MASSAGE FOR THE SYMPTOMATIC TREATMENT OF OSTEOARTHRITIS OF THE CERVICAL SPINE

Author: Devin Cox Case Advisor: Tia RamosVancouver College of Massage Therapy

AUTHOR CONTACT INFORMATION:
PH: 788-868-9422 EMAIL: DCOX02@UOGUELPH.CA
Address: Apt. 2202 – 788 Hamilton St., Vancouver, BC V6B 0E9

Table of Contents

Acknowledgements

I would like to extend my warmest thanks to my case study advisor, Tia Ramos, for her continued guidance and wisdom throughout this case study. I would also like to send my gratitude to the case study participant for her time and willingness to commit to such an endeavour, and contribute to my learning experiences. Finally, I would like to thank all my classmates and instructors that have been a part of my time at VCMT. You have all contributed to my life, learning, and growth more than you could ever know. Thank you all.

Abstract

Objective: To employ the use of several standard massage modalities including Proprioceptive Neuromuscular Facilitation (PNF) stretching, myo-fascial release, joint mobilizations, sustained tractions, passive range of motion (PROM) and Swedish massage therapy techniques and determine if they are an effective manual therapy for treatment of Osteoarthritis (OA) in the cervical spine.

Background: OA of the cervical spine has been researched extensively, however massage therapy as an effective treatment modality has not. Reviews of the prevailing literature have proven to be inconclusive due to wide range of results achieved from a relatively small number of studies. Generally, massage therapy as a modality for treating OA of the cervical spine is thought to be beneficial, but to what extent remains unclear.

Methods: This study employs a case study model, and involved the administration of ten (10) one-hour massage treatments to one patient over the course of 50 days. Active cervical range of motion, client perceived neck pain, and several secondary subjective metrics were tracked throughout the study. All measurements were recorded at the outset of the study (baseline), as well as immediately

before and after every second treatment. The patient was also given a stretch/strengthen/hydrotherapy homecare prescription to assist in achieving the established treatment goals.

Results: Results for this study were mixed. Moderate positive improvements were found in the patient's cervical flexion-extension ranges, while less conclusive trends were observed when testing for cervical side-flexion and rotation. Subjectively, there appeared to be immediate benefits following treatments in client stress levels, pain reduction, and overall perceived neck stiffness, however there was minimal substantive long-term improvement over the baseline by the end of the study.

Conclusion: Given the mixed results, short duration and small sample size of this study, further research into massage for treatment of cervical osteoarthritis is needed. However, encouraging short-term results from this study do suggest tangible benefits to incorporating massage therapy as a part of a multi-modality symptom management program for conditions such as OA.

Introduction

Overview of condition

Osteoarthritis (OA), or degenerative joint disease, is a common condition that affects joint cartilage, sub-chondral bone, synovial fluid and soft tissues surrounding joints in the body. It is a progressive disease that leads to degeneration of the articular cartilage of a joint, resulting in pain, loss of function, and joint deformity (1). It is most commonly seen in the hands and load-bearing joints such as the hip and knee (ibid), and is most prevalent in elderly populations aged 65 and up (1,2).

OA can be either a primary (idiopathic) or secondary disease, stemming from a pre-existing condition that may account for increased joint wear such as trauma, postural dysfunction or congenital bone or joint deformity (2,3). While the pathogenesis of primary OA is still unclear, it is generally accepted that consistent 'wear and tear' on a joint accelerates degeneration of the articular surface - eventually leading to cartilaginous thinning and irregularities (3). However further to this model, more research has begun to draw a correlation with chronic tissue inflammation and an 'aberrant' repair process (1) leading to the development of OA in certain joints, independent of wear and tear. This abnormal inflammation is said to stem from irregular and uneven anabolic and catabolic bone tissue activity taking place across the joint surface due to the presence of inflammatory cytokines IL-1R and TNF-a which are up-regulated after joint injury (1).

In both primary and secondary arthritides, it is generally accepted that the eventual thinning and deformation of the cartilage can lead to fibrillation, bone cysts, and shedding of cartilaginous fragments into the joint cavity, which further deteriorates the articular surfaces and negatively impacts joint function (3). Eventually, osteophytes begin to form along the margins of the joint,

and can protrude into the adjacent soft tissue, which ultimately is what leads to characteristic inflammation and pain (3).

The symptom picture in those suffering from OA most commonly presents with pain that is relieved by rest (3,4). In most cases, this pain is also accompanied by reduced range of motion (ROM) and function due to deformation of the articular surfaces. Consequently, muscle spasm and contractures can develop around inflamed joints, contributing to further reduction in joint function and increases in pain (3,4).

In the cervical spine specifically, OA is often accompanied by a degree of disc degeneration, which, in turn, leads to misalignment of the facet joints, causing bone-on-bone contact leading to further deterioration (4). Given the high degree of mobility in the neck, inflammation from conditions such as OA of the cervical joints can lead to a debilitating state of stiffness and substantial loss of ROM in said joints.

Cervical Spine Anatomy and Biomechanics

The cervical spine is made up of seven vertebrae which are responsible for creating the mobility and flexibility required for humans to move their head around. Here mobility is prioritized over stability, which is why the cervical spine can be particularly prone to injury and pathology (5). The cervical spine consists of 4 ‘typical’ vertebrae (C3-6), as well as 3 atypical vertebrae (C1, C2 and C7). The uppermost vertebra (C1) articulates with the base of the cranium creating the atlanto-occipital joints (C0-C1) which allow for capital flexion and extension, while the atlanto-axial joints (C1-2) below are predominantly responsible for capital rotation (though do assist in flexion and side flexion as well) (5). The lower cervical spine – specifically C5-C6 and to a lesser extent C4-C5 - is where the most flexion-extension of the cervical vertebrae takes place; meaning

the facet joints there take the brunt of the physical stress and weight loading from the head (5). This is why degenerative pathologies such as OA are most commonly found here.

Relevant Research

While it is generally thought that massage therapy can have a positive impact on those suffering from osteoarthritic pain, there have been relatively few substantive clinical trials done on the topic, and even fewer focusing on osteoarthritis of the cervical spine specifically. The current body of evidence does generally point (with some disagreement) towards massage modalities as having a positive impact on pain and mobility at affected joints, however, more robust supporting evidence is needed to galvanize this.

For example, a study completed by Field et al. (2014) suggested there was a positive correlation between moderate-pressure massage treatments and a decrease in perceived neck pain (6), while a study of similar design conducted by Borenstein et al. (2011) suggested massage had only a limited impact on neck pain unless it was included in a treatment plan involving other manual modalities and the use of pain medications (7). Furthermore, Vernon (2007) performed a systematic review of the prevailing neck pain management literature and found 'moderate to high-quality evidence that subjects with chronic neck pain […] showed clinically important improvements' from manual treatments such as spinal manipulation, but found no trials incorporating modalities such as trigger point therapy or manual cervical tractioning (8).

More recently, Ezzo et al. (2011) performed yet another systematic review of the evidence for massage as a treatment for neck disorders (9). The study's results were inconclusive due to the small number of relevant studies being reviewed, the lack of information available, and several poor study designs discrediting some of the peer-reviewed literature. Additionally, some of the

studies evaluated used massage therapy as a stand-alone treatment, whereas others incorporated homecare regimens. Therefore, Ezzo et al. concluded that no recommendations for the practice of massage therapy could be confidently made at the time due to the lack of sufficient scholarly data. She also suggested that more studies were needed in order to help better understand the role massage therapy plays in the treatment of neck pain, and additionally, how it can play a critical role in *multimodal* interventions (9).

One of the largest problems facing the ongoing study of manual treatments for osteoarthritis is the high number of variables involved with administration of clinical studies, and the high probability of confounding variables such as inter-tester reliability, treatment replicability, physical variation of participants, as well as the subjective nature of pain and sensation. Unfortunately, some of these factors are almost impossible to account for given the nature of manual therapy and the human body.

However, as is the case in all newer or under-explored fields of research, as more and more studies are undertaken and the body of evidence continues to expand, the field will continue gaining credibility, attention and funding until more universal truths about it can be known. Given the somewhat limited (and at times contradictory) evidence presented across the current slate of literature, it stands to reason that the field of massage therapy could potentially benefit from the completion of many more case studies such as this as a means of expanding the sphere of evidence which indicates massage as an effective treatment modality for patients suffering from osteoarthritis and many other conditions as well.

Theory & Reasoning

Before detailing a study design, it is important to understand the scope and limitations of massage therapy as it pertains to a degenerative condition such as osteoarthritis. While massage can arguably be a beneficial modality for symptom relief, it stands to reason that a patient with OA should not seek to rely solely on massage as a standalone method of symptom management, nor should one expect to see the progression of their condition substantially reversed. The very nature of OA is a cellular-level metabolic imbalance at the joint surface (1) - not something that can simply be 'reversed' by massage or any other manual therapy.

That being said, due to the high prevalence of OA in today's populations, and the enormous social and economic costs associated with it, it is critical that we continue striving to understand more about it in the hopes of providing better options for relief for those who suffer from it.

Going beyond what is only taking place at the articular surface alone, it is easy to rationalize the use of massage as a form of treatment in a case study such as this. For example, we know the effects of OA extend beyond just the joint cartilage surface - causing secondary issues such as antalgic posture, muscle guarding, hypertonicity, loss of ROM, and trigger points. Many massage modalities, such as Proprioceptive Neuromuscular Facilitation (PNF), Myo-Fascial Release (MFR), joint play, passive range of motion (PROM) and Swedish therapies are specifically designed to address these types of concerns. Myo-fascial techniques are known to soften superficial fascial restrictions, while PNF stretching can assist in effectively lengthening muscle bellies (4). Joint play and PROM techniques are an integral part of an OA treatment plan due to them bringing much-needed nutrition flow into afflicted joint capsules by creating space and movement (4). Additionally, Swedish techniques are an excellent way to reduce client stress,

which has numerous physiological benefits, including reduced overall muscle hypertonicty and decreasing sympathetic nervous firing (4).

Based off of the literature reviews' findings, it was also logical to incorporate a homecare exercise and stretch component due to the encouraging evidence (10, 11) suggesting that supplementary exercise seems to increase the overall patient benefit from a manual treatment program.

Case Study Hypothesis

Ultimately, the goal of this case study is to determine: will a regular protocol of back and neck massage, coupled with a targeted homecare regimen including exercise, hydrotherapy and stretching of muscles surrounding the affected joints, lead to a lasting increase in pain-free range of motion in a cervical spine with mild osteoarthritis?

Methods

Patient profile

The patient in this case study is an otherwise-healthy 26-year-old female who maintains an active lifestyle and good eating habits. In an average week she performs activities such as rock climbing, cycling and yoga multiple times per week, and works 40-50 hours as an Assistant General Manager at a busy restaurant. As such, her activities of daily living (ADL's) involve a mixture of desk work, typical restaurant front-of-house duties, and recreational activities.

In her teenage years, the patient was diagnosed with a mild right thoracolumbar scoliosis after having problems with chronic mid-upper back pain throughout her adolescence. She received regular chiropractic and massage therapy for her condition for some time, as well as intermittent

physiotherapy. While she continued to have lingering intermittent pain, over time, and with therapeutic intervention, her symptoms did improve. However, approximately two years ago she began experiencing pain and stiffness localized to her cervical spine rather than her upper thoracic area. In Fall 2016, she had X-rays taken of her cervical vertebrae and was diagnosed with early-stage osteoarthritis in her C4-C5 and C5-C6 verebrae, as well as hypo-lordotic curvature of her cervical spine. Refer to **Appendix C** for copies of X-rays obtained.

Prior to this case study, her routine for symptom management of OA involved regular stretching, as well as occasionally taking non-steroidal anti-inflammatory medications (NSAID's) such as acetaminophen and ibuprofen. She had also been visiting her chiropractor approximately once every 4-6 weeks for relief. Generally, she found each visit provided temporary relief for several days before her symptoms would gradually return. It is worth noting that while the patient had received extensive massage work for her scoliosis in the upper thoracic spine during her teenage years, as of the beginning of this study, she had not yet tried massage for her neck pain.

At the outset of the study, the patient's symptom picture included generalized neck stiffness, as well as moderate to severe pain during active ranges of motion. Her chief complaint was that she was experiencing pain when looking upwards - notably while rock-climbing and cycling. She also would experience mild pain and restriction in the other segmental ranges as well, though to a much lesser extent. She did not present with any complaints regarding her thoracic spine or scoliosis. Further details about the measurements taken during initial assessment can be found in the '**Assessments**' section on **page 10**.

Treatment summary

This case study followed a framework informed by Field's et al. 2014 study on the effects of massage on range of motion of an arthritic neck (6) and treatment guidelines for osteoarthritis set out in Rattray's 'Clinical Massage Therapy' (4). The case study incorporated ten (10) one-hour massage treatments, administered bi-weekly, and was accompanied by a stretch/ strengthen/hydrotherapy homecare regimen that was adhered to by the patient for the entirety of the study. Each one-hour session consisted of 10 minutes of assessment, 40 minutes of treatment time, and 10 minutes of re-assessment and homecare follow-ups. All measurements were taken once at the outset of the study as a baseline, as well as being taken immediately before and immediately after every second massage treatment (treatment #2, 4, 6, 8 and 10) for a total of 11 data points per metric over the course of the entire study. The measurements taken following the 10^{th} treatment of the case study also served as the final results.

Basic charting was also taken for each treatment. The treatment protocol used for each of the ten massages was developed to respond to the treatment goals outlined below, and was accompanied by a supplementary homecare protocol – all of which is outlined in detail in **Appendix A**.

Based on the objectives of the study, the findings established during initial assessment, and the needs of the client, the massage protocol was developed with the goal to:

1) Reduce perceived pain during active cervical extension > flexion > side flexion
2) Increase range of motion in all segmental cervical ranges (extension > flexion > side-flexion > rotation)
3) Decrease hypo-lordotic curvature of the cervical spine

Assessments

For the purpose of data collection for this case study, two primary metrics (one objective, one subjective) and one secondary (subjective) metric were used to assess the efficacy of the treatment protocol used. The first primary measurement taken was tracking cervical active range of motion (AROM) which was measured in degrees from neutral, using a goniometer. The measurements were taken using the prescribed method for cervical ROM measurement via goniometer as outlined in Magee's Orthopedic Physical Assessment (5). Upon initial assessment, the patient presented with significant reduction in range of cervical extension due to significant joint and muscle pain. During baseline measurements, she was able to perform 16° of cervical extension within tolerable limits. For reference, full range for an average person without cervical pathology should be approximately +/-80° (5). She also demonstrated mild-moderate reductions in ROM in flexion (25°) and side-flexion (Left = 25°; Right = 30°), each producing mild pain at end range. Cervical rotation was noted to be below average (Left = 44°; Right = 56°), but did not present with any pain or perceived stiffness. A full comparison of the client's baseline ROM measurements compared to average can be found below in **Figure 1**.

Figure 1: Client's Cervical ROM Baseline Measurements Compared to Averages (5)

Segmental Range	Average full range	Client baseline
Flexion	45-50°	25°
Extension	80-85°	16°
Left side flexion	20-45°	30°
Right side flexion	20-45°	25°
Left Rotation	70-90°	45°
Right Rotation	70-90°	56°

The second primary measurement was patient perceived pain, as felt at end range of each segmental range. The patient was guided through AROM of the cervical spine, and asked to record 'perceived pain' felt during each range (i.e. flexion, extension, left and right side flexion, and left and right rotation) for a total of 6 data points. She was then asked to record the intensity of her pain using a segmental range of motion star diagram as a visual analog scale. For the purpose of this case study, the center of the star marked the 'zero', or 'no pain' point for each axis, while the outer tip of each line in the diagram marked the 'maximum', or 'extremely painful' point for each axis. To reduce participant bias, no numerical values were assigned to the diagram at the time of recording, but were measured and converted into a percentile scale, with the center axis as 0% and end range acting as 100%. Interpretation of these scores utilized an approach informed by the Oswestry Low Back Pain Disability Index (13), and is outlined more thoroughly in **Appendix B.**

A similar, though more simplified approach was also employed to collect data for the third (secondary) metric for this study. A simple linear, non-numerical scale was used to track the patient's overall perceived neck dysfunction in three ways - as it related to overall perceived pain, overall perceived 'stiffness' and present perceived personal stress levels. These three metrics were tracked in order to capture additional qualitative information – both in terms of immediate effects following treatment, as well as overall trends over the course of the 7-week study. Similarly, the non-numerical scale was later measured and converted to a percentile, with a 0.00 score acting as a baseline for each (i.e. no pain, no stiffness, or no stress), and a 1.00 score acting as the maximum possible level for each (i.e. extreme pain, extreme stiffness, or extreme stress). A sample template of the paper forms used during assessments for recording the patient's perceived pain, stiffness and stress can also be found in **Appendix B.**

Results

At the completion of the 7-week protocol, results were mixed, but overall demonstrated a net positive impact. With the exception of right cervical rotation, all other planes of movement demonstrated a modest-to-moderate increase in range at the completion of the study when compared to baseline (**See Figure 2** on following page). Active cervical flexion increased from 25° at baseline, to 36° after Treatment 10. Similarly, cervical extension increased from 16° at baseline, up to 28° after Treatment 10 – however she continued to experience moderate to severe pain on full cervical extension despite increases in range. In both cervical flexion and extension, the patient showed steady incremental improvement in base (pre-treatment) range over the course of the 10 treatments, with significant improvements being recorded immediately following treatments when compared to beforehand. This demonstrates strong evidence for massage as an effective modality for at least temporary symptom relief of OA in the cervical spine. Results for cervical flexion and cervical extension measurements taken over the course of the study can be found in **Figure 3** and **Figure 4** respectively.

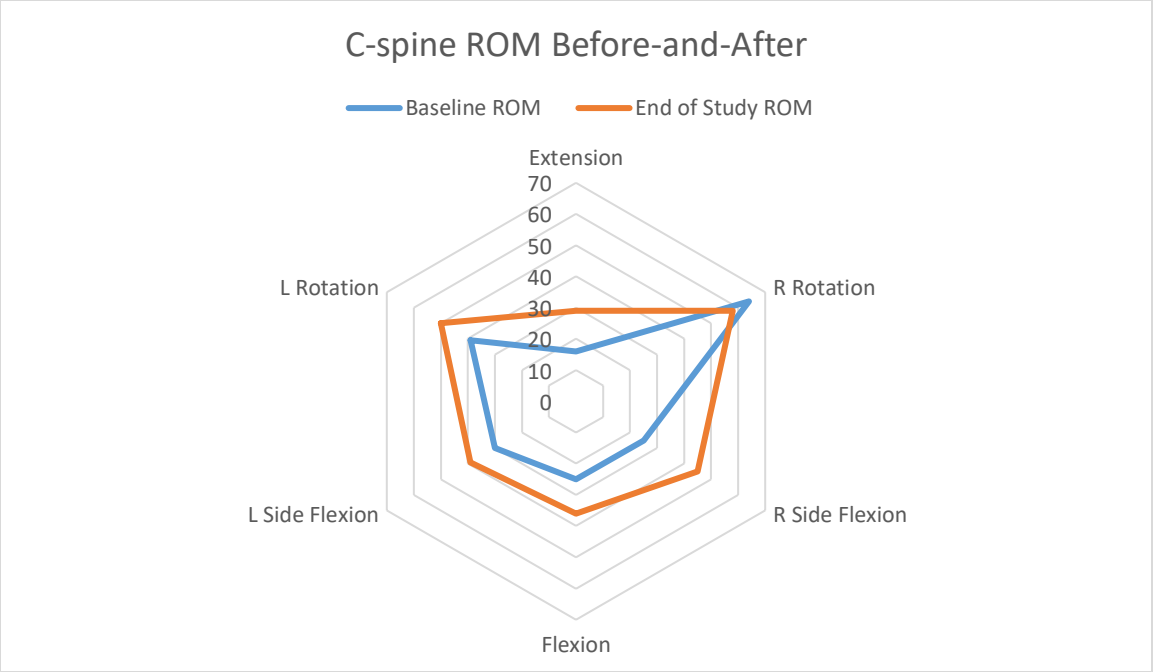


Figure 2: A graphic visualization of changes in segmental ranges of motion of the cervical spine, comparing the baseline measurements to those taken after the 10th treatment. Results show a mild to moderate improvement in all ranges except right rotation, which shows a minor decrease.

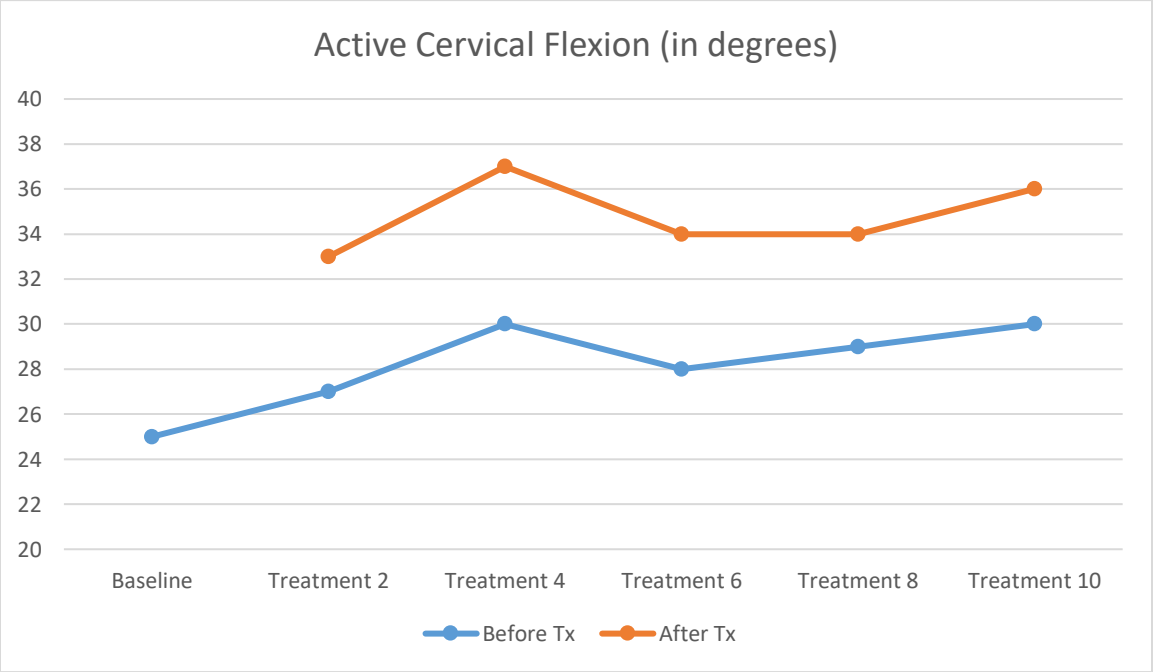


Figure 3: Graphic visualization of all flexion measurements taken before and after each treatment.

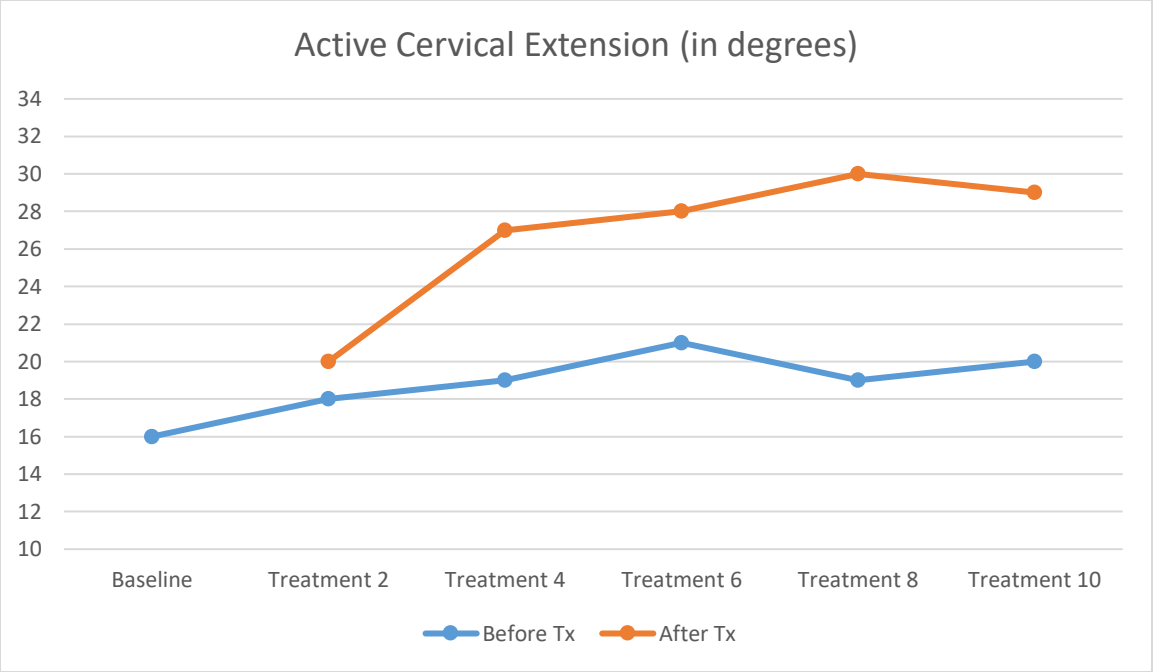


Figure 4: Graphic visualization of all extension measurements taken before and after each treatment.

Results for cervical side-flexion and rotation measured during the study were a little less clear. Despite almost all final measurements showing modest increases over baseline, the longitudinal results for each segmental range show a less clear trend. In fact, there were notable regressions in ROM measured at certain data points over the course of the 10 treatments. For example, right side-flexion showed an increase from 25° at baseline up to 43° measured before treatment 4, before dropping back down to 35° as of Treatment 8. While there was a net gain in ROM of both side-flexion ranges, there was not a clear and substantive improvement in pre-treatment ROM measurements over baseline taken over the course of the study. In other words, any increases in range seen post-treatment seemed to disappear by the time the next measurements were taken. See **Figure 5** for details.

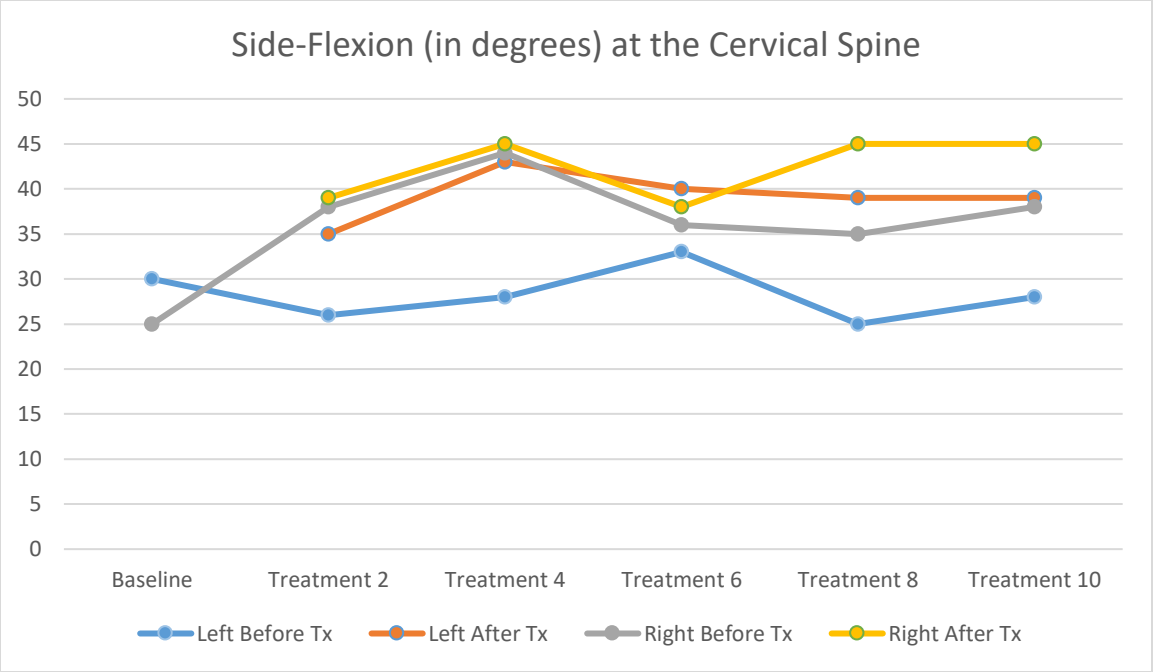


Figure 5: Graphic visualization of all left and right side-flexion measurements taken before and after each treatment.

When analyzing the data collected for cervical rotation, there was minimal (+2°) gain in ROM for right rotation over the 10 weeks, and moderate (+6°) improvement in left rotation. Both ranges also saw a similar decrease in range mid-study as well. Of note is a decrease in ROM measured in both rotational ranges following treatment 6 – even when compared to the pre-treatment measurements. Insights on these trends will be discussed further in the **Discussion** section (page 21). Full details of the rotational ROM measurements can be found below in **Figure 6**.

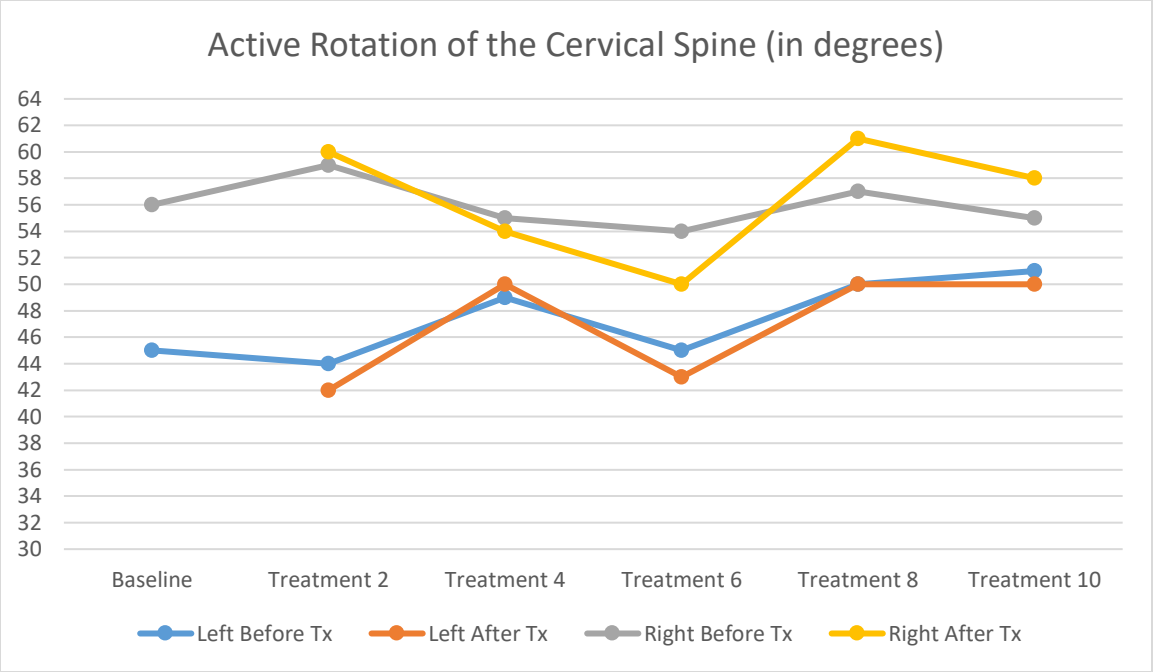


Figure 6: Graphic visualization of all left and right rotational measurements taken before and after each treatment.

Results from the subjective measurements taken during this study were also mixed. While there appeared to be noticeable improvements in 'perceived neck pain' in all ranges of motion immediately following treatment, the values tended to return to near-baseline by the time the next set of measurements were taken. For example, the values recorded on Day 1 during baseline measurements on the segmental AROM star are remarkably similar (and in some cases even better) than those recorded on the final (10^{th}) day of study. It is also interesting to note that spikes in increased *perceived* pain in both side-flexion and rotational ranges during treatments 4 and 6 also coincide with the recorded reductions in AROM charted in the tables above. However, these treatments also coincided with the days on which the patient recorded some of the lowest perceived stress levels – potentially going against an expected correlation between increases in stress causing decreases in range of motion.

Encouragingly, all three of the subjective secondary metrics (i.e. perceived overall pain, stiffness and stress) consistently showed moderate to substantial improvements immediately following treatment, with both perceived overall pain and perceived overall stiffness measurements exhibiting a mean average decrease of – 0.12 points, or %12 improvement post-treatment. Full results for the secondary measurements can be found in **Figure 7** and **Figure 8** below. See **Appendix B** for the index on interpretation of the visual analog score percentiles.

Figure 7: Perceived neck pain (0.00-1.00)

ROM	Baseline	Treatment 2 Pre/Post	Treatment 4 Pre/Post	Treatment 6 Pre/Post	Treatment 8 Pre/Post	Treatment 10 Pre/Post
Flexion	0.60	0.50/0.20	0.30/0.27	0.45/0.28	0.60/0.33	0.43/0.23
Extension	0.89	0.86/0.80	0.86/0.75	0.83/0.80	0.88/0.73	0.83/0.70
L Side-flexion	0.53	0.60/0.55	0.58/0.45	0.53/0.42	0.63/0.55	0.55/0.47
R Side-flexion	0.63	0.63/0.65	0.72/0.42	0.55/0.45	0.43/0.55	0.43/0.41
L Rotation	0.45	0.43/0.80	0.30/0.35	0.65/0.41	0.60/0.69	0.47/0.41
R Rotation	0.45	0.55/0.40	0.52/0.40	0.78/0.65	0.40/0.73	0.55/0.43

Figure 8: Subjective Perceived Metrics, (0.00-1.00)

Metric	Baseline	Treatment 2	Treatment 4	Treatment 6	Treatment 8	Treatment 10
Perceived overall pain	0.77	0.68/0.45	0.83/0.65	0.73/0.67	0.69/0.61	0.70/0.53
Perceived overall stiffness	0.88	0.72/0.42	0.81/0.56	0.86/0.60	0.79/0.63	0.79/0.65
Perceived overall stress levels	0.67	0.48/0.27	0.54/0.77	0.15/0.08	0.73/0.53	0.61/0.40

Discussion

Implications

There are a couple key take-away points from this study that have the potential to inform the massage therapist's approach to treatment of clients with osteoarthritis of the cervical spine. It is worth noting that the massage protocol *did* seem to successfully create incremental change in *the focal* baseline cervical movements over time; with clinically significant improvements recorded immediately following treatment and compared to those taken before. In the two ranges of motion (flexion-extension) that were of the most relevance to the patient and this case study, tangible improvements in range were recorded. Furthermore, immediate reductions in client perceived pain were often recorded post-treatment in *all ranges*, even though the overall longitudinal results for these other ranges were less clear. This suggests that massage may be an effective modality for at least temporary symptom relief of osteoarthritis – an understanding that could potentially shape how and when physicians and other healthcare practitioners refer their clients suffering from OA, as well as how massage therapists shape their treatment plans.

Impact to RMT's

For RMT's, osteoarthritis is a condition that will likely be encountered regularly. Having access to information about effective and ineffective treatment strategies for such a condition is an extraordinarily valuable resource for any RMT, and the more knowledge and information available to inform said treatments, the more effective a therapist can be. From a treatment perspective, it is worth noting that this specific treatment protocol was focused predominantly on increasing cervical extension ROM, which it appeared to do effectively. However, results were less conclusive when it came to treating the other cervical ranges of motion, and modification to the

treatment may be necessary to treat those suffering from OA, but presenting with a different symptom picture. Similarly, the results from this study also suggest that an increased treatment frequency may provide more effective care to clients presenting with similar symptoms, as the effects of each massage treatment appeared to diminish in the time between measurements.

Limitations

It is worth noting that while this study provides some valuable evidence towards massage being effectively used to treat cervical OA, it does have several limitations. The first notable limitation is, of course, scope. Having a longer time frame to work with, or being able to conduct the same massage protocols on multiple participants would go much further in providing more substantive data with a larger sample size that may confirm or refute the findings collected during this study on one individual. While distinct trends appeared while tracking both cervical flexion and extension over the course of the seven weeks, the results for cervical side-flexion and rotation were inconclusive at best. Moderate improvement was seen after some treatments, while after others there appeared to be a regression in symptoms. Similarly, a 7 week treatment protocol may not be sufficient for some cases, and a longer treatment time-frame may reveal overarching trends that would not appear in such a short study.

Another key limitation of this study is the use of the goniometer as a data collection tool. While it can most certainly serve as an approximate guide, it is by no means an accurate way to measure joint range to the precision of single degrees. Some evaluations have estimated that the instrument in practice is only accurate enough to determine minimum detectible changes of above 6°; with a +/-3° margin of error (12). This means that some of the results from this study are theoretically negligible if accounting for margin of error. More advanced instrumentation, or

significant increases in the number of data points collected would help towards eliminating degree of uncertainty due to equipment accuracy.

Finally, a third limitation to this case study is the factor of both tester and participant subjectivity. When asking questions regarding topics such as pain, stress or stiffness, it is difficult to establish a replicable and objective scale, namely due to the individuality of the experience of such phenomena. This also complicates studies that involve multiple practitioners treating multiple people, as communication of pain scales and pressure usage may vary from person to person and from treatment to treatment, potentially skewing results or application of treatment protocols.

Conclusion

Overall, it would appear that there is at least some evidence pointing towards the use of massage (including modalities such as PNF stretching, joint mobilizations and Myo-Fascial Release) being incorporated into a multi-modal routine targeting treatment of symptoms for osteoarthritis in the cervical spine. Over the course of treatment, baseline ranges of motion generally increased slightly, with more substantial improvements being noted immediately after treatment. Decreased stress levels, perceived neck stiffness, and perceived pain also generally were lower immediately following treatment when compared to the measurements taken immediately before. Additional longitudinal studies, particularly with a larger sample size, would help solidify our understanding of osteoarthritis as a condition, and the extent to which massage can help it. It will be interesting to see what the next few years reveal in terms of further defining the benefits and limitations of massage therapy, and determining how it can be incorporated into the lives of the many people who live with conditions such as osteoarthritis every single day.

References

1. Goodman C, Fuller K. Pathology. 3rd ed. St. Louis, Mo.: Saunders/Elsevier; 2009.

2. Tortora G, Derrickson B. Principles of Anatomy and Physiology. 13th ed. New York: Wiley; 2012.

3. Damjanov I. Pathology for the Health Professions. 4th ed. St. Louis, Mo: Saunders; 2012.

4. Rattray F, Ludwig L. Clinical Massage Therapy Understanding Assessing and Treating Over 70 Conditions. Austin, Tx: Talus Publishing; 2000.

5. Magee D. Orthopedic Physical Assessment. 6th ed. St. Louis, Mo: Elsevier Saunders; 2017.

6. Field T, Diego M, Gonzalez G. Neck arthritis pain is reduced and range of motion is increased by massage therapy. Complimentary Therapies in Clinical Practice. 2014;20(4):219-223.

7. Borenstein D. Chronic Neck Pain: How to Approach Treatment. Current Pain and Headache Reports. 2017;11(6):436-439.

8. Vernon H, Humphreys K, Hagino C. Chronic Mechanical Neck Pain in Adults Treated by Manual Therapy: A Systematic Review of Change Scores in Randomized Clinical Trials. Journal of Manipulative and Physiological Therapeutics. 2007;30(3):215-227.

9. Ezzo J, Haraldsson B, Gross A, Myers C, Morien A, Goldsmith C et al. Massage for Mechanical Neck Disorders. Spine [Internet]. 2007 [cited 17 July 2017];32(3):353-362. Available from: https://www.ncbi.nlm.nih.gov/pubmed/17268268

10. Petersen S, Cook C, Donaldson M, Hassen A, Ellis A, Learman K. The effect of manual therapy with augmentative exercises for neck pain: a randomised clinical trial. Journal of Manual & Manipulative Therapy [Internet]. 2015 [cited 22 July 2017];23(5):264-275. Available from: https://www.ncbi.nlm.nih.gov/pubmed/26955256

11. Gross A, Kay T, Paquin J, Blanchette S, Lalonde P, Christie T et al. Exercises for mechanical neck disorders. Cochrane Database of Systematic Reviews [Internet]. 2015 [cited 19 July 2017];5. Available from: http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004250.pub5/full

12. Krause D, Boyd M, Hager A, Smoyer E, Thompson A, Hollman J. Reliability and accuracy of a Goniometer Mobile Device Application for Functional Movement Screen Deep Squat Test. International Journal of Sports Physical Therapy. 2015; 10(1): 37-44.

13. Baker D, Pynsent PB, Fairbank JCT (1989) The Oswestry disability index revisited: its reliability, repeatability, and validity, and a comparison with St Thomas Disability Index. In Roland MO, Jenner JR eds (1989) Back Pain: new approaches to rehabilitation and education. New York, NY. Manchester University Press 174-186

APPENDIX A – Treatment & Homecare Protocols

The following protocol was used for each massage treatment during the case study. To rule out as many confounding variables as possible, the protocol focuses entirely on the upper body, with special focus on the upper shoulders, upper chest, and neck muscles – all areas that can cause pain and dysfunction through muscular compensation. The techniques used are listed below in the order they are performed in, and with the structures they are performed on.

Prone Techniques:

- **Rocking:** Upper torso, lower torso, thighs, legs, feet
- **Gentle Compressions:** Trapezius (traps), rhomboids, erector spinae group (ESG), latissimus dorsi
- **Myo-Fascial Release (MFR):** *Bowing* - erector spinae group, upper trapezius; *Squeezing* - Upper trapezius, splenius capitus, splenius cervicis; *Skin rolling* - upper thoracic fascia
- **Introductory strokes/oil spreading:** All back, posterior shoulders
- **Stroking:** Traps, rhomboids, ESG, lats, obliques
- **Ulnar border stroking:** Traps, rhomboids, ESG, lats, obliques
- **Thumb knead**: ESG, rhomboids, traps, levator scapula, infraspinatus
- **Ischemic compression**: levator scapula trigger point release
- **Gentle Swedish stroking**: to clear all major muscle groups of the back, posterior shoulders and cervical spine
- **Redrape + compressions**: to all major muscle groups of back, posterior shoulders and cervical spine; and to dry remaining oil

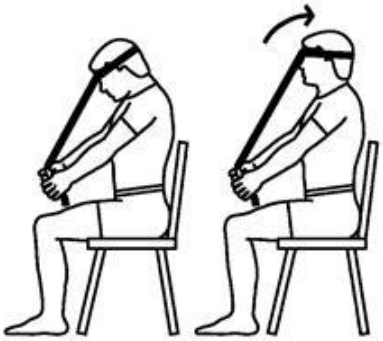
Supine Techniques:

- **MFR:** X-hands upper chest
- **Swedish Stroking:** upper pectorals, subclavius, anterior deltoid fibers
- **Ischemic release:** Pectoralis major, pectoralis minor
- **Cervical spine traction**: 1-2 minute hold
- **MFR:** *Bowing* - Sternocleidomastoid
- **Ischemic Release**: Sternocleidomastoid (Trigger point)
- **Knuckle Stripping**: scalenes
- **Joint play:** lateral cervical vertebrae translations – vertebrae C2-C6
- **Ischemic Release:** Upper splenius group and suboccipital group
- **Proprioceptive Neuromuscluar Fascilitation:** *Hold relax stretch:* Cervical side-flexion - performed bilaterally
- **Passive Range of Motion (ROM):** Cervical spine – flexion, side flexion, rotation – performed bilaterally
- **Gentle Swedish stroking**: to clear all major muscle groups of the upper chest, anterior shoulders, and anterior and lateral neck

Homecare prescription:

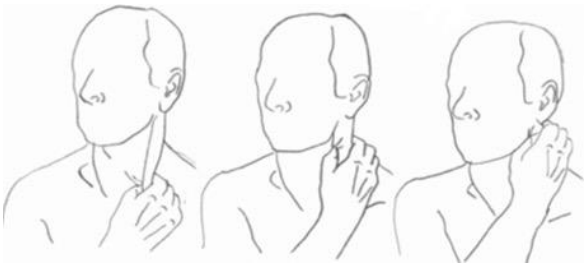
- **Hydrotherapy**
  - Deep moist heat (ex. Cloth wrapped around neck and shoulders) applied to neck and upper shoulders (trapezius, splenius group, scalenes, SCM)
    - 1-2x a day
    - 20 minutes on affected area
    - every 2nd day through the completion of the case study

- **Strengthening**
  - Isotonic strengthening of primary cervical extensors against resistance using a theraband or towel within pain-free range (full flexion into slight extension past neutral)
  - Active muscle groups: Splenius groups, spinalis groups, semispinalis groups, upper trapezius and longissimus cervicus
    - 12-15 reps x 3-5s per rep x 2 sets
    - 1x a day
    - Daily through the duration of the case study



- **Stretching**
  - Cervical spine side flexion self-stretch – (working muscle groups: scalenes, upper trapezius, levator scapula,
    - 30-40 seconds, 2 reps each side
    - 2-3x per day
    - daily through the duration of case study

- Sternocleidomastoid (SCM) self-massage – gentle bowing & kneading of muscle bellies to help increase length without requiring cervical extension, which was painful for the client.
  - 30-40 seconds per side, performed bilaterally
  - 2-3x per day
  - daily through duration of case study



APPENDIX B – Metrics Template and Scoring Index

Attached below is a sample of the template given to the patient to record the subjective measures being tracked during the study. On this template, the patient was asked to record two subjective measures – one primary, and one secondary. For the primary subjective measurements, the patient was guided through an active range of motion assessment of the cervical spine, and asked to record 'perceived pain' felt during each segmental range (i.e. flexion, extension, left and right side flexion, and left and right rotation) for a total of 6 recorded metrics. She was then asked to record the intensity of her pain using a non-numerical visual analog scale, marked on a segmental range of motion star diagram. For the purpose of this case study, the center of the star marked the 'zero', or 'no pain' point for each axis, while the outer tip of each line in the diagram marked the 'maximum', or 'extremely painful' point for each axis. In the interest of saving space and paper, copies of the results recorded by the patient are intentionally not included, as all relevant information can be found in the **Results** section.

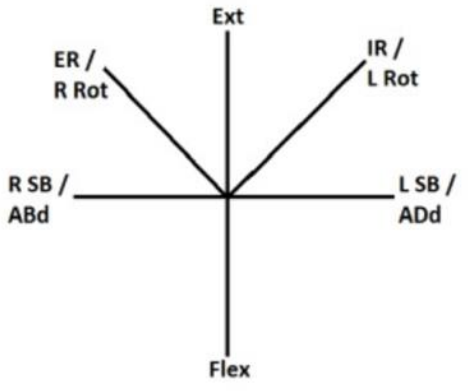
The secondary subjective measure involved using three metrics to track the patient's overall perceived neck dysfunction as it related to pain, stiffness and personal stress. These three metrics were tracked on a simple, non-numerical, visual analog scale as well. They are displayed just below the ROM star diagram in the template. These metrics were tracked in order to capture additional information on the qualitative benefits of massage for OA of the cervical spine – both immediately following treatment, as well as over the course of the 7-week study. Interpretation of the visual analog scale scores was loosely informed by the interpretation scale used in the Oswestry Low Back Pain Disability Questionnaire (13), though was modified to be more relevant to neck pain. Both a sample template of the page that was given to the client for tracking, as well as the score interpretation guide for the visual analog scales can be seen on the following pages.

SAMPLE TEMPLATE

Treatment number: _____ Date: _____

Qualitative/Subjective measurements:

Client perceived pain per segmental neck movement during AROM of the cervical spine:



Client overall perceived neck pain:

Not painful Extremely painful
|----------|

Client overall perceived neck stiffness:

Not Stiff Extremely stiff
|----------|

Client current perceived personal stress level:

Not Stressed Very stressed
|----------|

Interpretation of all scores recorded on visual analog scales:

0% to 30%: Minor Disability – Minor pain or stiffness, but the patient can easily cope with most activities of daily living (ADL's). No treatment is indicated apart from homecare recommendations.

31%-60%: Moderate Disability - The patient experiences more pain and difficulty with ADL's, though they are not grossly affected and the patient's symptoms can be managed with varying degree of interventions.

61%-90%: Severe Disability - Pain remains the main problem in this group, with activities of daily living being seriously affected. These scores suggest positive intervention is required.

91%-100%: Crippled - These patients are either require immediate medical care (due to injury or trauma) or are exaggerating their symptoms.

APPENDIX C – Patient X-Ray Records

Attached are copies of the x-rays taken of the patient's cervical and thoracic spine, showing the existing left lumbar scoliosis and right thoracic scoliosis, as well as cervical facet degeneration around C4-5 and C5-6, and accompanying cervical hypo-lordosis. The images were taken approximately 6 months before the beginning of the study. The image of the thoraco-lumbar area is from an anterior view.