A STUDY ON THE EFFECTIVENESS OF DERMONEUROMODULATION ON NECK PAIN AND DISABILITY AMONG PATIENTS WITH CERVICAL SPONDYLOSIS

A dissertation submitted in partial fulfilment of the Requirements for the degree of

MASTER OF PHYSIOTHERAPY

ELECTIVE – PHYSIOTHERAPY IN NEUROLOGY

To

The Tamil Nadu Dr. M.G.R. Medical University

Chennai - 600032

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CERTIFICATE

Certified that this is bonafide work of Mr. K.A.Nishar Basha of R.V.S. College of Physiotherapy, Sulur, Coimbatore submitted in partial fulfilment of requirements for Master of Physiotherapy Degree course from the Tamilnadu Dr. M.G.R Medical University under the Registration No. 271720022

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Date:

A STUDY ON THE EFFECTIVENESS OF DERMONEUROMODULATION ON NECK PAIN AND DISABILITY AMONG PATIENTS WITH CERVICAL SPONDYLOSIS

INTERNAL EXAMINER

EXTERNAL EXAMINER

A dissertation submitted in the partial fulfilment of the requirement for the degree of **Masters of Physiotherapy-May 2019** to the Tamilnadu Dr. MGR Medical University, Chennai - 600032.

DECLARATION

I hereby declare and present my project work entitled **"A STUDY ON THE EFFECTIVENESS OF DERMONEUROMODULATION ON NECK PAIN AND DISABILITY AMONG PATIENTS WITH CERVICAL SPONDYLOSIS".**

The outcome of the original research work undertaken and carried out by me, under the guidance of Principal **Prof**. **Dr. R. Nagarani, M.P.T, Ph. D.**
R.V.S College of Physiotherapy, Sulur, Coimbatore.

I also declare that the material of this project work has not formed in any way the basis for the award of any other degree previously from the **Tamil Nadu Dr. M.G.R Medical University.**

Place: Signature

Date:

K.A. Nishar Basha

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K.A. Nishar Basha

ABBREVATIONS

DNM - Dermoneuromodulation

CS - Cervical Spondylosis

fMRI - Functional Magnetic Resonance Imaging

VAS - Visual Analogue Scale

NDI. - Neck disability Index

NPRS - Numerical Pain Rating Scale

VRS - Verbal Rating Scale

PI - Pain Intensity

CROM - Cervical Range of Motion

HVLA - High Velocity Low Amplitude

SF-36 - Short Form 36

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Introduction

I. INTRODUCTION

Cervical Spondylosis is defined as a chronic degenerative process affects the intervertebral discs and facet joints, and may progress to disk herniation, osteophyte formation, vertebral body degeneration, compression of the spinal cord, or cervical spondylotic myelopathy **(Xiong *et al.*, 2015).**

Mostly people with cervical spondylosis has no symptoms but when symptoms occur, they typically have pain and stiffness in the neck. This pain can range from mild to severe. The pain often comes from abnormalities in structures innervated by the vertebral nerve or branches of the posterior primary ramus. Sometimes, the pain can be from the facet joints, which are innervated by the primary posterior ramus (**Morishita *et al.*, 2009).**

Cervical Spondylosis is most commonly occurring degenerative disorders of the spine, which affects 95% of patients by the age of 65 years. Patients who has symptoms tend to be older than 40 years and usually have three types of symptoms; neck pain, cervical radiculopathy, and/or cervical myelopathy **(Connell *et al.*, 1992).**

Evidence of Spondylotic changes can be even found on asymptomatic adults, with 25% of adults under the age of 40, 50% of the adults over the age of 40, and 85% of adults over the age of 60 showing some evidence of disc degeneration. Another study of asymptomatic adults showed significant degenerative changes at 1 or more levels in 70% of women and 95% of men at age 65 and 60.The most common degeneration is found at C5-C6 followed by C6-C7 and C4-C5 **(Kelly *et al.*, 2012).**

limited range of motion, minor neurological changes (unless complicated by myelopathy or radiculopathy).Symptoms such as cervical pain aggravated by movement, referred pain (occiput, between the shoulder blades, upper limbs), retro-orbital, cervical stiffness, vague numbness, tingling or weakness in upper limbs, dizziness or vertigo, poor balance, and rarely, syncope which triggers migraine **(Binder *et al.*, 2007).**

Cervical Spondylosis patients do not need special investigations and the diagnosis is made on clinical grounds alone. However, diagnostic imaging such as X-ray, MRI, and EMG can be used to confirm a diagnosis **(Zhijun *et al.*, 2014)**.

Reliable and valid measures of pain and disability are available to evaluate neck pain such as Visual Analogue Scale (VAS), Neck Disability Index (NDI), and Short Form 36 (SF-36). Range of motion is assessed by Goniometer.

Visual Analogue Scale (VAS) and Neck Disability Index (NDI) are used to evaluate neck pain and disability in cervical spondylosis patients. VAS is the most common pain scale for quantification of Neck Pain. Neck pain related disability and function need to be measured in order to assess pre and post treatment patient outcomes. NDI is the most commonly used, translated and oldest questionnaire for neck pain. Neck Disability Index is a 10-item questionnaire which measures a patient's self-reported neck pain related disability. This test has high "test-retest" reliability. The NDI has also been shown to be valid when comparing it to other pain and disability measures **(Howell., 2011).**

Cervical spondylosis is medically treated by Analgesics, Nonsteroidal anti-inflammatory medicines and Muscle Relaxants. It is also treated by conventional

physiotherapy modalities such as IFT, TENS, Cervical Traction, and with Spinal manipulation techniques.

Dermoneuromodulation(DNM) is recently popularising touch based pain relieving approach which is a gentle, structured method of interacting with patient's nervous system to help them resolve pain, regain function, and feel better. It was developed by Diane Jacobs, a Canadian physiotherapist specialised in pain science and the treatment of painful conditions. During her 40 years of practice, Jacobs was interested in Ronald Melzack, who developed the original Gate Control theory of pain along with Patrick Wall, and who later developed the NeuroMatrix model of pain.

In 2007, Jacobs made a cadaver study that defined how peripheral cutaneous nerves divide into rami, which spread outward into the underside of skin. This work inspired her to develop a new conceptual approach to manual therapy for patients with pain **(Erickson., 2015).**

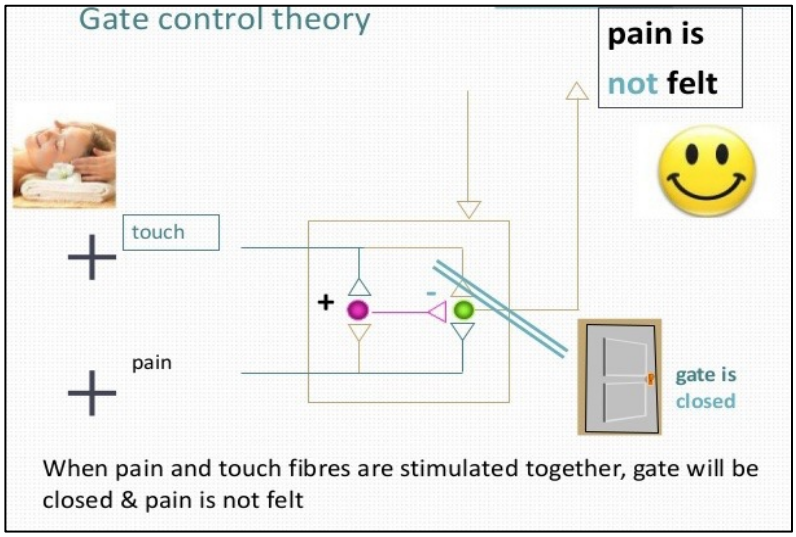

Figure 1: Pain Gate Control Theory

Dermoneuromodulation is compatible with concepts of neurodynamics? In David Butler's book, "The Sensitive Nervous System", there are some neurodynamic concepts: The nervous system is a continuous structure in which all functions are interdependent. It is electrically, mechanically and chemically connected, when there

is alteration in structure or function, will have far reaching effects in remote parts. The nervous system is mobile in nature. Neurons (comprising 2% of the whole body but requiring 20% of available oxygen) require sufficient blood flow: for nutrition (high oxygen demand) for clearing away of metabolic by-products. The blood supply to the neural structures itself benefits from movement. It will be slack and twisted in some positions, in some zones, and on tension in other places, depending on its position. All these concepts apply to the nervous system that is directly below the cutis/subcutis as much as they apply to the nerves and the spinal cord **(Butler., 2000).**

It is important to know that pain and tight muscles are not bad things to be stopped, but are instead protective responses produced by the nervous system. Of these protective responses, the motor aspects are withdrawal and muscle tightness ("bracing"), and the sensory experience is pain or other discomfort. These may persist long after any injury or danger has occurred. If we make the nervous system happy, it may abandon these protective responses which are annoying to us.

Anatomically, the nervous system consists of central nervous system (brain, nerve roots, and spinal cord) and peripheral nervous system(deep and cutaneous nerves). During embryological development, the brain, nerves, and skin all develop from the same ectodermic tissue. From the above points we should know that skin is the exposed portion of the brain; For better understanding if the brain is a computer, then the skin is a keyboard. When nerve pass through one layer to another, nerves are subjected to shearing forces which may impinge nerves and cause localized ischemia and nociception, which may also lead to pain, increased muscle tension, and other

protective responses. When this occurs, it is called as nerve compression syndrome, or tunnel syndrome **(Jacob., 2007).**

Moving nerves (neurodynamics) helps to restore the nerve health and well-being. Tunnel syndromes often involves cutaneous nerves (found throughout the skin and subcutis), it would appear that moving nerves attached to the skin could relieve most of the musculoskeletal pain. This can be done without pressure sufficient to damage or deform the underlying muscle, fascia, or other soft tissues. DNM uses body positioning and/or skin stretching to resolve discomfort from tunnel syndromes.

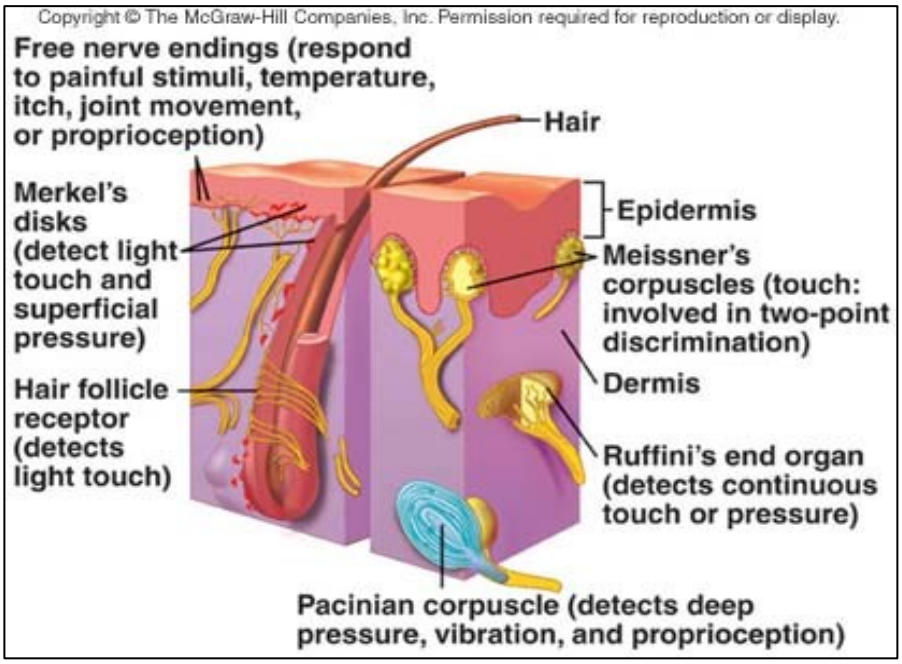

Figure 2 : Structure of Skin

The skin is full of innervation, even skin surface have much of it. Hilton's law states that, "The nerve supplying a joint supplies also the muscles that move the joint and the skin covering the articular insertion of those muscles." It makes sense that

whatever we do to skin affects motor output indirectly (reflexively). Mechanoreceptors adapt at different speeds and in different ways. Fast adaptors fire when they detect movement, then shut off until new movement stimulates them again, similar to a motion detector light. Slow adaptors remain turned on, transducing information and firing action potentials into the spinal cord the whole time a stimulus is operating, regardless of whether it moves or doesn't. When we stretch the skin, we move multiple tissue layers and the nerves embedded within them, and nerve compression may be relieved. Slow fibre mechanoreceptors, such as Ruffini corpuscles, respond to the sustained pressure of slow skin stretching. Their impulse to the brain might trigger a positive response which is descending modulation of pain and muscle contraction.

Most of us seen instances of animal mothers transporting their young, lifting them by the scruff of the neck. The animal infants relax completely, and the mothers appear to be very gentle with their use of jaws and teeth for this purpose. The back of the neck is very easy to treat, by simply attending to the dorsal cutaneous rami or posterior rami of neck. In fact, all the dorsal cutaneous rami all way down the back are easy to treat, so we will going to address the ones that serve the back of the neck **(Jacob., 2007).**

1.1 Statement of the Study:

A study on the effectiveness of Dermoneuromodulation on neck pain and disability among patients with cervical spondylosis.

1.2 Objective of the Study:

- To find out the effectiveness of Dermoneuromodulation in the management of neck pain among patients with Cervical Spondylosis.
- To find out the effectiveness of Dermoneuromodulation in the management of disability among patients with Cervical Spondylosis.

1.3 Need of the Study:

Dermoneuromodulation is a new technique getting noted for its pain-free approach which places little physical demand on the patient or the therapist. Hence, Dermoneuromodulation has been practiced widely and found to be effective in treating cervical spondylosis patients. So, there is a need for a study to know the effectiveness of dermoneuromodulation on neck pain and disability among patients with cervical spondylosis.

1.4 Hypothesis:

It is hypothesized that there may be no significant difference in reduction of pain following Dermoneuromodulation among patients with cervical spondylosis.

It is hypothesized that there may be no significant difference in disability following Dermoneuromodulation among patients with cervical spondylosis.

1.5 Operational Definition:

Cervical Spondylosis

Cervical Spondylosis is defined as a chronic degenerative process affects the intervertebral discs and facet joints, and may progress to disk herniation, osteophyte formation, vertebral body degeneration, compression of the spinal cord, or cervical spondylotic myelopathy **(Xiong et al., 2015).**

Dermoneuromodulation

Dermo refers to Skin, Neuro refers to Nervous System, the term Modulation means a change in input and/or output**.** DNM is a structured, interactive approach to manual therapy that facilitate change, particularly in terms of its pain and motor outputs. Techniques are slow, light, kind, intelligent, responsive and effective **(Erickson.,2013).**

Pain

An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage **(Kumar., 2016).**

Visual Analogue Scale

Visual Analogue Scale (VAS) is often used in epidemiologic and clinical research to measure the intensity or frequency of pain.it is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured **(Gould *et al.*, 2001).**

Neck Disability Index

Neck Disability index (NDI) is an instrument to measure patient-reported disability secondary to neck pain. It was developed utilizing the Oswestry Low Back Pain Index. At the time of creation, it was distinguished from other simpler pain assessments by examining patient function with respect to activities of daily living **(Vernon *et al.*, 1991).**

Review of Literature

II. REVIEW OF LITERATURE

Section A - General Aspects of Cervical Spondylosis

Section B - Studies on effects of Dermoneuromodulation

Section C - Studies on reliability and validity on Visual Analogue Scale

Section D - Studies on reliability and validity on Neck Disability Index

Section A - General Aspects of Cervical Spondylosis:

Thoomes *et al.,* (2016) conducted a study on effectiveness of manual therapy for patients with CR (cervical radiculopathy) compared to placebo, no treatment, other forms of conservative care or surgery on patient outcome such as pain, disability, return to work, global perceived effect or quality of life. Electronic databases were systematically searched for clinical guidelines, reviews and randomized clinical trials reporting on the effectiveness of manual therapy for patients with cervical radiculopathy. Eight relevant reviews, two guidelines and Two recent RCTs, that had not yet been included in either, were retrieved. The results show that One review included four studies in which combinations of different techniques like thrust and non-trust mobilizations, neurodynamic techniques and muscle energy techniques were used. The author concluded that manual therapy techniques combined with specific exercises were effective in improving function, active range of motion and in reducing pain and restrictions in activity and limitations in participation. Six other reviews assessed the effectiveness of manual therapy as a form of conservative treatment for patients with neck pain and also included patients with cervical radiculopathy, but not as a separate subgroup. This review concluded that in both patients with or without cervical radiculopathy, the long-term

effectiveness of manual therapy combined with specific exercises on the level of pain a global perceived effect was better than no treatment.

Rodine *et al*., (**2012)** resolved a systematic review on cervical radiculopathy following treatment by spinal manipulation and measurement with the neck disability index, stated in their study of twenty-six subjects(n=26) twenty-four subjects were randomised to treatment group. In that treatment group, unspecified manipulation was delivered to 17 subjects once, 4 subjects twice and 2 subjects three times. One subject received both cervical and lumbar manipulation. A subset of subjects received an analgesic injection prior to spinal manipulation due to high pain levels. The results shows that , in all treated subjects, rotational ROM improved immediately following manipulation by an average of 5°. Symptoms of stiffness and paraesthesia were reported as improved for the treatment group and this study reported on the test-re-test reliability of the neck disability index in neck and arm pain patients. The study concluded that High Velocity Low Amplitude Spinal Manipulation is very effective and Neck Disability Index is well suited as Outcome measure scale.

Wainner *et al*.,(2003) resolved in their study of reliability and diagnostic accuracy of the clinical examination and patient self-report measures for cervical radiculopathy. This blinded prospective diagnostic test study is to assess the reliability and accuracy of individual clinical examination items and self-report instruments for the diagnosis of cervical radiculopathy, and to identify and assess the accuracy of an optimum test item cluster for the diagnosis of cervical radiculopathy. The results shows that this study involved 82 patients. More than two thirds of 34 clinical examination items had reliability coefficients rated at least fair or better, and 13 items had likelihood ratio point estimates about 2 or below 0.50. The 95% confidence

intervals for all likelihood ratio point estimate in this study were wide. This study concluded that many items of the clinical examination were found to be reliable and to have acceptable diagnostic properties.

Saal *et al*.,(1996) reported their study on non operative management of herniated cervical intervertebral disc with radiculopathy which is a longitudinal cohort study volunteered 26 patients who underwent a systematically and uniformly applied treatment program with increasing intervention as further pain control is needed. All patients were followed up by questionnaire evaluating function and symptoms. The role of surgical versus nonsurgical treatment of patients with cervical disc herniation has been adequately studied. The majority of published data reflects surgical outcomes, with little available data regarding the outcome of nonoperatively treated patients. The majority of patients presented with neurologic loss. The results of this study shows that twenty-four patients were successfully treated without surgery. Twenty patients achieved a good or excellent outcome of these 19 had disc extrusions. Two patients underwent cervical spine surgery. Twenty-one patients returned to the same job. One patient retired. This study concluded that many cervical disc herniations can be successfully managed with aggressive nonsurgical treatment (24 of 26 in the present study). Progressive neurologic loss did not occur in any patient, and most patients were able to continue with their preinjury activities with little limitation. High patient satisfaction with nonoperative care was achieved on outcome analysis.

Section B - Studies on effect of Dermoneuromodulation

Cerritelli *et al*.,(2017) conducted a study on effect of continuous touch on brain functional connectivity is modified by the operator's tactile attention. it is asserted from this study that insular cortex is active in subjects receiving the touch based treatments which is a randomised controlled single blinded study of 40 subjects with the help of fMRI (Functional Magnetic Resonance Imaging). This study aimed to explore the effect of sustained static touch on subjects brain functional connectivity while the operator is engaged in focused tactile/non-tactile attention tasks. It is concluded that continuous touch by the operators hand will have brain functional connectivity.

Hertzman *et al*.,(2016) narrated a study on the role of touch in manual therapy which is an extensive systematic literature review with relevant articles published between 2006 to 2016 using three databases: PubMed, Science Direct and a collection of references mentioned in the body of the text. It is concluded from this study that by activation of C-Fibre system using pleasurable touch in manual therapy provides an opportunity for pain management, somatosensory activation and building rapport in the physiotherapeutic settings.

Vigotsky *et al*.,(2015) stated a study on the role of descending modulation in manual therapy and its analgesics implications which narrated the review to examine the neurophysiological response to different types of manual therapy, in order to better understand the neurophysiological mechanisms behind each therapy's analgesic effects. It is concluded that different forms of manual therapy elicit analgesic effects

via different mechanisms, and nearly all therapies appear to be at least partially mediated by descending modulation.

Jacobs *et al*.,(2007) coordinated a cadaver study that demonstrated how peripheral cutaneous nerves divide into rami, which spread outward into the underside of skin. This inspired her to develop a new conceptual approach to manual therapy for clients in pain: dermo (skin); neuro (nervous system); modulation (change); which equals dermoneuromodulation, or touching the skin to interact with the nervous system and effect change. Dermoneuromodulation was first coined in this paper.

Section C - Studies on reliability and validity on Visual Analog Scale

Delgado *et al.*,(2018) resolved a study on validation of digital visual analogue scale pain scoring with a traditional paper based visual analogue scale in adults. One hundred consecutive patients aged ≥18 years who presented with a chief complaint of pain were asked to record pain scores via a paper VAS and digitally via both the laptop computer and mobile phone. Ninety-eight subjects, 51 men (age, 44 ± 16 years) and 47 women (age, 46 ± 15 years), were included. The minimal clinically important difference was set at 1.4 cm (14% of total scale length) for detecting clinical relevance between the three VAS platforms. A paired one-tailed Student t-test was used to determine whether differences between the digital and paper measurement platforms exceeded 14% ($P < 0.05$). The Results shows that there is significant difference in scores was found between the mobile phone–based (32.9% ± 0.4%) and both the laptop computer– and paper-based platforms (31.0% ± 0.4%, $P < 0.01$ for both). These differences were not clinically relevant (minimal clinically important difference <1.4 cm). No statistically significant difference was observed

between the paper and laptop computer platforms. It is concluded that no clinically relevant difference exists between the traditional paper-based VAS assessment and VAS scores obtained from laptop computer and mobile phone based platforms.

Hjermstad *et al.*,(2010) narrated a study on comparing Numerical Rating Scales(NRS), Verbal Rating Scales(VRS), and Visual Analogue Scales(VAS) for assessment of Pain Intensity(PI) in adults. This study included fifty-four of 239 papers. Postoperative PI was most frequently studied; six studies were in cancer. Eight versions of the NRS (NRS-6 to NRS-101) were used in 37 studies; a total of 41 NRSs were tested. Twenty-four different descriptors (15 for the NRSs) were used to anchor the extremes. When compared with the VAS and VRS, NRSs had better compliance in 15 of 19 studies reporting this, and were the recommended tool in 11 studies on the basis of higher compliance rates, better responsiveness and ease of use, and good applicability relative to VAS/VRS. Twenty-nine studies gave no preference. Many studies showed wide distributions of NRS scores within each category of the VRSs. Overall, NRS and VAS scores corresponded, with a few exceptions of systematically higher VAS scores. It is concluded that VAS's are applicable for unidimensional assessment of PI in most settings.

Boonstra *et al*.,(2008) determined in their study on reliability and validity of the visual analogue scale for disability in patients with chronic musculoskeletal pain. For this study on reliability a test-retest design was used and for the validity of the study a cross-sectional design was used. The study population consisted of patients over 18 years of age, suffering from chronic musculoskeletal pain; 52 patients in the reliability study, 344 patients in the validity study. Main outcome measures were as

follows. For Reliability study : Spearmen's Correlation coefficients (rho values) of the test and retest data of the VAS for disability; For Validity study: rho values of the VAS disability scores with the scores on four domains of the SF-36 and VAS pain scores, and with Roland Morris Disability Questionnaire scores in chronic low back pain patients. Results were as follows: in the reliability study rho values varied from 0.60 to 0.77; and in the validity study rho values of VAS disability scores with SF-36 domain scores varied from 0.16 to 0.51, with Roland-Morris Disability Questionnaire scores from 0.38 to 0.43 and with VAS pain scores from 0.76 to 0.84. This study concluded that the reliability of VAS scale for disability is moderate to good.

Kelly *et al*.,(1998) explained in their study, does the clinically significant difference in visual analog scale pain scores vary with gender, age, or cause of pain? This prospective, descriptive study of 152 adult patients presenting to the ED with acute pain. At presentation and at 20-minute intervals to a maximum of three measurements, patients marked the level of their pain on a 100-mm, nonhatched VAS. At each follow-up they also gave a verbal rating of their pain as "a lot better," "much the same," "a little worse," or "much worse." The minimum clinically significant difference in VAS pain scores was defined as the mean difference between current and preceding scores when pain was reported as a little worse or a little better. Data were compared based on gender, age more than or less than 50 years, and traumatic vs nontraumatic causes of pain. The results shows that minimum clinically significant difference in VAS pain scores is 9 mm (95% CI, 6 to 13 mm). There is no statistically significant difference between the minimum clinically significant differences in VAS pain scores based on gender (p=0.172), age (p=0.782), or cause of pain (p=0.84).This

study concluded that no significant difference in minimum significant VAS scores was found between gender, age, and cause-of-pain groups.

Section D - Studies on reliability and validity on Neck Disability Index

Howell *et al*.,(2011) stated their study that the association between neck pain, the neck disability index and cervical range of motion. Study reviewed the literatures to determine how the NDI is associated with neck pain and Cervical Range of Motion(CROM) Outcomes. The Neck Disability Index (NDI) and Cervical Ranges of Motion (CROM) are measurement tools that are used for neck pain patients. Computer based searches of 5 databases were performed and supplemented by internet and hand searching of article references and "related citations." The search yielded 23 studies that met the inclusion and exclusion criteria and these were summarized into four categories: NDI, NDI and other questionnaires, whiplash and NDI and cervical range of motion and NDI. The NDI was shown to be a well validated and reliable self-reported questionnaire, especially when compared to other questionnaires, in both neck pain and whiplash patients. There are very few studies that discuss the NDI and cervical range of motion. This review concludes that the strength of the NDI as a self-reported neck disability questionnaire, but also demonstrates a need for further research to explore the association between the NDI, neck pain and cervical ranges of motion.

Rodine *et al*., (**2012)** resolved a systematic review on cervical radiculopathy following treatment by spinal manipulation and measurement with the neck disability index, stated in their study of twenty-six subjects(n=26) twenty-four subjects were randomised to treatment group. In that treatment group, unspecified manipulation was delivered to 17 subjects once, 4 subjects twice and 2 subjects three times. One subject received both cervical and lumbar manipulation. A subset of subjects received an analgesic injection prior to spinal manipulation due to high pain levels. The results shows that , in all treated subjects, rotational ROM improved immediately following manipulation by an average of 5°. Symptoms of stiffness and paraesthesia were reported as improved for the treatment group and this study reported on the test-re-test reliability of the neck disability index in neck and arm pain patients. The study concluded that High Velocity Low Amplitude Spinal Manipulation is very effective and Neck Disability Index is well suited as Outcome measure scale.

MacDermid *et al*.,(2009) conducted a study on the measurement properties of the neck disability index. Neck Disability Index is the most commonly used outcome measure for neck pain, and a synthesis of knowledge should provide a deeper understanding of its use and limitations. Using a standard search strategy (1966 to September 2008) and 4 databases (Medline, CINAHL, Embase, and PsychInfo), a structured search was conducted and supplemented by web and hand searching. In total, 37 published primary studies, 3 reviews, and 1 in-press paper were analysed. Pairs of raters conducted data extraction and critical appraisal using structured tools. Ranking of quality and descriptive synthesis were performed. This study concluded that NDI has sufficient support and usefulness to retain its current status as the most commonly used self-report measure for neck pain.

Vernon *et al*.,(1991) narrated The Neck Disability Index : a study of reliability and validity. Injuries to the cervical spine, especially those involving the soft tissues, represent a significant source of chronic disability. Methods of assessment for such disability, especially those targeted at activities of daily living which are most affected by neck pain, are few in number. A modification of the Oswestry Low Back Pain Index was conducted producing a 10-item scaled questionnaire entitled the Neck Disability Index (NDI). Face validity was ensured through peer-review and patient feedback sessions. Test-retest reliability was conducted on an initial sample of 17 consecutive "whiplash"-injured patients in an outpatient clinic, resulting in good statistical significance (Pearson's r = 0.89, p less than or equal to .05). Concurrent validity was assessed in two ways. First, on a smaller subset of 10 patients who completed a course of conservative care, the percentage of change on NDI scores before and after treatment was compared to visual analogue scale scores of percent of perceived improvement in activity levels. These scores correlated at 0.60. Secondly, in a larger subset of 30 subjects, NDI scores were compared to scores on the McGill Pain Questionnaire, with similar moderately high correlations (0.69-0.70).Hence this study concluded that the NDI achieved high degree of reliability and internal consistency.

Methodology

III. METHODOLOGY

3.1 Study setting:

The study was conducted in R.V.S Physiotherapy Outpatient Department, Sulur and Ideal Physiotherapy Centre, Coimbatore

3.2 Selection of subjects:

10 patients were selected who fulfilled the inclusion and exclusion criteria.

3.3 Variables

3.3.1 Dependent variables:

- Pain
- Disability

3.3.2 Independent variables:

- Dermoneuromodulation approach

3.4 Measurement Tools:

Variables	Tools
Pain	Visual Analogue Scale
Disability	Neck Disability Index

3.5 Study Design:

The study design was a pre and post-test experimental study .

3.6 Inclusion criteria:

- Clinically diagnosed cervical spondylosis patients.
- Age 55 to 65 years.
- Symptoms for at least three months.
- Both male and female.
- Patient who are willing to participate.

3.7 Exclusion criteria:

- Patients having psychosocial problems.
- Diabetes mellitus, Uncontrolled Hypertension, Rheumatoid arthritis.
- Any surgeries in cervical region
- Thoracic kyphoscoliosis
- Skin infections in the neck region
- Pregnancy
- Acute Urticaria
- Congenital deformities of the nervous system.

3.8 Orientation to the subject:

Before collection of data, all the subjects were explained about the purpose of study. The investigator has to give a detailed orientation about the various test procedures such as Visual analogue scale to measure pain and Neck disability index to measure the Disability. The concern and full co-operation of each participant was sought after complete explanation of the procedure involved in the study.

3.9 Materials used

- Couch
- Pillow or Rolled Towel
- Dycem
- Data collection sheet
- Evaluation chart
- Patient Consent Form
- Visual Analogue scale
- Neck Disability Index form.

3.10 Test administration

a. Visual Analog scale (VAS)

Visual analog scale consists of 10 cm horizontal line with 2 end points, labeled no pain and worst pain respectively. The patient is requested to place a mark on the 10 cm line to know his pain intensity at that particular time (presently feeling).

The distance in cm from the lower end of visual analog scale to the patient's mark is used as a numerical index of the severity of pain.

b. Neck Disability Index (NDI)

Originally published in 1991 in the Journal of Manipulative and Physiologica Therapeutics, the Neck Disability Index (NDI) is an instrument to measure patient-reported disability secondary to neck pain. It was developed

utilizing the Oswestry Low Back Pain Index as a model and therefore, at the time of its creation, was distinguished from other simpler pain assessments by examining patient function with respect to activities of daily living. The instrument has 10 items and patients rate their pain from 0 (no pain) to 5 (worst imaginable pain). Individual item responses are summed to a total score, where 0 points indicate no activity limitations and 50 points indicate complete activity limitation. This instrument may be useful in patients with chronic or acute onset neck pain and in patients with musculoskeletal complaints**.**

3.11 Treatment procedure

Technique 1 : Dermoneuromodulation for Dorsal Cutaneous Nerve (C3-T1)

(Skin Stretch Approach)

Indication: Neck Pain, Tenderness along spine, Stiffness

1. In this approach, patient should be in prone position. Head should be in slight flexion which is supported by a padded face hole in the bed for better comfort.
2. Along the spinous processes landmarks, place the your finger pads to stick to the patients skin.
3. The skin should be stretched longitudinally from caudal to cephalad.
4. The skin could be stretched in any direction however; diagonally, clockwise, counter clockwise and can be creative to ourselves. We have to go with whatever seems a direction of ease for the patient and self.
5. Hold for 2 minutes. Take up any slack as it presents itself.
6. Let it go slowly.

Figure 3.1 DNM - Skin Stretch Approach

Number of session : 2 sessions/ week for continuous four weeks.

Treatment duration : 10 minutes / session.

Technique 2 : Dermoneuromodulation for Dorsal Cutaneous Nerve (C3-T1)

(Skin Stretch Balloon Approach) Kitten Technique - Treatment Variation.

Indication: Neck Pain, Tenderness along spine, Stiffness.

1. In this approach, patient should be in prone position. Head should be in slight flexion which is supported by a padded face hole in the bed for better comfort.
2. Find the tender spot.
3. Use the other hand to treat, pull the skin into a bunch like a cat carry a kitten over the other occipital ridge. And let it go slowly.
4. Tender spot will usually soften and will not be tender anymore.
5. Hold for at least 2 minutes.
6. Let it go slowly

Figure 3.2 DNM – Kitten Technique

Number of session : 2 sessions/ week for continuous four weeks.

Treatment duration : 10 minutes / session.

Total treatment duration: 20 minutes / Session

3.12 Collection of data

The selected 10 subjects were treated with Dermoneuromodulation techniques for four weeks. Before and at the end of study the pain and disability values were assessed using visual analog scale and neck disability index.

3.13 Statistical technique

The collected data were analysed by paired 't' test to find out significant difference between pre and post-test value of experimental group.

Data Analysis & Result

IV. DATA ANALYSIS AND RESULTS

4.1 DATA ANALYSIS

This chapter deals with the systematic presentation of the analysed data followed by the interpretation of the data.

- **Paired 't' test**

$$\bar{d} = \frac{\sum d}{n}$$

$$s = \frac{\sqrt{\sum d^2 - \frac{(\sum d)^2}{n}}}{n-1}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

Where,

d – Difference between pre-test and post-test values

$\bar{d} = \frac{\sum d}{n}$ – Mean of difference between pre test and post test values

n – Total number of subjects

s – Standard deviation

Table 1

Table 1 shows mean value, mean difference, standard deviation and paired 't' value between pre and post test scores of pain.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre-test	6.3	2.4	0.69	10.9*
Post test	3.9			

*0.005 level of significance

The Calculated Paired't' value for pain is 10.9 and the table 't' value is 3.250 at 0.005 level of significance. Hence, the calculated't' value is greater than the table't' value there is significant difference in pain following DNM among cervical spondylosis.

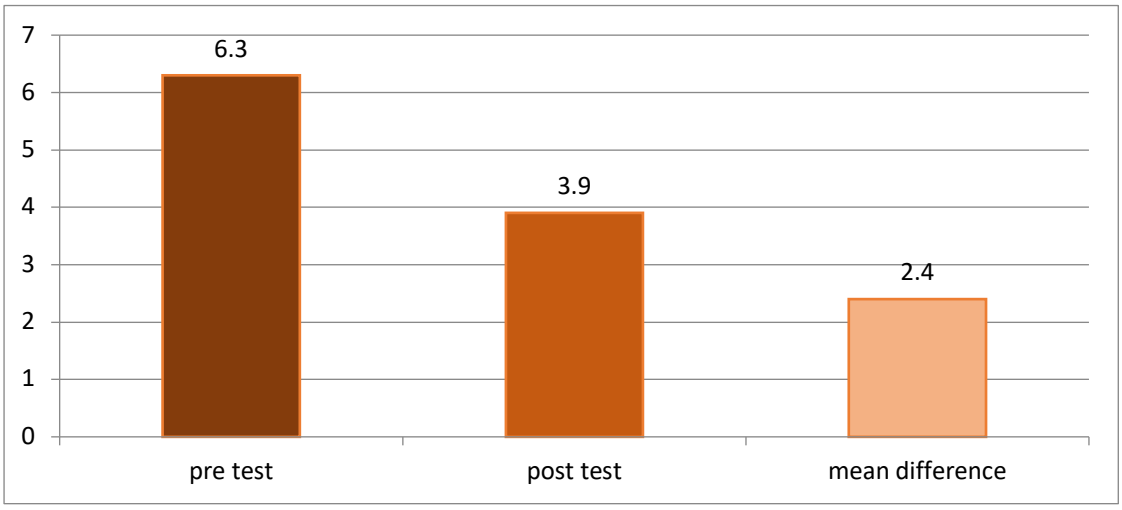

Figure 4 : Shows graphical representation of the pre and post-test mean values of pain.

Table 2

Table 2 shows mean value, mean difference, standard deviation and paired 't' value between pre and post test scores of Disability.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' valve
Pre-test	50.1	7.6	2.36	8.86*
Post test	42.5			

*0.005 level of significance.

For disability among Cervical Spondylosis the calculated paired 't'value is 8.86 and 't' table value is 3.250 at 0.005 level of significance. Since the calculated 't' value is more than 't' table value. It shows that there is significant difference in disability using DNM.

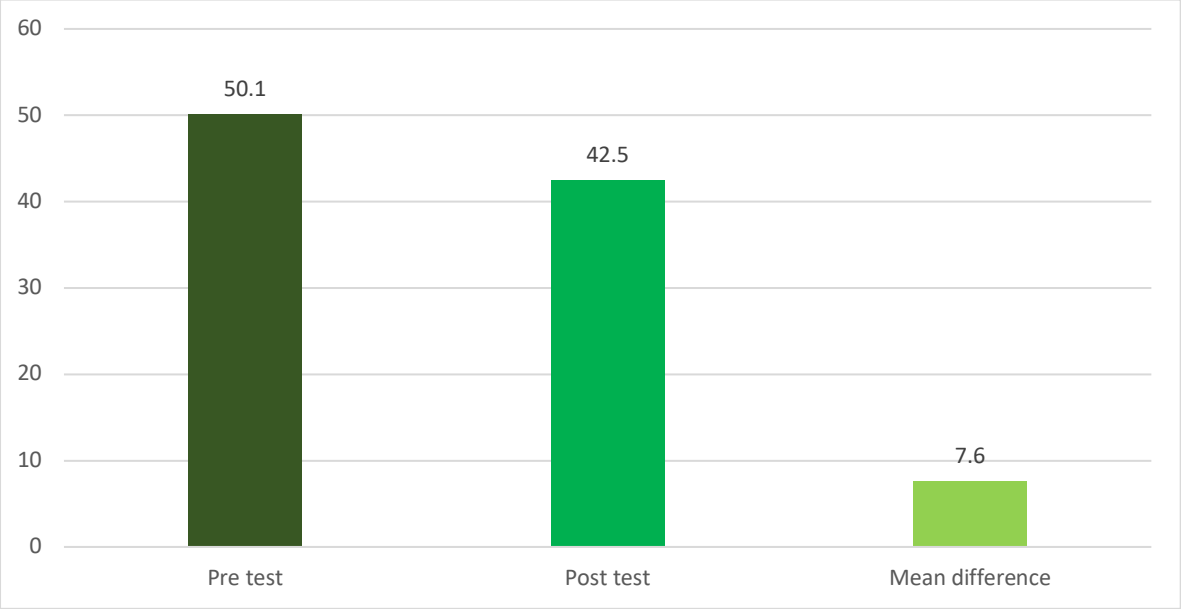

Figure 5 : Shows graphical representation of pre and post-test mean value of disability.

4.2. Results

Total number of 10 clinically diagnosed cervical spondylosis patients were chosen and DNM was given for a period of four weeks. Pain and Disability were assessed by VAS and Neck disability index before and after Interventions. Both male and female were included.

Analysis of Dependent Variable pain in the experiment: The Calculated Paired‘t’ value for pain is 10.9 and the table‘t’ value is 3.250 at 0.005 level of significance. Hence, the calculated‘t’ value is greater than the table‘t’ value there is significant difference in pain following DNM among cervical spondylosis patients .

Analysis of Dependent Variable disability in the experiment: The Calculated Paired ‘t’ value for disability is 8.86 and the table ‘t’ value is 3.250 at 0.005 level of significance. Hence, the calculated ‘t’ value is greater than the table‘t’ value there is significant difference in disability following DNM among cervical spondylosis patients.

Discussion

V. DISCUSSION

Cervical Spondylosis is defined as spinal canal and neural foraminal narrowing in cervical spine secondary to multifactorial degenerative changes. The number of subjects for the study were 10 with symptoms lasting more than 3 months.

Present study shows that the reduction in neck pain intensity and disability was significant with Dermoneuromodulation. Pain relief is evident due to descending modulation and reduced stress in neck structures.

The result of this study is supported by **(Wright.,1995)** in his study a review of available scientific evidence related to the structure and function of descending pain inhibitory systems projecting from the periaqueductal gray region to the spinal cord. The theory shows that the initial pain relieving effect of manual therapy procedures may involve activation of these control systems is proposed and a series of hypothesis based on this theoretical concept are presented, the outcomes of these studies are discussed in relation to theoretical role of descending pain inhibitory systems in manipulation-induced analgesia. Therefore, Manual techniques such as Dermoneuromodulation proposed to activate the descending modulatory system which contribute to their therapeutic effects.

There is also a study on the role of descending modulation in manual therapy and its analgesics implications which narrated the review to examine the neurophysiological response to different types of manual therapy, in order to better

understand the neurophysiological mechanisms behind each therapy's analgesic effects. It is concluded that different forms of manual therapy elicit analgesic effects via different mechanisms, and nearly all therapies appear to be at least partially mediated by descending modulation. **(Vigotsky *et al*.,2015)**

A study by (**Cerritelli *et al*.,2017)** in which they found the effect of continuous touch on brain functional connectivity is modified by the operator's tactile attention. it is asserted from this study that insular cortex is active in subjects receiving the touch based treatments which is a randomised controlled single blinded study of 40 subjects with the help of fMRI (Functional Magnetic Resonance Imaging). This study aimed to explore the effect of sustained static touch on subjects brain functional connectivity while the operator is engaged in focused tactile/non-tactile attention tasks. It is concluded that continuous touch by the operators hand will have brain functional connectivity.

To find the effect experienced by the subject even unconsciously, we can use fMRI(Functional MRI) to see the response by measuring the increase in blood flow that is correlated with an increase in neuronal activity. On the surface of the brain, there is an area called somatosensory cortex which is brain's map of the body familiarly known as Homunculus. As expected, touch increases activity in the somatosensory cortex (**Young *et al*., 2004).**

Chronic pathologies like cervical spondylosis might be best treated by touch based treatments such as Dermoneuromodulation.

Hence, the hypothesis for the study is rejected.

Conclusion

VI. CONCLUSION

An experimental study was done to find out the effectiveness of DNM in pain and disability among patients with cervical spondylosis.

10 clinically diagnosed cervical spondylosis patients were included in this study and DNM was given for a period of four weeks, pain and disability were assessed by VAS and NDI before and after the interventions respectively. From the statistical results, it can be concluded that there is reduction in pain and disability. Therefore, Dermoneuromodulation is more effective in reducing pain and disability among patients with Cervical Spondylosis.

6.1 Limitations

- This is limited to a small size sample.
- The study was done for short period.
- It is limited to the patients attending for therapy sessions at Outpatients Department of RVS college of physiotherapy and Ideal physiotherapy centre, Coimbatore.
- Only one independent variable was selected.

6.2 Suggestions

- More number of variable can be added.
- A longer duration study can be done.
- The study can be carried out in various settings.

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Annexure

ANNEXURES

ANNEXURE I

PHYSIOTHERAPY ASSESSMENT

1) Subjective Examination

   Name

   Age

   Sex

   Occupation

2) History Collection

   Present medical history

   Past medical history

3) Pain assessment (VAS)

   - Onset
   - Duration
   - Site
   - Type
   - Nature
   - Aggravating factor
   - Relieving factor
   - Intensity

4) Objective assessment

On Observation

- General body built
- Tropical changes
- Deformity
- Musculature

On Palpation

- Temperature
- Swelling
- Oedema
- Muscle spasm
- Local tenderness

On Examination

- Motor assessment
- Range of motion
- Muscle strength
- Neck disability Index (NDI)

ANNEXURE II

Table 3

Pre and Post-test mean value of pain

SL.NO	PRE-TEST	POST TEST
1	8	6
2	7	4
3	7	4
4	8	5
5	5	3
6	6	5
7	6	4
8	7	5
9	5	2
10	4	1

ANNEXURE III

Table 4

Pre and post-test mean value of disability

SL.NO	PRE-TEST	POST TEST
1	57	53
2	59	55
3	53	50
4	61	57
5	62	60
6	44	40
7	50	47
8	46	42
9	42	39
10	32	30

ANNEXURE IV

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.

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
- ☐ Pain prevents me from lifting heavy weights but I can manage light to medium
- ☐ weights if they are conveniently positioned
- ☐ I can only lift very light weights
- ☐ 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
- ☐ I have a lot of difficulty in concentrating when I want to
- ☐ I have a great deal of difficulty in concentrating when I want to
- ☐ I cannot concentrate at all.

Section 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.

Patients Name _____

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

ANNEXURE V

PATIENT CONSENT FORM

I……...voluntarily consent to participate in the research named on **"A STUDY ON THE EFFECTIVENESS OF DERMONEUROMODULATION IN NECK PAIN AND DISABILITY AMONG PATIENTS WITH CERVICAL SPONDYLOSIS".**

The researcher has explained me the treatment approach in brief, risk of participation and has answered the questions related to the study to my satisfaction.

Signature of patient **Signature of researcher**

Signature of witness

Place :

Date :