EFFICACY OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION AND THERAPEUTIC ULTRASOUND IN PATIENTS SUFFERING FROM CHRONIC CERVICAL PAIN

Meenakshi Sharma¹ and Shyamal Koley²

¹Post-Graduate Student, Department of Physiotherapy, Guru Nanak Dev University, Amritsar – 143005, Punjab, India

²Professor and Head, Department of Physiotherapy, Guru Nanak Dev University, Amritsar – 143005, Punjab, India

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Corresponding author: Meenakshi Sharma

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Abstract:

The purpose of the present study was to search the efficacy of transcutaneous electrical nerve stimulation and therapeutic ultrasound in patients suffering from chronic cervical pain. To fulfill the purpose, A total of randomly selected 30 patients with chronic cervical pain aged 20-70 years were selected from the Physiotherapy Center of Guru Nanak Dev University, Amritsar for the present study. The patients were further randomly divided into two groups, in Group-A, patients were treated with Transcutaneous Electrical Nerve Stimulation (TENS), Therapeutic Ultrasound (TUS), followed by hot pack, massage, therapeutic exercises (shoulder circumduction, pectoral stretching), cervical stretching, cervical isometrics with the recommendation for daily living activities, whereas, in Group-B, the patients were treated only with hot pack, massage, therapeutic exercises (shoulder circumduction, pectoral stretching), cervical stretching and cervical isometrics with the recommendation for daily living activities.

The outcome measures were Visual Analogue Scale (VAS) for pain, Neck Pain Visual Disability Index (NDI) for disability. The results revealed statistically significant decrease ($p < 0.001$) both in NDI and VAS in patients with cervical pain between pre- and post-intervention in the

Group-A and B, but Group-A showed significantly superior effects both in NDI (82.88% decrement) and VAS (71.62% decrement) than Group-B. In conclusion, it might be stated that transcutaneous electrical nerve stimulation and therapeutic ultrasound were found more effective than conventional physiotherapeutic techniques in relieving pain intensity and disability in patients with chronic cervical pain.

Keywords: Transcutaneous Electrical Nerve Stimulation, Therapeutic Ultrasound, Patients with Chronic Cervical Pain.

Introduction:

Neck problems are common in every population. Childs et al. (2008) reported that at any given time, 10% to 20% of the population reports neck problems, with 54% of individuals having experienced neck pain within the last 6 months. Neck disorders affect 13% of adults at any one time and up to 30% of men and 50% of women in the course of a lifetime (Aker et al., 1996;

Borghouts et al., 1998). Chronic cervical pain defines as pain perceived anywhere in the posterior region of the cervical spine, from the superior nuchal line to the first thoracic spinous process (Physiopedia). Pain is classified as chronic when it has duration of 12 weeks or more. Chronic neck pain often presents as widespread hyperalgesia on palpation and in both passive and

active movements in neck and shoulder area. The overall balance of evidence supports a variable view of the clinical course of neck pain (Misailidou et al., 2010). Recovery appears to occur most rapidly in the first 6 to 12 weeks post injury, with considerable slowing after that and little recovery after 12 months (Blanpied et al., 2017; Sterling et al., 2010). Some studies have stressed the importance of physical factors like faulty posture, monotonous work and unsuitable working positions. (Aker et al., 1996).

A number of different treatments are available to patients and are accepted as standard forms of practice, including common conservative strategies such as medication, physical therapy methods, manual treatments, and patient education. (Barry et al., 1992, Tollison et al., 1992). Transcutaneous electrical nerve stimulation (TENS) is the use of electric current produced by a device to stimulate the nerves for therapeutic purposes to reduce pain (Robertson et al., 2006). It was also reported that therapeutic ultrasound has been used to injured tissues to speed the rate of healing and enhance the quality of the repair (Watson et al., 2005). In the present study, an attempt has been made to search the efficacy of transcutaneous electrical nerve stimulation and therapeutic ultrasound in patients suffering from chronic cervical pain.

Materials and Methods

Samples: A total of randomly selected 30 patients with chronic cervical pain (pain ongoing for longer than 4 weeks) aged 20-70 years were selected from the Physiotherapy Center of Guru Nanak Dev University, Amritsar for the present study. Exclusion criteria for the subjects were presence of vertebrobasilar insufficiency syndrome, history of cervical fracture, cervical hypermobility, bone tumors or infection, diabetic neuropathy, osteoporosis and rheumatoid arthritis and acute intervertebral disc prolapse. The patients were further randomly divided into two groups, in Group-A, patients were treated with Transcutaneous Electrical Nerve Stimulation (TENS), Therapeutic Ultrasound (TUS), followed by hot pack, massage, therapeutic exercises

(shoulder circumduction, pectoral stretching), cervical stretching, cervical isometrics with the recommendation for daily living activities for four weeks. Whereas, in Group-B, the patients were treated only with hot pack, massage, therapeutic exercises (shoulder circumduction, pectoral stretching), cervical stretching and cervical isometrics with the recommendation for daily living activities for four weeks. The outcome measures were Visual Analogue Scale (VAS) for pain, Neck Pain Visual Disability Index (NDI) for disability. Prior to the study, the purposes of the study was explained to all the subjects, also a written consent was taken. The study was approved by Institutional Ethical Committee.

Transcutaneous Electrical Nerve Stimulation (TENS)

All the apparatus and equipment needed were assembled and suitably positioned. The area to be treated was properly exposed covering rest of body. Silicone rubber electrodes were fixed to the skin with adhesive tape. The dermatomal placement method was used. One electrode was placed at the corresponding spinal nerve root level and other at the distal end of dermatome. The conventional type of TENS was used with the pulse duration of 50 μ s, Frequency 100 Hz. Continuous mode of application and with 30 minutes of duration of treatment.

Therapeutic ultrasound (TUS)

All the apparatus and equipment needed were assembled and suitably positioned. The area to be treated was properly exposed covering rest of body. The ultrasound gel was applied on the ultrasound head of machine. Then it was moved in circular motion on the affected area of the patients. The ultrasound mode was continuous, 1 MHz with the intensity of 1-1.5 w/cm² for the duration of 8 minutes.

Hot Pack (HP)

The part to be treated was properly exposed covering rest of the body. The subject was asked to lie prone on the treatment plinth in prone position with one pillow under the chest. The hot

pack was then applied to the posterior aspect of neck of the subject.

Isometric Neck Exercises (INE)

Isometric neck exercises began with isometric contractions for neck flexors, lateral flexors, rotators, and extensors. These contractions were maintained for a period of 6-8 seconds. Subjects were asked to perform 5 repetitions in each direction.

Isometric stretching (IS)

Stretching of neck flexors, extensors, lateral flexors and rotators, pectorals was applied with 3 sets of 5 repetition maintained stretch upto 10-30 seconds.

Massage

Appropriate massage technique was applied for 5-10 seconds aided circulation and muscle relaxation.

Statistical Analysis

Standard descriptive statistics (percentages) were analyzed for directly measured variables of the subjects using SPSS (Statistical Package for Social Science) version 20.0. Chi-square test was applied to search the association of different mobile sizes and number of text messaging per day with the De-Quervain's tenosynovitis. To indicate statistical significance, 5% level of probability was used.

Results

Table 1 showed the descriptive statistics of NDI and VAS (both in pre- and post-intervention conditions) in patients with cervical pain treated in Group-A and Group-B. The patients treated both in Group-A and Group-B, statistically no significant differences ($p > 0.05$) were found in NDI and VAS in pre-intervention conditions. However, in post intervention condition, significant differences ($p < 0.001$) were observed in NDI ($t = 9.514$) and VAS ($t = 5.579$) between the patients treated in Group-A and Group-B.

Table 1: Descriptive statistics of NDI and VAS in patients treated in Group-A and B

Combinations	Pre-intervention NDI value		Post-intervention NDI value		Pre- intervention VAS value		Post- intervention VAS value	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group-A	65.54	11.15	11.22	7.79	8.00	1.00	2.27	0.70
Group-B	67.97	10.72	43.39	10.53	7.87	0.99	4.53	1.41
t-value	0.606		9.514		0.367		5.579	
p-value	0.549		<0.001		0.716		<0.001	

Comparisons of pre- and post-intervention values of NDI and VAS in patients with cervical pain in Group-A were shown in table 2. Statistically significant decrease ($p < 0.001$) was found both in NDI ($t = 28.545$) and VAS ($t = 13.229$) in patients with cervical pain between pre- and post-intervention in this group.

Table 2: Comparisons of NDI and VAS between pre- and post-intervention conditions in Group-A

combinations	Mean	SD	t- value	p value
Pre -NDI	65.54	11.15	28.545	<0.001
Post-NDI	11.22	7.79		
Pre-VAS	8.00	1.00	13.229	<0.001
Post-VAS	2.27	0.70		

Table 3 showed the comparisons of pre- and post-intervention values of NDI and VAS in patients with cervical pain in Group-B. Statistically significant decrease ($p < 0.001$) was found both in NDI ($t = 12.972$) and VAS ($t = 3.553$) in patients with cervical pain between pre- and post-intervention in Group-B.

Table 3: Comparisons of NDI and VAS between pre- and post-intervention conditions in Group-B

Combination	Mean	SD	t-value	p-value
Pre-NDI	67.96	10.72	12.972	<0.001
Post-NDI	43.39	10.53		
Pre-VAS	7.87	0.99	3.553	<0.001
Post-VAS	4.53	1.41		

The percentage decrement of NDI and VAS between pre- and post-intervention conditions in Group-A and Group-B was given in Table 4. The percentage decrement of NDI (82.88%) and VAS (71.62%) in patients with cervical pain in Group-A was significantly more than Group-B (36.16% and 42.43% respectively).

Table 4: Percentage decrement of NDI and VAS between pre- and post-intervention conditions in Group-A and Group-B

combination	NDI	VAS
Group-A	82.88	71.62
Group-B	36.16	42.43

Discussion

The findings of the present study revealed statistically significant decrease ($p < 0.001$) both in NDI and VAS in patients with cervical pain between pre- and post-intervention in the

Group-A and B (Table 2 and 3), but Group-A where the patients treated with transcutaneous electrical nerve stimulation, therapeutic ultrasound, followed by hot pack, massage, therapeutic exercises (shoulder circumduction, pectoral stretching), cervical stretching, cervical isometrics with the recommendation for daily living activities, showed significantly superior effects both in NDI (82.88% decrement) and VAS (71.62% decrement) than Group-B where the patients were treated only with hot pack, massage, therapeutic exercises (shoulder circumduction, pectoral stretching), cervical stretching and cervical isometrics with the recommendation for daily living activities (Table 4).

Prabhakar *et al.* (2011) reported that cervical mobilization when compared to transcutaneous electrical nerve stimulation was equally effective in relieving pain reducing the radicular pain in upper limb and improving the functional outcome. Thomas TW chiu *et al.* 19 investigated the effect of transcutaneous electrical nerve stimulation and neck exercise in chronic neck

pain patients and reported that there was a significant reduction ($p = 0.034$) in the Northwick park neck pain questionnaire score of subjects receiving TENS. The effectiveness of TENS plus therapeutic ultrasound in relieving pain intensity, disability, and improving quality of life patients

With chronic neck pain was also reported. (Soyal *et al.*, 2013; Sayilir, 2018). The mechanism of the analgesia produced by transcutaneous electrical nerve stimulation was explained by the gate control theory of pain modulation proposed by Elver (1986). It was also hypothesized that with enhanced intersegmental motion, the introduction of home exercises also enabled the subject to have a physiological and remedial influence on the pathological neural tissue.

Conclusion

The findings of the present study, that it might be concluded that transcutaneous electrical nerve stimulation and therapeutic ultrasound were found more effective than the conventional physiotherapeutic techniques in relieving pain intensity and disability in patients with chronic cervical pain.

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References

1. Aker PD, Gross AR, Goldsmith CH, Peloso P. Conservative management of mechanical neck pain: Systematic overview and meta-analysis. *British Medical Journal*. 1996; 313(7068): 1291–6.
2. Barry M, Jenner JR. ABC of rheumatology, pain in neck, shoulder, and arm. *British Medical Journal*. 1995; 310(6973): 183–6.
3. Blanpied PR, Gross AR, Elliott JM, Devaney LL, Clewley D, Walton DM, Sparks C, Robertson EK. Neck Pain: Revision 2017. *The Journal of Orthopaedic and Sports Physical Therapy*. 2017; 247(7): A1–A83.
<https://doi.org/10.2519/jospt.2017.0302>.
4. Borghouts JA, Koes BW, Bouter LM. (1998). The clinical course and prognostic factors of non-specific neck pain: a systematic review. *Pain*. 1998; 77(1): 1–13.
5. Childs JD, Cleland JA, Elliott JM, Teyhen DS, Wainner RS, Whitman JM, Sopky BJ, Godges JJ, Flynn TW. Neck pain: Clinical practice guidelines linked to the International Classification of Functioning, Disability, and Health from the Orthopedic Section of the American Physical Therapy Association. *The Journal of Orthopaedic and Sports Physical Therapy*, 2008; 38(9), A1–A34.
<https://doi.org/10.2519/jospt.2008.0303>.
6. Chiu TTW, Hui-Chan CWY. A randomized clinical trial of TENS and exercise for patients with chronic neck pain. *Clinical Rehabilitation*. 2005; 19: 850–60.
7. Elver RL. Treatment of arm pain associated with abnormal brachial plexus tension. *Australian Journal of Physiotherapy*. 1986; 32: 225–30.
8. Misailidou V, Malliou P, Beneka A, Karagiannidis A, Godolias G. Assessment of patients with neck pain: A review of definitions, selection criteria, and measurement tools. *Journal of Chiropractic Medicine*. 2010; 9(2): 49–59.
<https://doi.org/10.1016/j.jcm.2010.03.002>.
9. Prabhakar R, Ramteke GJ. Cervical spinal mobilization versus TENS in the management of Cervical Radiculopathy: A comparative, experimental, randomized controlled trial. *Indian Journal of Physiotherapy & Occupational Therapy*. 2011; 5(2): 135–40.
10. Robertson Valma J, Ward A, Low J, Reed A. *Electrotherapy Explained: Principles and Practice* (4th ed.). Butterworth-Heinemann (Elsevier), 2006.
11. Sayilir S. The short-term effects of TENS plus therapeutic ultrasound combinations in chronic neck pain. *Complement Ther Clin Prac*. 2018; 31: 278–81.
12. Soysal A, Aslan U. Treatment of chronic neck pain by two combined physiotherapy programs: Comparison of phonophoresis and ultrasound. *Asian Biomedicine*. 2017; 7(6): 821–7.
13. Sterling M, Hendrikz J, Kenardy J. Compensation claim lodgement and health outcome developmental trajectories following whiplash injury: A prospective study. *Pain*. 2010; 150(1): 22–8.
<https://doi.org/10.1016/j.pain.2010.02.013>.
14. Tollison CD, Satterthwaite JR. *Painful cervical trauma: diagnosis and rehabilitative treatment of neuromusculoskeletal injuries*. Baltimore: Williams and Wilkins, 1992.
15. Watson T. *Tissue Repair: The Current State of the Art*. Sport and Exercise Medicine. 2006; 28: 8–12.