Dugas E, et al. Manipulation and mobilisation for neck pain contrasted against an inactive control or another active treatment. *Cochrane Database Syst Rev* 2015.
56. Goertz CM, Long CR, Vining RD, Pohlman KA, Walter J, Coulter I. Effect of Usual Medical Care Plus Chiropractic Care vs Usual Medical Care Alone on Pain and Disability Among US Service Members With Low Back Pain: A Comparative Effectiveness Clinical Trial. *JAMA Network Open*. 2018;1(1).
57. Bussi eres AE, Stewart G, Al-Zoubi F, Decina P, Descarreaux M, Haskett D, et al. Spinal Manipulative Therapy and Other Conservative Treatments for Low Back Pain: A Guideline From the Canadian Chiropractic Guideline Initiative. *Journal of Manipulative and Physiological Therapeutics*. 2018;41(4):265-93.
58. Van Griensven H, Strong J, Unruh AM. *Pain : a textbook for health professionals*. Second edition. ed: Oxford : Churchill Livingstone Elsevier; 2014.
59. Rubinstein SM, Terwee C, Assendelft W, de Boer M, van Tulder M. Spinal manipulative therapy for acute low-back pain. *Cochrane Database Syst Rev* 2012.
60. Rubinstein SM, van Middelkoop M, Assendelft W, de Boer M, van Tulder M. Spinal manipulative therapy for chronic low-back pain. *Cochrane Database Syst Rev* 2011.
61. Coulter ID, Crawford C, Hurwitz EL, Vernon H, Khorsan R, Suttorp Booth M, et al. Manipulation and mobilization for treating chronic low back pain: a systematic review and meta-analysis. *Spine J*. 2018;18(5):866-79.
62. Paige N, Miake-Lye I, Booth MS, Beroes J, Mardian A, Dougherty P, et al. Association of Spinal Manipulative Therapy With Clinical Benefit and Harm for Acute LowBack Pain Systematic Review and Meta-analysis. *JAMA-J Am Med Assoc* 2017. p. 1451-60.
63. Bryans R, Decina P, Descarreaux M, Duranleau M, Marcoux H, Potter B, et al. Evidence-Based Guidelines for the Chiropractic Treatment of Adults With Neck Pain. *Journal of Manipulative and Physiological Therapeutics*. 2014;37(1):42-63.
64. Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, et al. *AHRQ Comparative Effectiveness Reviews. Noninvasive Treatments for Low Back Pain*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2016.
65. Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, et al. Nonpharmacologic Therapies for Low Back Pain: A Systematic Review for an American College of Physicians Clinical Practice Guideline. *Ann Intern Med* 2017. p. 493-+.

66. Deyo RA. The Role of Spinal Manipulation in the Treatment of Low Back Pain. *JAMA*. 2017;317(14):1418.
67. Machado GC, Maher CG, Ferreira PH, Day RO, Pinheiro MB, Ferreira ML. Non-steroidal anti-inflammatory drugs for spinal pain: a systematic review and meta-analysis. *Annals of the Rheumatic Diseases*. 2017;76(7):1269.
68. Saragiotto B, Machado G, Ferreira M, Pinheiro MB, Shaheed C, Maher CG. Paracetamol for low back pain. *Cochrane Database Syst Rev*2016.
69. Staal J, de Bie R, de Vet H, Hildebrandt J, Nelemans P. Injection therapy for subacute and chronic low-back pain. *Cochrane Database Syst Rev*2008.
70. Von Heymann JW, Schloemer JP, Timm JJ, Muehlbauer JB. Spinal High-Velocity Low Amplitude Manipulation in Acute Nonspecific Low Back Pain: A Double-Blinded Randomized Controlled Trial in Comparison With Diclofenac and Placebo. *Spine*. 2013;38(7):540-8.
71. Bally M, Dendukuri N, Rich B, Nadeau L, Helin-Salmivaara A, Garbe E, et al. Risk of acute myocardial infarction with NSAIDs in real world use: bayesian meta-analysis of individual patient data. *BMJ*. 2017;357.
72. Ernst E. Deaths after chiropractic: a review of published cases. *International Journal of Clinical Practice*. 2010;64(8):1162-5.
73. Swait G, Finch R. What are the risks of manual treatment of the spine? A scoping review for clinicians. *Chiropractic & Manual Therapies*. 2017;25(1):37.
74. Nielsen SM, Tarp S, Christensen R, Bliddal H, Klokke L, Henriksen M. The risk associated with spinal manipulation: an overview of reviews. *Systematic Reviews*. 2017;6(1):64.
75. Stiggelbout AM, Weijden TVD, Wit MPTD, Frosch D, Légaré F, Montori VM, et al. Shared decision making: really putting patients at the centre of healthcare. *BMJ*. 2012;344(7842).
76. Hincapié C, Tomlinson G, Côté P, Rampersaud Y, Jadad A, Cassidy J. Chiropractic care and risk for acute lumbar disc herniation: a population-based self-controlled case series study. *European Spine Journal*. 2018;27(7):1526-37.
77. Church EW, Sieg EP, Zalatimo O, Hussain NS, Glantz M, Harbaugh RE. Systematic Review and Meta-analysis of Chiropractic Care and Cervical Artery Dissection: No Evidence for Causation. *Cureus*. 2016;8(2):e498.
78. Cassidy D, Boyle E, Cote P, Hogg-Johnson S, Bondy SJ, Haldeman S. Risk of Carotid Stroke after Chiropractic Care: A Population-Based Case-Crossover Study. *J Stroke Cerebrovasc Dis*. 2017;26(4):842-50.
79. Cassidy D, Boyle LE, Côté JP, He JY, Hogg-Johnson JS, Silver JF, et al. Risk of Vertebrobasilar Stroke and Chiropractic Care: Results of a Population-Based Case-Control and Case-Crossover Study. *Spine*. 2008;33(4S Suppl):S176-S83.
80. Cassidy D, Bronfort G, Hartvigsen J. Should we abandon cervical spine manipulation for mechanical neck pain? No. *BMJ : British Medical Journal*. 2012;344(jun07 3).
81. Fine M. Quantifying the Impact of NSAID-Associated Adverse Events. *American Journal of Managed Care*. 2013(19):S267-S572.
82. Schmidt M, Sorensen HT, Pedersen L. Diclofenac use and cardiovascular risks: series of nationwide cohort studies. *Bmj*. 2018;362:k3426.
83. Rahme E, Joseph L, Kong SX, Watson DJ, Leloir J. Cost of prescribed NSAID-related gastrointestinal adverse events in elderly patients. *British Journal of Clinical Pharmacology*. 2001;52(2):185-92.
84. Pountos I, Panteli M, Walters G, Bush D, Giannoudis PV. Safety of Epidural Corticosteroid Injections. *Drugs in R&D*. 2016;16(1):19.

85. Wand BM, Heine PJ, O'connell NE. Should we abandon cervical spine manipulation for mechanical neck pain? Yes. *BMJ : British Medical Journal*. 2012;344(jun07 3).
86. Nielsen SM, Tarp S, Christensen R, Bliddal H, Klokke L, Henriksen M. The risk associated with spinal manipulation: an overview of reviews.(Report). *Systematic Reviews*. 2017;6(1).
87. Kosloff TM, Elton D, Tao J, Bannister WM. Chiropractic care and the risk of vertebrobasilar stroke: results of a case-control study in U.S. commercial and Medicare Advantage populations.(Report)(Case study). *Chiropractic & Manual Therapies*. 2015;23(1).
88. Symons BP, Leonard T, Herzog W. Internal forces sustained by the vertebral artery during spinal manipulative therapy. *Journal of Manipulative and Physiological Therapeutics*. 2002;25(8):504-10.
89. Piper SL, Howarth SJ, Triano J, Herzog W. Quantifying strain in the vertebral artery with simultaneous motion analysis of the head and neck: A preliminary investigation. *Clinical Biomechanics*. 2014;29(10):1099-107.
90. Herzog W, Leonard TR, Symons B, Tang C, Wuest S. Vertebral artery strains during high-speed, low amplitude cervical spinal manipulation. *Journal of Electromyography and Kinesiology*. 2012;22(5):740-6.
91. Bolton JE, Humphreys BK. The Bournemouth Questionnaire: a short-form comprehensive outcome measure. II. Psychometric properties in neck pain patients. *J Manipulative Physiol Ther*. 2002;25(3):141-8.
92. Bolton JE, Breen AC. The Bournemouth Questionnaire: A short-form comprehensive outcome measure. I. Psychometric properties in back pain patients. *Journal of Manipulative and Physiological Therapeutics*. 1999;22(8):503-10.
93. Vianin M. Psychometric properties and clinical usefulness of the Oswestry Disability Index. *J Chiropr Med*. 2008;7(4):161-3.
94. Fairbank CTJ, Pynsent BP. The Oswestry Disability Index. *Spine*. 2000;25(22):2940-53.
95. Bolton JE. Sensitivity and specificity of outcome measures in patients with neck pain: detecting clinically significant improvement. *Spine (Phila Pa 1976)*. 2004;29(21):2410-7; discussion 8.
96. The Code and Your Rights - Health and Disability Commissioner [Available from: <https://www.hdc.org.nz/your-rights/the-code-and-your-rights/>].
97. Waller BN, Repko RA. Informed Consent: Good Medicine, Dangerous Side Effects. *Camb Q Healthc Ethics*. 2008;17(1):66-74.
98. Walker BF, Cameron M, French S, Pollard HP, Vitiello AL, Reggars JW, et al. Risk management for chiropractors and osteopaths: informed consent. A common law requirement. *Australas Chiropr Osteopath*. 2004;12(1):19-23.