Short-term effects of dry needling in addition to standardised exercise protocol in pain and quality of life in patients with chronic mechanical neck pain.

Submitted by

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21-01-2022

Dedication:

I dedicate my thesis to my father and mother. To my wife

Acknowledgement:

Thanks to Allah the Almighty, the most Gracious, and the most Merciful for giving me the strength and blessing.

This study could not have been completed without the generous help received from many people whom I would like to acknowledge and thank.

My supervisor Dr. Shibili Nuhmani, for his guidance and support from the initial to the final level, and for encouraging me to complete the thesis.

My parents-they encouraged me to chase my dreams and always gave me the support I needed.

My lovely wife Shima, For the encouragement and the sacrificing that is kept me going throughout the study journey.

My friends, for their support and motivation during my MSc.

Finally, I would like to thank my father for giving me the chance to complete my master's program and for his financial support during study journey, this MSc would never have reached completion without his support.

1.Introduction

Neck pain is a major public health concern in the general population, with the prevalence ranging from 16.7 % to 75.1% (mean 37.2 %) with a lifetime prevalence of 48.5 %. Mechanical neck pain (MNP) is the generalised neck pain and/ or pain in the shoulder with mechanical features, including symptoms exacerbated by cervical movements and maintenance of neck posture for a prolonged period (Onat *et al.*, 2019). "International Association for the Study of Chronic Pain" defined Chronic Pain as the pain that lasts for more than 12 weeks. (Geneen *et al.*, 2017). Neck pain can be traumatic, muscular, or neurological in origin. Mechanical neck pain, also known as Non-specific neck pain, is cervical pain with or without radiation with no known pathological origin. The most commonly affected muscles are the upper trapezius, elevator scapulae, splenius, multifidi, etc.(Cerezo-Téllez *et al.*, 2016).

Following lower back pain, neck pain is the second most common musculoskeletal condition in the general population. According to Cote et al1 at least 64% of the total population experience neck pain. Chronic pain has a 20 % weighted mean prevalence in adults, which increases with age (62 per cent of adults above 75 years, 32 per cent of adults aged 25 to 34 years) . This is a higher percentage than people in the same population with diabetes or asthma.(Geneen *et al.*, 2017). Moreover, chronic neck pain related to disability is becoming more common, with long-term follow-up. Around 50 % of neck pain patients suffer from chronic symptoms with mild disabilities, which causes considerable economic expenses. (Javanshir *et al.*, 2010). Morvever, it cause a healthcare costs and poor quality of life(Geneen *et al.*, 2017) , (Leadley *et al.*, 2014), found that there is lowe quality of life in chronic neck pain patient more than other population. The development of myofascial pain syndrome may cause due to activities involving repetitive use of the same muscle groups or persistent poor postures.(Llamas-Ramos *et al.*, 2014). Compared to lumbar disorders, lifestyles appear to change the prevalence of cervical disorders.

The specific pathology of chronic neck pain remains unclear since only a few cases are trauma or severe degenerative conditions. It is assumed that the cause of neck pain is

multifactorial ((Ylinen et al., 2003)). Chronic neck pain is also a common feeling of hyperalgesia in skin, muscles and ligaments in both active and passive movements and on palpation; medical examinations or diagnostic imaging often show the precise source and cause of neck pain. (Ylinen, 2007)

Physical therapists use various treatments methods, such as exercise therapy, mobilisation, manipulation ((Gross *et al.*, 2010; Cross *et al.*, 2011))Traction (Graham *et al.*, 2008) and electrotherapy modalities for the management of mechanical neck pain (Llamas-Ramos *et al.*, 2014). One of the most widely used treatment modalities for mechanical neck disorders is exercise therapy. Exercise therapy involves a wide range of approaches such as stretching, mobilising exercises, static/isometric exercises, proprioceptive exercises, and endurance training, including the patient's active involvement. (Sarig-Bahat, 2003).

Resistance exercise, or other types of strength training, may strengthen the ability of the individual to support cartilage and bone by strengthening the muscles that supports mobility around a joint, with the potential to reduce stiffness and bring about some relief from pain. If exercise interventions and physical activity are demonstrated to minimise pain severity or frequency efficiently and safely, it can be the preferred complementary or adjunct therapy to surgical/pharmacological chronic pain treatment. (Cerezo-Téllez *et al.*, 2016).

Exercise therapy is proven to be beneficial for chronic non-specific neck pain, Irrespective of the type of exercise, including isotonic or isometric neck endurance or strengthening exercises.**(Hurwitz *et al.*, 2008)**

Moderate quality evidence from two studies indicates that a structured exercise protocol for neck pain, including active repetition of cervical rotations, resistance training and stretching exercises, is likely to have a beneficial effect on pain and function but not immediately on the quality of life**(Gross *et al.*, 2015)**. Specific moderate and high-intensity exercise of the neck muscles will reduce the pain in the neck. Intensive regular training in chronic neck pain patients will increase neck muscle strength and range of motion, leading to less impairment and better function. (Ylinen, 2007). There is moderate evidence of the efficacy of exercise when exercises are done alone, and good evidence exists when exercise is paired with mobilisation or manipulation for both short and long-term subacute and chronic neck mechanical disorders ((**Kay *et al.*, 2005; Ylinen, 2007)**).

Trigger point dry needling (TrP-DN) is an invasive technique in which a sold-filament needle is inserted into the hyperirritable part or nodule of exquisite tenderness to palpation, which is known as myofascial trigger point (MTrP). Several studies (Borg-Stein, 2004; Andersen *et al.*, 2011) have documented that neck pain patients have trigger points in the upper trapezius muscle and cervical and shoulder muscles. Some authors have argued that MTrPs is the leading cause of neck pain. (Pecos-Martín *et al.*, 2015) Dry needling is a non-pharmacological procedure widely used for a-MTrPs-associated pain relief in Myofascial pain syndrome. Dry needling helps to reduce pain secondary to MTrPs by eliciting one or more local twitch responses (Gerber *et al.*, 2015). Several studies (Ay et al., 2010; Cummings & White, 2001; Venancio Rde et al., 2008) indicate that the effects of dry needling are primarily due to mechanical disruption of muscle fibres and nerve endings from the needle prick, and some authors reported a local twitch response is elicited during the treatment. Recent studies indicated that the dry needling in the upper-quarter of trapezius muscle , relieves myofascial pain syndromes, especially neck pain, TrP-DN resulted in immediate relief of pain and improvement in range of motion with four weeks of follow up.(Perreault, Dunning and Butts, 2017)

In dry needling, the needle is inserted 5 mm deep, attempting to suppress C-fiber pain impulses to indirectly affect pain. The affected muscle is directly stimulated using deep DN to elicit an LTR, with various physiological effects. The deeper penetration of the needle affects the muscle, skin, and fascia and has a better analgesic effect than when only the skin and superficial muscle are inserted. The needle can be moved up and down, and it can also be left for a while in situ.A meta-analysis by Kietrys et al illustrated that dry needling is beneficial for immediate relief of pain after four weeks of treatment and follow up for neck pain patients.(Llamas-Ramos *et al.*, 2014)

Several studies also indicated that Dry needling for TrP is more effective in improving symptoms of neck pain than sham needling.((Itoh *et al.*, 2007; Tekin *et al.*, 2013)) . A meta-analysis by Kietrys et al ((Kietrys *et al.*, 2013)) documented that TrP DN is helpful for immediate pain alleviation following the treatment and at a 4-week follow-up. This study found that one DN session targeting active MTrPs decreases motor endplate hyperactivity and sympathetic nervous irritability system. DN seems to be effective in symptom improvement and in active MTrPs deactivating (Abbaszadeh-Amirdehi *et al.*, 2017).

Even though there are studies available in the literature regarding the beneficial effects of dry needling and exercise therapy in mechanical neck pain , It is unknown whether TrP DN's benefits with exercise exceed those of neck exercise alone. Therefore, the purpose of this study was to investigate the effects of DN and exercise in chronic mechanical neck pain with regards to disability, pain intensity, quality of life, and symptoms of depression.

Literature review

Mechanical neck pain is a pain in the neck, deprived of any neurological symptoms that can be provoked with sustained position and/or specific cervical spine movements.(Gallego-Sendarrubias *et al.*, 2020) A high rate of chronicity and recurrence is demonstrated with neck pain. According to *Lytras et al* around one-third of patients with neck pain develop chronic symptoms that may last more than six months and may last more than 12 months in 34% of the cases(Lytras *et al.*, 2020). Among 291 studied cases in 2010 about neck pain by Global Burden of Disease, neck pain ranked as a fourth-highest condition measured by years of living with disability. 10%-20% of outpatient is accounted to physical therapy with neck pain patients.(Gattie, Cleland and Snodgrass, 2017).

Neck pain is considered the second most common musculoskeletal condition in the general population (Geneen *et al.*, 2017). More than half of the patients with neck pain are reported to be suffering from chronic symptoms with mild disability, which causes considerable economic expense to individuals and society.(Javanshir *et al.*, 2010).)which include the healthcare cost, reduction in work productivity, absenteeism of work..(Hoy *et al.*, 2014). Allied healthcare (such as physical therapy and occupational therapy) has the largest direct costs proportion (84%). In the Netherlands, neck pain and low back pain cost in men was 401 million euros and women 554 million euros. This matches to 1.28% of total health costs which studied at 2007.(Groeneweg *et al.*, 2017)

The Precise pathology and origin of chronic neck pain remain unclear since only a few cases are trauma or severe degenerative conditions. It is assumed that the cause of neck pain is multifactorial (Ylinen *et al.*, 2003; Lytras *et al.*, 2020). Usually, pain persistence is associated with disorders such as rheumatic diseases, musculoskeletal conditions, psychosocial factors, genetic predisposition, and/or lifestyle issues. Many researchers in the neck pain rehabilitation field indicate the association of myofascial disorders in the shoulder/neck region muscles, including the upper trapezius, elevator scapulae, splenius and multifidi etc.(Cerezo-Téllez *et al.*, 2016). One of the most common studied muscles is the trapezius.(Aguilera *et al.*, 2009)

Neck pain can be caused by trauma (traffic accidents specifically), tumors, infections, inflammations, and congenital defects; determining the underlying cause is impossible in many cases. Neck pain in these cases will be considered as 'non-specific neck pain'. In acute neck pain cases, the general practitioner sometimes will not take action immediately. Prescription of pain medication might be considered. One study by Vos et al. points that 51% of referral patients to manual therapy or physical therapy have neck pain (Groeneweg *et al.*, 2017)

MTrP is a hyperirritable spot within a taut band of skeletal muscle fibers which is painful on compression. Usually, there are multiple trigger points muscle in chronic neck pain patients. (Lytras *et al.*, 2020) They are clinically classified as latent and active MTrPs, the difference being the presence of spontaneous referred pain in the active MTrPs. The aetiology of the MTrPs is not currently known. The most accepted hypothesis focuses on dysfunctional endplates leading to a perpetuated shortening of the muscle. (Aguilera *et al.*, 2009).

A study on 2000 chronic neck pain patients reported that all participants have trigger points in the cervical muscles with a higher incidence of trigger points in the upper trapezius. (Lytras *et al.*, 2020). The development of myofascial pain syndrome may cause due to activities involving repetitive use of the same muscle groups or persistent poor postures. Several scholars study the association between neck pain and MTrPs in cervical and shoulder muscles (Lytras et al., 2020). Individuals who experience chronic Pain with MTrPs were reported with increased intramuscular electromyographic of the agonist and antagonist muscles during synergistic muscle activation and increased muscle fatigue during isometric muscle contraction (Lytras et al., 2020).

Meanwhile, Ylinen et al studied that chronic neck pain patients compared with healthy individuals, concluding that unhealthy participants have decreased the strength values and endurance for all neck muscle groups. For this reason, the combination of trigger point deactivation technique and exercise presents a research interest (Lytras et al., 2020).

Management of chronic neck pain:

The physical therapist is using various methods to manage chronic neck pain. As there is no specific therapy, generally goals of the treatment are to make the painful trigger points inactivated, break the vicious cycle of muscle- pain, muscle tension release, and break ischemia pain spasms. Latest studies indicate that local injection therapy and different physiotherapy management, such as local heat applications of shockwave therapy, Kinesio taping , acupuncture, exercise therapies (especially stretching), and laser therapy, effectively manage chronic neck pain. (Király, Bender and Hodosi, 2018).

TENS

"Transcutaneous electrical nerve stimulation (TENS) is the non-invasive, transcutaneous, use of electrical stimulation to produce analgesia"; since 1967, it is subjected and developed in clinical research. TENS is an inexpensive and portable device that generates a mild electrical current that pulses across the skin's surface to stimulate and deliver peripheral nerves through electrodes. There is a huge controversy about the effectiveness of TENS, which include its possible placebo effect as it is almost impossible to blind the participants during research.(Martimbianco *et al.*, 2019). There is uncertainty about the effectiveness of conventional TENS on pain reduction when compared to sham TENS. Other types of TENS also did not present a relevant difference at short-term follow-up. At short-term follow-up, TENS versus neck exercise showed improvement in the Visual Analogue Scale but not in the intermediate-term. In comparing TENS with kinesotape improvement in numerical pain, a scale was showed at short term follow up. (Martimbianco *et al.*, 2019)

Ultrasound (US):

Ultrasound (US), a form of acoustic energy, is often used in physical therapy because of its deep - heat and pain-relieving effects' - When US enters the body, the tissues and cells can be affected through nonthermal and thermal mechanisms. US heat Structures includes fibrotic muscle, sheaths of the tendon, and major nerve roots. It plays a significant therapeutic effect in the nonthermal mechanisms (Hsieh, 2006). Myofascial trigger points have been treated recently in different studies using ultrasound. However, the possibilities of this treatment application and its intensity and frequency it is not explored enough yet (Dibai-Filho *et al.*, 2017).

Laser therapy:

Low-level laser therapy (LLLT). Invasive treatments, LLLT refers to Class IIIb lasers with less than 600 mW of power. Wavelength is determining the depth of penetration; underlying tissue or skin is not heated. LLLT is bio stimulative non-invasive, safe, and nonthermal. Regarding the exact mechanism of action is unknown, there are many suggest mechanisms by which LLLT shows the positive effects in the treatment of dysfunctions and myofascial pain. Controversial results in the study on LLLT to deactivate trigger points in the orofacial region. On the one hand, positive results of LLLT in some research; on the other hand, some research illustrates no difference among placebo groups and treatment groups (Munguia *et al.*, 2018).

Shockwave:

Extracorporeal shock wave therapy (ESWT) is a non-invasive, safe, and tolerable treatment method for patients with MTrPs. It can be administered to a large surface, and it rarely has side effects at low intensities.; Some studies proposed the use of ESWT in the management of various musculoskeletal disorders, such as plantar facilities, lateral or medial epicondylitis, non-union fracture, calcific tendonitis syndrome., Gür et al. reported that Low-dose ESWT is more effective than conventional ultrasound on MTrPs in the upper trapezius muscle. It is showed that three sessions of ESWT improved the levels of pain significantly, disabilities of the neck, and the quality of life by reducing the number of MTrPs (Manafnezhad *et al.*, 2019).

Manual therapy:

Manual therapy is also one of the most common methods of treatment for pain and other musculoskeletal disorders. The .aim of manual therapy in Neck Pain is to decrease pain, function, improve movement, motor control, and reduce disability (Hidalgo *et al.*, no date). The overall evidence compared to other Neck Pain management proposed that mobilisation and manipulation are effective treatment .(Coulter *et al.*, 2019)

Kinesiotape:

Another common technique for the management of musculoskeletal disorders is kinesiotaping (KT). Even though it is popular, scientific evidence supporting KT for neck pain is minimal. KT is favourable for disability and ROM improvement. KT application might be possible to provide proper sensory feedback to the patients, decrease fear of movement, and thus ROM improvement. The traction in KT elevates the epidermis, which relieves the pressure on the mechanoreceptors beneath the dermis, contributing to the re-education of pain levels. Onat concluded that both KT and DN increased quality of life on Mechanical Neck Pain, positively impacting ROM with KT. KT was superior to Dry needling in Mechanical Neck Pain in decreasing disability and increasing ROM. (Onat *et al.*, 2019)

Dry needling:

In the last decades, attention has been received mainly to dry needling among the many approaches proposed to treat TrPs. Dry needling is defined as a "skilled intervention using a thin filiform needle to penetrate the skin that stimulates myofascial TrPs, muscles, and connective tissue for the treatment of musculoskeletal pain disorders." (Navarro-Santana *et al.*, 2020). The theoretical models are varying, but not limited to, deep dry needling (DDN), superficial dry needling (SDN), and intramuscular stimulation (IMS) (Gunn 1997; Simons, Travell et al. 1999; Baldry 2005).

Dry needling is a neurophysiological evidence-based treatment technique that requires effective manual assessment of the neuromuscular system. Improvement of pain control with dry needling is supported by Research, muscle tension reduction, normalisation of biochemical and electrical motor endplates dysfunction, and facilitation an acceleration returns to active rehabilitation (AAOMPT 2009).

Examination by flat palpation and dry needling technique by direct finger pressure to the skin over the muscle was described by Travell and Simons (Simons, Travell et al. 1999). One of the dry needling palpation techniques is Flat palpation is applied by pressing the fingers down onto the skin and muscle to examine the target tissues. The underlying structures are compressed against target muscle(s) such as bone, e.g., gluteals and infraspinatus. When the pincer grip is not applicable, this technique is usually used. (Menezes, 2012)

Pincer grip technique examination and dry needling grip technique where the tissues are pinched and lifted in a pinch like fashion and has been described by Travell and Simons (Simons, Travell et al. 1999). This supports taut band palpation and trigger point recognition. In DN this technique is usually performed in isolation of the target muscle(s) for DN by pulling the muscle away from other structures like lungs, nerves and blood vessels. Needling is performed across the pinched tissues. Application of this technique safe choice in muscles such as the elevator scapula lower trapezius, upper trapezius, gastrocnemius.(Menezes, 2012)

Common adverse effects of DN include bleeding, bruising, and post-treatment soreness. Infection, pneumothorax, and nerve irritation are significant adverse effects and rarely happen. The application of good technique, hygiene, and well-known practical anatomical knowledge can minimise serious complications. The physical therapist must ensure very good hygiene standards and use precautions, include hygiene the hand, clean and suitable needle disposal. Wearing gloves at least on the palpating hand.(Menezes,2012).

pressure pain intensity was decreased following two sessions of dry needling in patients with MTrPs in upper trapezius muscle. However, there are no significant differences between DN and Ischemic compression (IC) techniques on pain and pressure pain threshold also DN was considerably greater after 2 days compared with immediate effect of IC after treatment session, maybe be due to the muscle soreness with DN group, after 4-weeks of treatment program and after 3 months increasing in the neck disability index (NDI) was remarkable; also, significant decreasing in pain intensity after 3 months. After 4-weeks with the program of treatment, PPT was significantly improved, the elasticity of muscle and stiffness.(Ziaeifar, Arab and Nourbakhsh, 2016).

A systematic review with meta-analysis reports that DN in patients with upper quarter myofascial pain syndrome can immediately relieve the pain after treatment and in 4 weeks of follow-up. Regardless, there is limited in the number of high-quality randomised controlled trials (RCTs), and long-term evidence of the efficacy of dry needling for myofascial pain that is associated with shoulder and neck pain was deficient in this meta-analysis; thus, to support this recommendation, a large-scale, multiple-term RCTs are needed.(Liu *et al.*, 2015).

Dry needling with placebo or other treatments were compared in 20 RCTs for MTrPs related with pain of shoulder and neck. significant improvement afterDry needling in the short and medium term in comparing with control/sham. Meanwhile, wet needling of MTrPs in the medium and long term was more effective than dry needling in associations with shoulder and neck pain. Moreover, dry needling in comparing with, in different terms the other treatments illustrated a significant clinical effect. Data about the effects of wet needling in comparing with dry needling on MTrPs associated with neck and shoulder pain in long-term still insufficient.(Liu *et al.*, 2015)

Not many reviews have investigated the effectiveness of dry needling inactivating TrPs associated with neck pain. Cagnie et al. reported that DN could be recommended for upper trapezius muscle TrPs treatment. Liu et al. reported that TrP dry needling at short and mid-term could be recommended for treating the myofascial origin of neck/shoulder pain. Pain intensity was only included at this meta-analysis as an outcome and 1 month considered a mid-term follow-up. (Navarro-Santana *et al.*, 2020).

Exercise:

Several guidelines on managing chronic neck pain show that exercise is a major component of the treatment. It is an effective treatment method in relieving pain and improving the level of daily activities in different chronic musculoskeletal pain disorders, including chronic neck pain. (Daenen *et al.*, 2015). Based on current evidence, different exercises include strengthening the neck muscle, stabilising and stretching exercises, this exercise is recommended to overcome these complications in patients with chronic non-specific neck pain. (Tunwattanapong, Kongkasuwan and Kuptniratsaikul, 2016).

A study by Khan et al (2014) compared the effectiveness of isometric exercise and general exercise which targeting neck muscles using a TheraBand for isometric group and range of motion exercise for general exercise group for 12 weeks, and found that both isometric and general exercises are effective in reducing neck pain, increasing neck active range of motion and improving function (Khan et al, 2014), change in pain and disability over time. Isometric neck muscle strength and ROM towards flexion-extension and lateral flexion improved significantly in both groups.(Häkkinen *et al.*, 2008)

Ylinen et al. found at a 12-month follow-up a significant reduction in neck pain as a result of stretching exercises performed on average twice weekly. However, the effectiveness was significantly better when stretching exercises combined with neck muscle endurance or strength training.(Ylinen *et al.*, 2003). A study conducted in 2007 comparing the manual therapy versus stretching exercise found that is four weeks of follow-up resulted in a significant reduction in the numbness and stiffness of the neck and shoulder areas, headache, and impairment in work among Chronic neck pain patients. (Ylinen *et al.*, 2007) . 12-month neck muscle strength training and stretching period were found to reduce neck pain more efficiently than the stretching exercises alone in women with chronic neck pain.(Ylinen *et al.*, 2003). A study comparing Strength training and stretching versus stretching only in treating patients with chronic neck pain found that neck extension strength in the strength training and stretching group increased slightly more than in the stretching only group.(Häkkinen *et al.*, 2008).

Exercise has both physical and mental benefits through its effects on numerous cardiovascular, immune, neurologic, and musculoskeletal systems. (Gross *et al.*, 2016). Moderate evidence was noted about exercise. Seven trials supported different methods of direct neck stretching and strengthening exercises for chronic neck disorder with headache and chronic mechanical neck disorders.(Gross *et al.*, 2007). Cervical Stretch/ROM exercises Cervical/Scapulothoracic Strengthening Static/Dynamic Cervical/Shoulder Stabilisation versus placebo: Moderate quality evidence was found. In conclusion, moderate-quality evidence (four trials 341 participants) shows moderate pain relief and improved function up to long-term follow-up for combined cervical, scapulothoracic stretching and strengthening for chronic neck pain.(Gross *et al.*, 2016).

There were some favourable effects in reducing neck pain severity and improved physical function, though these were mostly of small-to-moderate effect and were not consistent across the reviews. There were variable effects for psychological function and quality of life. Four reviews found no significant difference between intervention and control groups in health-related quality of life post-intervention. Physical function was significantly (statistically) improved as a result of the intervention in 14 reviews; there were variable results for psychological function and quality of life: results were either favourable to exercise (two reviews reporting significantly large effect sizes for quality of life.(Geneen *et al.*, 2017)

In 2008, the American Physical Therapy Association published a series of clinical guidelines for neck pain treatment that supported participation in active exercise. Guidelines by Scholten-Peeters et al. as well recommended education and exercise therapy as main components of any multimodal approach for the treatment of more significant impact in pain transmission inhibiting and pain management. Active exercise targets the expected damaged muscles during the injury; consequent tears and strains of the stabilising systems (which includes the ligaments and deep muscles) can result in dysfunctional movement patterns due to the lack of cervical spine motor control. Deep muscles are replacing the actions of superficial neck muscles, which results in early overactivity, fatigue, and pain; thus, active exercise has an effective rehabilitation impact for musculoskeletal structures injury and correcting movement patterns. (O'Riordan *et al.*, 2014)

The frequency of exercise is different between the studies, ranging typically from 3 sessions a week to daily sessions with obvious benefits amongst all frequencies. Three exercise sessions per week show a positive outcome for isometric strength, pain intensity, health-related quality of life, and perceived disability. A significant increase was demonstrated in studies in isometric strength used frequency of between 3 and 5 times per week. Three sessions a week of exercise interventions is producing a strength gain. (O'Riordan *et al.*, 2014)

There are guidelines set by the American College of Sports Medicine that agree with the effects and benefits of known training with resistance. The intervention of high-frequency exercise is not considered appropriate for the chronic neck pain population. Thus, findings proposed that the most beneficial frequency of exercise for people with chronic neck pain is 3 times a week, and it targets the pain, weakness, and quality of life in this population. Moreover, 10 minutes a day three times a week of exercises were seen as benefits. Exercise should be used, between 2- and 20-minutes high results in the least spent time. Interventions within a short duration have been demonstrated to produce benefits immediately in pain intensity, isometric strength, and perceived disability (O'Riordan *et al.*, 2014).

The intensity of training is varied depending on the exercise type, that is, endurance or resistance. Usually, resistance exercises are conducted between 20% and 70% of maximal voluntary contraction (MVC. Although high-dose/intensity exercise can reduce neck pain, exercise with low-dose or low-load endurance was found to have positive results. Thus, from reviewing and collating the evidence, the intensity of training in a population with chronic neck pain should be tailored based on baselines abilities that MVC has defined their values.(O'Riordan *et al.*, 2014).

Dry needling and exercise versus exercise alone:

A study comparing the effects of dry needling and exercise versus shame needling on chronic neck whiplash injury found that the dry needling approach decreased the pain and disability by reducing the sensory hypersensitivity, and exercise program facilitated the effects. (Sterling, Valentin, Vicenzino, Souvlis and Luke B Connelly, 2009).A study conducted in 2021 comparing dry needling, manual therapy, and exercise for chronic mechanical neck pain found that dry needling resulted that Dry needling alone, or manual therapy alone, may be sufficient to create this desired neurophysiologic response, and the addition of dry needling to manual therapy did not substantially increase the effect. Moreover, it adds no benefit to the treatment of neck pain.(Gattie *et al.*, 2021).

Research question:

Does dry needling in addition to exercise have a better effect than exercise alone in treating chronic mechanical neck pain?

significance of the study

Dry needling is considered easy and safe to apply without any hazard or harmful effect; if the therapist knows how to apply it, it will reduce the treatment cost and effort. Moreover, to guide the physical therapist to choose the proper and further impact treatment program effectively and improve the pain and quality of life to the patient with mechanical neck pain.

The aim of the study

This study aims to investigate the short-term effects of dry needling in addition to standardised exercise protocol in pain and quality of life with chronic mechanical neck pain patients.

Null hypothesis:

Dry needling in addition to a standardised exercise protocol has similar short-term effect in quality of life and pain in comparison to standardised exercise protocol alone in patients with "chronic mechanical neck pain".

Alternate Hypothesis

Dry needling in addition to standardised exercise protocol can cause a short-term improvement in pain and quality of life in patients with "chronic mechanical neck pain "in comparison to standardised exercise protocol alone.

Material and Methods:

Study design

Single blinded Randomised control trial with pre-test and post-test-control group design.

Subjects

Thirty participants aged 18 to 60 with chronic mechanical neck pain were randomly allocated into control and experimental groups. The subjects were recruited from the physical therapy clinic in king Fahad hospital of iam Abdulrahman bin Faisal university

Sampling

The participants were selected non-random (nonprobability) and will use a convenience sample in which available subjects that fit criteria will be taken.

Randomisation

The participant was randomly allocated into two groups by using a sealed envelope.

Ethics approval

Ethical approval was obtained from Imam Abdulrahman bin Faisal University.(IRB-PGS-2021-03-209)

Sample size

Sample size was calculated based on a previous study that investigated the effect" on Pain and Quality of Life in patients with chronic mechanical neck pain .(Onat *et al.*, 2019) By calculating the mean, standard division SD of the two groups, 80% power, and 0.05 type 1 error. The calculating as the following: group one mean 13.4 SD (4.9) and group two mean 6.9, the ratio between the two groups is 1:1 with 0.05 significant level (alpha) and 80% power. The result shows that we need eighteen subjects, nine subjects in each group.

The following website link was used for the sample size calculation.
https://clincalc.com/stats/samplesize.aspx

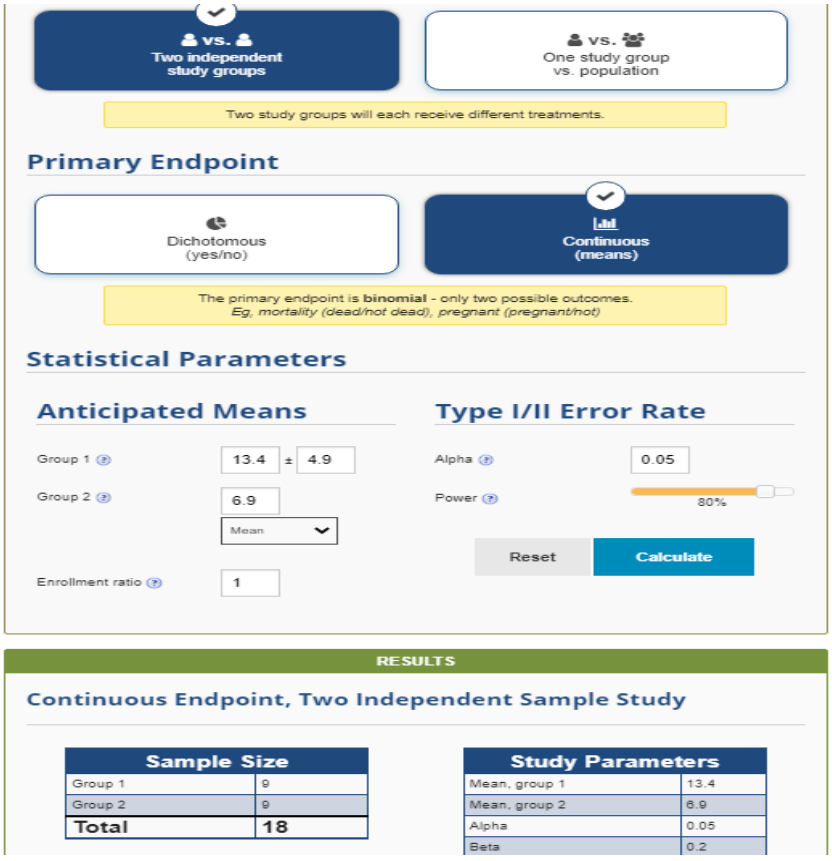
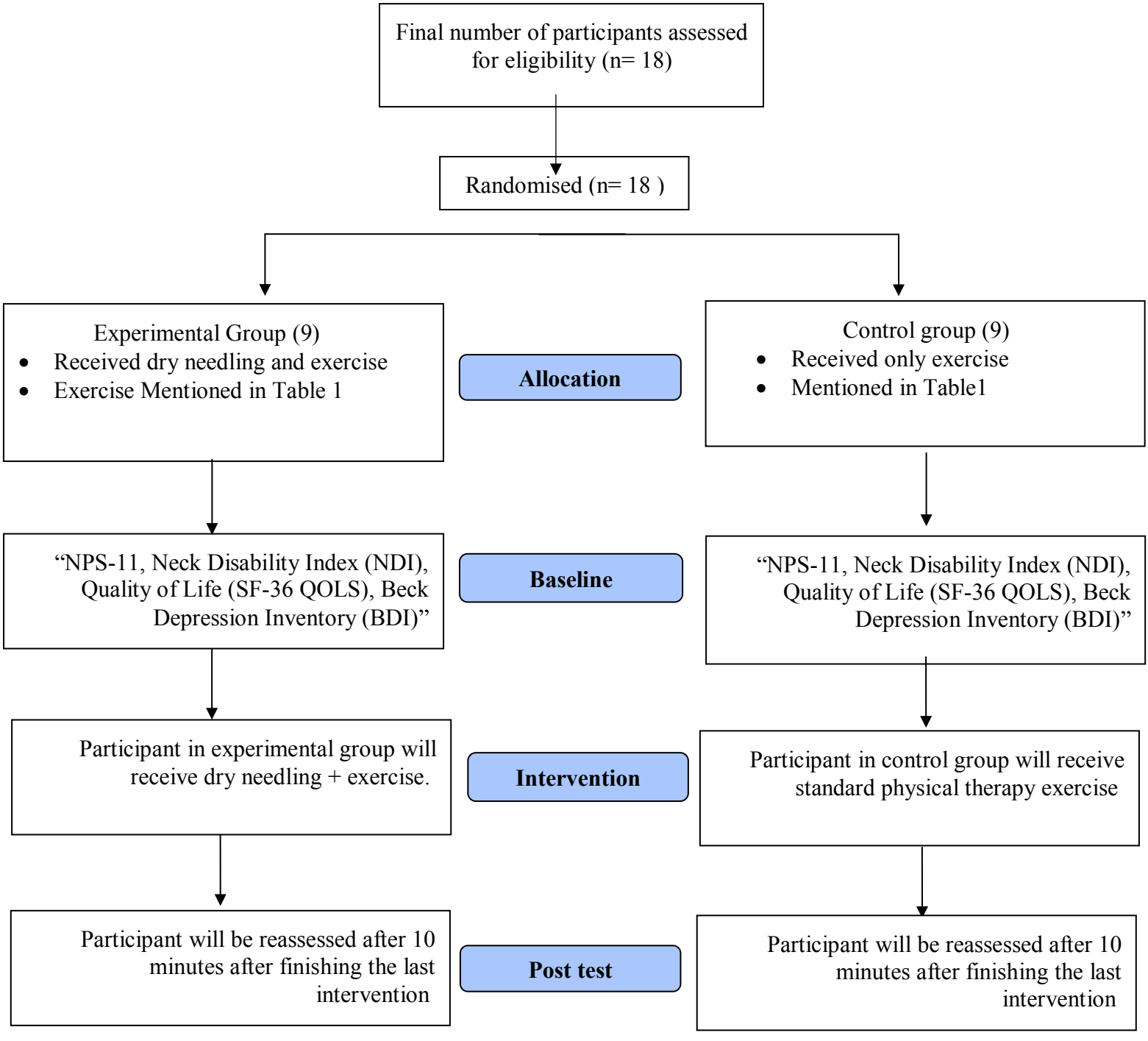


Figure 1: Sample Size Calculation

CONSORT
TRANSPARENT REPORTING of TRIALS

CONSORT 2010 Flow Diagram



Inclusion criteria

1- Participants medically diagnosed with chronic mechanical neck pain by a primary physician or by an orthopaedic consultant were be screened by the primary investigator.
2- Participants diagnosed with the presence of Triggrt ponts neclk or shoulder region with the following criteria – a) hypersensitive spot in a palpable taut bandb) palpable or visible local twitch on pincer palpation.c) reproduction of referred pain elicited by palpation of the sensitive spot
3- Participants were classified to have neck pain and are chronic provoked by the movement of the neck, neck postures, and cervical palpation.
4- Chronic neck pain from lasting more than 12 weeks.
5- When recruited for the study, participants must be not under any treatment for their chronic neck pain.

Exclusion criteria

1- Confirmed cervical myelopathy or radiculopathy medical diagnosis
2- Fear of needles
3- Reported history of shoulder injury, whiplash injury or cervical spine injury.
4- Any 'red flags' (malignancy, inflammatory arthritis, fracture, osteoporosis, and others).
5- Patient with congenital problem
6- Any treatment that might be received by the participants at the time of recruitment in the study.
7- Diagnosis of fibromyalgia
8- contraindication for dry needling (eg, anticoagulants or psychiatric disorders).

Procedure

The primary investigator screened the participants to ensure that they are fit to participate in the study based on inclusion criteria.

All participants were explained about the research idea, including benefits, risks, the time needed, source of funding. When the subjects were agreed to participate, a consent form was provided to them and upon their approval, the participant was included in the study. The participants were randomised into two groups -the experimental and the control groups and they were provided synergistic interventions in the experimental group, including exercise and dry needling, for two weeks . Only exercise protocol was given as the intervention for the participants in the control group (Table 1) within two weeks (Onat et al.2019.). The participants were blinded regarding the intervention.

Pre-test

After allocation to one of the two groups and before receiving the first intervention, participants were assessed by answering questioners about their pain intensity, quality of life, neck functional disability, and depression.



Figure2: pre-test

Outcome Measures

Questionnaires was used for patient evaluations and progression during the experiment. Numeric Rating Scale (NPS-11) was used to assess the intensity of the pain. The NPS-11 ranges between 0 and 10 (0: minimum pain, 10: maximum pain). NPS-11 has been identified as an effective tool for the analysis and intensity of pain among patients (Jensen *et al.*, 1999)[appendix A]. The Arabic version of the NPS11 was used in the current study which is also found reliable and valid (Alghadir, Anwer and Iqbal, 2016).

In order to detect the functional disability, Neck Disability Index (NDI) was used. NDI has been designed to assess the pain intensity of the neck and how it affects the quality of life by affecting the daily activities. Total NDI score is 0 and 54 and consists of 10 questions (MacDermid *et al.*, 2009). The NDI form in holds significant reliability and validity in Arabic version (Shaheen, Omar and Vernon, 2013)[appendix B]. To assess the quality of the patients, "Short Form-36 Quality of Life Scale (SF-36 QOLS)" was used (Ware and Sherbourne, 1992). 8 sub-scores are contained in the SF-36 QOLS assessing the physical functions of the body through analysis of body pain, physical role difficulties (PRD), vitality/energy, general perception of health, social functions and mental health. The sub-scores will be calculated separately between 0 and 100 (0: the worst, 100: the best health status). The study was also assessing the scores of two main components of health i.e., mental and physical health. The Arabic validation was performed (Khoudri *et al.*, 2007)[appendix C].To assess patient depression “Beck Depression Inventory (BDI)” will be used (Beck *et al.*, 1961). An Arabic version of BDI will be used in the current study (Fawzi, Fawzi and Abu-Hindi, 2012). The total score of BDI will be evaluated between 0 and 63. BDI scores near to high range or above than that indicate more sever forms of depression (Beck *et al.*, 1961) [appendix D].

Intervention

Dry Needling

Dry needling addition to the exercise protocol was applied in the experimental group.. Dry needling was applied to over active trigger points of the upper trapezius muscle. Patients were in prone position; the needle was inserted into the skin until the first local twitch response was obtained; after that, the needle was moved for 25 to 30 seconds. The needle moved up and down at approximately 1Hz (2- to 3-mm vertical motions with no rotations. According to healthcare evidence, TrPDN is the most effective practice if, during the needle therapy, local twitch response (LTR) is elicited (Onat et al., 2019.; Sterling et al., 2009).

The trigger point was identified by using the following criteria:

1. Visible or palpable local twitch upon insertion of the needle on pincer palpation
2. The appearance of a hypersensitive spot in the palpable taut band
3. Pain recurrence at the sensitive spot upon palpation

Stainless-steel disposable needles ((0.3 × 40 mm; Novasan, S.A.)) was used for the TrP (Trigger point) DN. Fast-in and fast-out needle insertion methods as reported by Hong (Hong, 1994) was used and a TrP area was palpated and marked for needle insertion in the upper trapezius muscle . After performing the needle insertion, alcohol swabs were used to sterilise the TrP area. Needle insertion was performed until a local twitch response was obtained as the needle was inserted to penetrate the skin for up to 10 to 15 mm and were applied to the symptomatic side of the neck, at the site of the active TrP.. In order to regain the homeostasis, the injected area was firmly compressed for less than 10 minutes, DN injection was performed once at the first session and before starting the exercise (Onat et al., 2019.) and participant were followed for two weeks. The day after needling participant started the exercises for two weeks one time a day (table1). Applying needles session was achieved by the researcher which is qualified and certified as (Dry needling practitioners).

Infection control in DN application:

Standard precautions include:

1) Hand Hygiene before and after the needling
2) Wearing gloves before start needling.
3) Cleaning the environment before and after
4) Before the needling patient was swabbed by an alcohol swab.
5) After finishing the needling procedure, the needle was disposed at medical trash.
6) The patient was swabbed again by an alcohol swab.

("ASAP_Guidelines_2013.pdf," .)



Figure3: trigger point identification



Figure4: cleaning the area via alcohol swap





Figure 5: needle insertion

Neck exercise protocol:

Both experimental and control groups received a standardised neck exercise protocol which consisted of stretching and strengthening of the neck and upper back muscles, re-education of neutral posture, and retraining of the scapular muscles, with five sessions per week for two weeks, repetitions of one set daily for each exercise (Onat et al., 2019.). Detail of the exercise program is available in table number1. The researcher supervised all the exercise session.

Table 1: Exercise protocol for control group and experimental group

Exercise	**Description**
Cranio-cervical spine flexion	- Neck flexors' holding capacity training - Cranio-cervical movement re-education - Re-education and retraining of "cranio-cervical flexors" eccentric control in "upright postures"
Cranio-cervical spine extension	- Education and training of staff for extension of cranio-cervical muscles - Neck extensors' training holding capacity
Shoulder elevation exercise	- Shoulder elevation toward the ceil
Scapular muscles retraining	- Endurance capacity training of the "scapular stabilisers" - Scapular orientation retraining in neural posture - Scapular control retraining with load and arm movement
Right Side bending and Left Side bending through con contraction of neck muscles	- use of "self-resisted isometric rotation" for facilitated rotation in either correct upright sitting posture or in supine posture
Neck protrusion exercise	- by pushing the head forward and isometric self- resisted
Streatching exercise	- By pulling the head to the contralateral side and keep it stretched for 30sec

This table is cited and Modified from (Sterling, Valentin, Vicenzino, Souvlis and Luke B. Connelly, 2009)



Figure6: Cranio-cervical spine flexion



Figure7: Cranio-cervical spine extension



Figure8: Cranio-cervical spine Left side bending

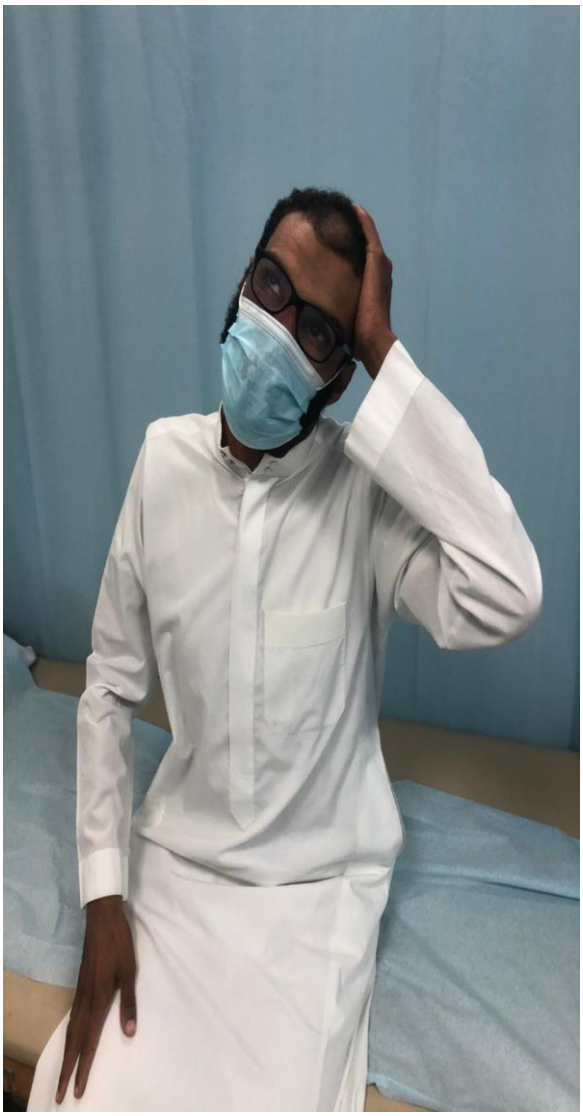


Figure9: Cranio-cervical spine Right side bending



Figure10: Neck protrusion exercise



Figure 11: Shoulder elevation exercise



Figure12: Scapular muscles retraining



Figure13: stretching exercise

Post-test

A post-test was taken 10 minutes after the final intervention using the same questionnaire used for the pre test.

Statistical Analysis

SPSS 23.0 version was used for the statistical analysis of the data., For the normality distribution of the data will be checked by Kolmogorov–Smirnov testPaired t test was used to find out the effectiveness of each intervention and between group comparison was done by independent t test and the chi-square test was used to compare the distribution of categorical variables. The significance level was set at $p \leq 0.05$ with a 95% confidence interval.

Confidentiality:

Data was kept confidently in a computer with a password, no identity of the individual was expose, data was collected collectively.

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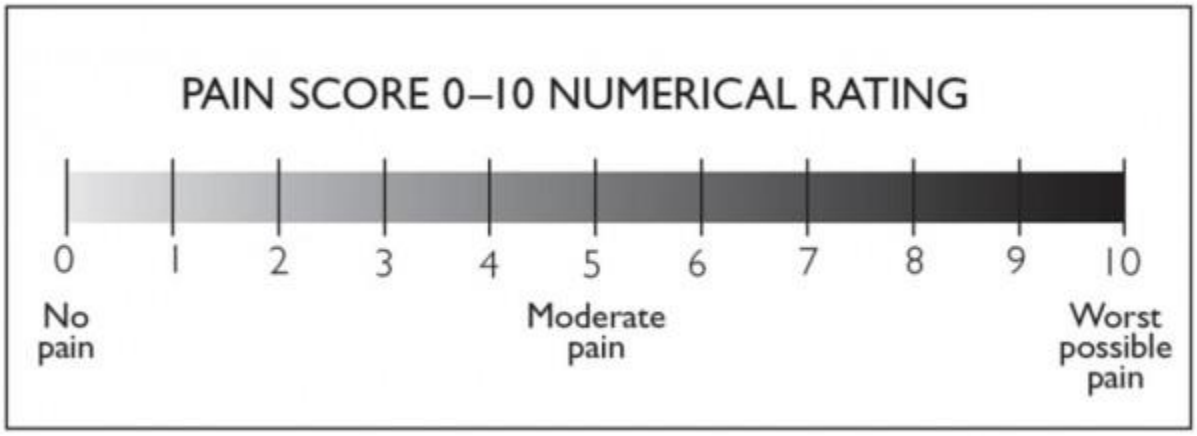
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Appendixes A



Appendixes B

Neck Disability Index

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

Office Use Only
Name _____
Date _____

Section 1: Pain Intensity

- ☐ I have no pain at the moment
- ☐ The pain is very mild at the moment
- ☐ The pain is moderate at the moment
- ☐ The pain is fairly severe at the moment
- ☐ The pain is very severe at the moment
- ☐ The pain is the worst imaginable at the moment

Section 2: Personal Care (Washing, Dressing, etc.)

- ☐ I can look after myself normally without causing extra pain
- ☐ I can look after myself normally but it causes extra pain
- ☐ It is painful to look after myself and I am slow and careful
- ☐ I need some help but can manage most of my personal care
- ☐ I need help every day in most aspects of self care
- ☐ I do not get dressed, I wash with difficulty and stay in bed

Section 3: Lifting

- ☐ I can lift heavy weights without extra pain
- ☐ I can lift heavy weights but it gives extra pain
- ☐ Pain prevents me lifting heavy weights off the floor, but I can manage if they are conveniently placed, for example on a table
- ☐ I cannot lift or carry anything

Section 4: Reading

- ☐ I can read as much as I want to with no pain in my neck
- ☐ I can read as much as I want to with slight pain in my neck
- ☐ I can read as much as I want with moderate pain in my neck
- ☐ I can't read as much as I want because of moderate pain in my neck
- ☐ I can hardly read at all because of severe pain in my neck
- ☐ I cannot read at all

Section 5: Headaches

- ☐ I have no headaches at all
- ☐ I have slight headaches, which come infrequently
- ☐ I have moderate headaches, which come infrequently
- ☐ I have moderate headaches, which come frequently
- ☐ I have severe headaches, which come frequently
- ☐ I have headaches almost all the time

Section 6: Concentration

- ☐ I can concentrate fully when I want to with no difficulty
- ☐ I can concentrate fully when I want to with slight difficulty
- ☐ I have a fair degree of difficulty in concentrating when I want to

Section 7: Work

- ☐ I can do as much work as I want to
- ☐ I can only do my usual work, but no more
- ☐ I can do most of my usual work, but no more
- ☐ I cannot do my usual work
- ☐ I can hardly do any work at all
- ☐ I can't do any work at all

Section 8: Driving

- ☐ I can drive my car without any neck pain
- ☐ I can drive my car as long as I want with slight pain in my neck
- ☐ I can drive my car as long as I want with moderate pain in my neck
- ☐ I can't drive my car as long as I want because of moderate pain in my neck
- ☐ I can hardly drive at all because of severe pain in my neck
- ☐ I can't drive my car at all

Section 9: Sleeping

- ☐ I have no trouble sleeping
- ☐ My sleep is slightly disturbed (less than 1 hr sleepless)
- ☐ My sleep is mildly disturbed (1-2 hrs sleepless)
- ☐ My sleep is moderately disturbed (2-3 hrs sleepless)
- ☐ My sleep is greatly disturbed (3-5 hrs sleepless)
- ☐ My sleep is completely disturbed (5-7 hrs sleepless)

Section 10: Recreation

- ☐ I am able to engage in all my recreation activities with no neck pain at all
- ☐ I am able to engage in all my recreation activities, with some pain in my neck
- ☐ I am able to engage in most, but not all of my usual recreation activities because of pain in my neck
- ☐ I am able to engage in a few of my usual recreation activities because of pain in my neck
- ☐ I can hardly do any recreation activities because of pain in my neck
- ☐ I can't do any recreation activities at all

Score: ___/50 **Transform to percentage score x 100 = %points**

Scoring: For each section the total possible score is 5: if the first statement is marked the section score = 0, if the last statement is marked it = 5. If all ten sections are completed the score is calculated as follows:

Example: 16 (total scored)
50 (total possible score) x 100 = 32%

If one section is missed or not applicable the score is calculated:

16 (total scored)
45 (total possible score) x 100 = 35.5%

Minimum Detectable Change (90% confidence): 5 points or 10 %points

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NDI developed by: Vernon, H. & Mior, S. (1991). The Neck Disability Index: A study of reliability and validity. Journal of Manipulative and Physiological Therapeutics. 14, 409-415

Appendix C

SF-36 QUESTIONNAIRE

Name:_____ **Ref. Dr:**_____ **Date:** _____

ID#: _____ **Age:** _____ **Gender: M / F**

Please answer the 36 questions of the **Health Survey** completely, honestly, and without interruptions.

GENERAL HEALTH:
In general, would you say your health is:

◯ Excellent ◯ Very Good ◯ Good ◯ Fair ◯ Poor

Compared to one year ago, how would you rate your health in general now?

◯ Much better now than one year ago
◯ Somewhat better now than one year ago
◯ About the same
◯ Somewhat worse now than one year ago
◯ Much worse than one year ago

LIMITATIONS OF ACTIVITIES:
The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports.
◯ Yes, Limited a lot ◯ Yes, Limited a Little ◯ No, Not Limited at all

Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf
◯ Yes, Limited a Lot ◯ Yes, Limited a Little ◯ No, Not Limited at all

Lifting or carrying groceries
◯ Yes, Limited a Lot ◯ Yes, Limited a Little ◯ No, Not Limited at all

Climbing several flights of stairs
◯ Yes, Limited a Lot ◯ Yes, Limited a Little ◯ No, Not Limited at all

Climbing one flight of stairs
◯ Yes, Limited a Lot ◯ Yes, Limited a Little ◯ No, Not Limited at all

Bending, kneeling, or stooping
◯ Yes, Limited a Lot ◯ Yes, Limited a Little ◯ No, Not Limited at all

Walking more than a mile
◯ Yes, Limited a Lot ◯ Yes, Limited a Little ◯ No, Not Limited at all

Walking several blocks
◯ Yes, Limited a Lot ◯ Yes, Limited a Little ◯ No, Not Limited at all

Walking one block
◯ Yes, Limited a Lot ◯ Yes, Limited a Little ◯ No, Not Limited at all

Bathing or dressing yourself

Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

PHYSICAL HEALTH PROBLEMS:

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

Cut down the amount of time you spent on work or other activities

Yes No

Accomplished less than you would like

Yes No

Were limited in the kind of work or other activities

Yes No

Had difficulty performing the work or other activities (for example, it took extra effort)

Yes No

EMOTIONAL HEALTH PROBLEMS:

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

Cut down the amount of time you spent on work or other activities

Yes No

Accomplished less than you would like

Yes No

Didn't do work or other activities as carefully as usual

Yes No

SOCIAL ACTIVITIES:

Emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

Not at all Slightly Moderately Severe Very Severe

PAIN:

How much bodily pain have you had during the past 4 weeks?

None Very Mild Mild Moderate Severe Very Severe

During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all A little bit Moderately Quite a bit Extremely

ENERGY AND EMOTIONS:
These questions are about how you feel and how things have been with you during the last 4 weeks. For each question, please give the answer that comes closest to the way you have been feeling.

Did you feel full of pep?
- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you been a very nervous person?
- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you felt so down in the dumps that nothing could cheer you up?
- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you felt calm and peaceful?
- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Did you have a lot of energy?
- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you felt downhearted and blue?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Did you feel worn out?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you been a happy person?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Did you feel tired?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

SOCIAL ACTIVITIES:
During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

- All of the time
- Most of the time
- Some of the time
- A little bit of the time
- None of the Time

GENERAL HEALTH:
How true or false is each of the following statements for you?

I seem to get sick a little easier than other people
Definitely true | Mostly true | Don't know | Mostly false | Definitely false

I am as healthy as anybody I know
Definitely true | Mostly true | Don't know | Mostly false | Definitely false

I expect my health to get worse
Definitely true | Mostly true | Don't know | Mostly false | Definitely false

My health is excellent
Definitely true | Mostly true | Don't know | Mostly false | Definitely false

Appendix D

Beck's Depression Inventory

This depression inventory can be self-scored. The scoring scale is at the end of the questionnaire.

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully and then pick out the one statement in each group that best describes the way you have been feeling during **the past two weeks, including today.** Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite.)

1.
- 0 I do not feel sad.
- 1 I feel sad
- 2 I am sad all the time and I can't snap out of it.
- 3 I am so sad and unhappy that I can't stand it.

2.
- 0 I am not particularly discouraged about the future.
- 1 I feel discouraged about the future.
- 2 I feel I have nothing to look forward to.
- 3 I feel the future is hopeless and that things cannot improve.

3.
- 0 I do not feel like a failure.
- 1 I feel I have failed more than the average person.
- 2 As I look back on my life, all I can see is a lot of failures.
- 3 I feel I am a complete failure as a person.

4.
- 0 I get as much satisfaction out of things as I used to.
- 1 I don't enjoy things the way I used to.
- 2 I don't get real satisfaction out of anything anymore.
- 3 I am dissatisfied or bored with everything.

5
- 0 I don't feel particularly guilty
- 1 I feel guilty a good part of the time.
- 2 I feel quite guilty most of the time.
- 3 I feel guilty all of the time.

6.
- 0 I don't feel I am being punished.
- 1 I feel I may be punished.
- 2 I expect to be punished.
- 3 I feel I am being punished.

7.
- 0 I don't feel disappointed in myself.
- 1 I am disappointed in myself.
- 2 I am disgusted with myself.
- 3 I hate myself.

8.

0 I don't feel I am any worse than anybody else.
1 I am critical of myself for my weaknesses or mistakes.
2 I blame myself all the time for my faults.
3 I blame myself for everything bad that happens.

9.

0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10.

0 I don't cry any more than usual.
1 I cry more now than I used to.
2 I cry all the time now.
3 I used to be able to cry, but now I can't cry even though I want to.

11.

0 I am no more irritated by things than I ever was.
1 I am slightly more irritated now than usual.
2 I am quite annoyed or irritated a good deal of the time.
3 I feel irritated all the time.

12.

0 I have not lost interest in other people.
1 I am less interested in other people than I used to be.
2 I have lost most of my interest in other people.
3 I have lost all of my interest in other people.

13.

0 I make decisions about as well as I ever could.
1 I put off making decisions more than I used to.
2 I have greater difficulty in making decisions more than I used to.
3 I can't make decisions at all anymore.

14.

0 I don't feel that I look any worse than I used to.
1 I am worried that I am looking old or unattractive.
2 I feel there are permanent changes in my appearance that make me look unattractive
3 I believe that I look ugly.

15.

0 I can work about as well as before.
1 It takes an extra effort to get started at doing something.
2 I have to push myself very hard to do anything.
3 I can't do any work at all.

16.

0 I can sleep as well as usual.
1 I don't sleep as well as I used to.
2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
3 I wake up several hours earlier than I used to and cannot get back to sleep.

17.

0	I don't get more tired than usual.
1	I get tired more easily than I used to.
2	I get tired from doing almost anything.
3	I am too tired to do anything.

18.

0	My appetite is no worse than usual.
1	My appetite is not as good as it used to be.
2	My appetite is much worse now.
3	I have no appetite at all anymore.

19.

0	I haven't lost much weight, if any, lately.
1	I have lost more than five pounds.
2	I have lost more than ten pounds.
3	I have lost more than fifteen pounds.

20.

0	I am no more worried about my health than usual.
1	I am worried about physical problems like aches, pains, upset stomach, or constipation.
2	I am very worried about physical problems and it's hard to think of much else.
3	I am so worried about my physical problems that I cannot think of anything else.

21.

0	I have not noticed any recent change in my interest in sex.
1	I am less interested in sex than I used to be.
2	I have almost no interest in sex.
3	I have lost interest in sex completely.

INTERPRETING THE BECK DEPRESSION INVENTORY

Now that you have completed the questionnaire, add up the score for each of the twenty-one questions by counting the number to the right of each question you marked. The highest possible total for the whole test would be sixty-three. This would mean you circled number three on all twenty-one questions. Since the lowest possible score for each question is zero, the lowest possible score for the test would be zero. This would mean you circles zero on each question. You can evaluate your depression according to the Table below.

Total Score	**Levels of Depression**
1-10	These ups and downs are considered normal
11-16	Mild mood disturbance
17-20	Borderline clinical depression
21-30	Moderate depression
31-40	Severe depression over 40
0ver 40	Extreme depression