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Original Research Article

Multimodal Physiotherapy Improves Pain, Functional Disability, Sleep Quality and Health Related Quality of Life in Chronic Mechanical Neck Pain Patients

Shumaila Choudhary[1], M. Ejaz Hussain[2], Adam Moscovitch[3], Seithikurippu R. Pandi-Perumal[4], Ahmed S. Bahammam[5]

[1]Assisstant Professor (Visiting), [2]Director,
Centre for Physiotherapy and Rehabilitation Sciences, Jamia Millia Islamia, New Delhi, INDIA
[3]Medical Director, Sleep and Fatigue Institute, The University of Calgary, CANADA.
[4]President and Chief Executive Officer, Somnogen Canada Inc., College Street, Toronto, CANADA.
[5]Professor, King Saud University, Riyadh, SAUDI ARABIA.

Corresponding Author: Shumaila Choudhary

ABSTRACT

Background and purpose- Mechanical neck pain is a common problem affecting people worldwide. According to current evidence, 30% to 50% of general population suffers from MNP and experience chronic pain yearly. The use of objective measures such as cervical range of motion; cervical muscles strength, endurance and electromyography have been widely used in mechanical neck pain interventional studies. However sleep quality and health related quality of life, which are important subjective measures reflecting well-being of an individual has been neglected in the past. Therefore, there is a need to investigate these variables in these patients.

Methods- It was a randomized control study. Thirty patients were randomly assigned to Group A-experimental group and Group B-control group with 15 patients in each group. Group-A received supervised physiotherapy while Group-B received minimal intervention as home program. All the outcome measures were collected at baseline and post intervention.

Results- There was a statistically significant improvement in both the groups. In between group comparison the experimental group shows statistically significant improvement than the control group in all the outcome measures.

Conclusions- Patients with chronic mechanical neck pain found to have substantial decrease in quality of life and impaired sleep quality. The physiotherapy resulted in significant improvement in pain, functional disability, sleep quality and health related quality of life in experimental group compared to the control group.

Key words: Mechanical neck pain (MNP), Sleep quality, Health related quality of life (HRQOL), Multimodal physiotherapy.

INTRODUCTION

Neck pain is a common disorder in the general population leading to disability in terms of patient's physical, social and emotional well-being. Current data suggest that 22% to 70% of people experience neck pain at some point of their lives. [1,2] In a recent systematic analysis for the global burden of disease study, 1990-2015, neck and lower back pain was found to be the leading cause of disability in terms of years lived with disability (YLDs). [3]

Mechanical neck pain (MNP) defined as generalized neck pain provoked by sustained neck postures, neck movements, pain on palpation of cervical musculature without pathologies. [4] According to current evidence, 30% to 50%

of general population suffers from MNP and experience chronic pain yearly. The pathology behind MNP has not been established yet but it is thought to be multifactorial including one or more of the following, poor posture, anxiety, depression, neck strains and sporting or emotional activities. [5] Chronic neck pain has poor prognosis and also the disability due it leads to decreased health status, work absenteeism and long lasting psychological issues. In fact, neck pain is more pertinacious than low back pain and is usually followed by low back pain as a factor responsible for work absenteeism. [6]

Various conservative treatments such as manual therapy, therapeutic exercise, manual /mechanical traction, massage, patient education and functional training are available to treat MNP, although the current evidence suggests that multimodal treatment is the best approach to address MNP. [7,8] Physiotherapists generally use objective measures such as range of motion, strength, endurance and EMG to treat MNP but nowadays, subjective measures are also considered to be equally important in clinical practice and published research. Emerging evidence suggests that screening tools such as questionnaires have an important role in the management. These tools not only help in diagnosis but also in reassessment of the patients post intervention. These values are easy for the patient to understand; hence, they become an important tool in building the confidence of the patient. [9]

Health-related quality of life (HRQOL), such as subjective health status, is patient based, but focuses more on the impact of a perceived health state on the ability to live a fulfilling life. [10] As evident by the literature, chronic neck pain has found to be associated with a decrease in HRQOL. [11] General health and neck pain are important variables to judge individual well-being, as well as sleep. Yet of these three variables, sleep is often neglected in outcome studies. Sleep becomes more important during the disease as it can influence the pathological significance of any disease that in turn can influence the general well-being of the patient. [12] In a recent study on sleep in university students, we found a significant influence of both gender and years at universities on measured sleep parameters. [13] In another study, it was found that patients with sleep problems due to pain have significantly pure musculoskeletal pain in comparison with other patients who have systemic disorders and the recognition of disturbed or unrefreshing sleep can influence the management of painful musculoskeletal disorders. [12]

Sleep disturbance has been reported in chronic MNP patients recently in two studies. [14,15] According to one of the recent study, patients with MNP exhibited higher disability and worse sleep quality than controls. Furthermore, sleep quality was found to be associated with pain intensity and disability. The higher the pain and disability the worse was sleep quality. [14] To best of our knowledge, there is no interventional study assessing sleep quality as an independent outcome variable till date. Therefore, we conducted this study to assess the impact of multimodal treatment on sleep quality and HRQOL in patients with chronic MNP.

MATERIALS AND METHODS

It was a randomized control design study. The study was approved by the Institutional Ethics Committee, Jamia Millia Islamia, New Delhi, India. The informed consent was obtained from every patient and they were informed about their right as a research subject. A sample of 30 patients with chronic MNP were recruited from CPRS clinic, JMI and from local community based on inclusion and exclusion criteria during the months of July 2014 - April 2015.

Inclusion criteria

- Patient having localized MNP that had persisted for 12 weeks or more where MNP is defined as generalized neck pain provoked by sustained neck postures,

neck movements, pain on palpation of cervical musculature without any pathologies. [4]

- Male and female patients aged 20-40 years
- PSQI score>5.

Exclusion criteria

- Patients having referred neck pain
- Progressive neurological deficits
- Vascular diseases of the neck or upper extremity
- Previous cervical spine injury

Spinal manipulative therapy or exercise therapy within 3 months before study entry date or concurrent treatment for neck pain by other health care providers.

The 30 patients were divided into two groups Group A- Experimental (n=15) and Group-B Control (n=15) by computer generated block randomization. Patient's height and weight were measured by digital weighing machine and stadiometer respectively prior to the treatment. Then the respective treatment was given to both the groups for 8 weeks. The experimental group received supervised physiotherapy while the control group was given a home programme which he/she carried out at home.

Interventions

Treatment protocol for Group A

Each treatment started with hot pack application for 15-20 min in the comfortable position reported by the patient i.e. sitting, supine or prone. Posture education and advice were also given in the first session.

Scapular-strengthening exercises included prone horizontal abduction, side lying forward flexion, prone extension of each shoulder, as well as prone push-ups with emphasis on shoulder protraction, one set of 10 repetitions for four weeks. Then for two weeks, two sets of 10 repetitions. And in the last two weeks, three sets of 10 repetitions. The goal was three sets of 10 repetitions, with manual resistance added as tolerated.

Neck muscle strengthening exercises: For the first four weeks – Manual resisted exercises for cervical flexors, extensors and lateral rotators were performed in supine, prone and sitting positions respectively. All these exercises were performed one set of 10 repetitions. The goal was to achieve two sets of 10 repetitions.

For the next four weeks: Strengthening exercises with resistance band were performed for cervical flexors, extensors and lateral rotators were performed in supine, prone and sitting positions respectively. All these exercises were performed one set of 10 repetitions. The goal was to achieve two sets of 10 repetitions

Endurance exercises: For the first four weeks- In the supine position, patients were asked to do chin tucks with lifting their head up and holding it for 5 to 10 seconds/count and this exercise was performed one set of 10 repetitions progressed up to two set of 10 repetitions.

For next 4 weeks: Endurance exercises in supine position. Patients were asked to do chin tucks with lifting their head up and holding for 5 to 10 seconds and this exercise was performed for 3 sets 10 repetitions.

Mobilization with movement (SNAGs) technique: The patient was seated in a supportive low back chair with the therapist's position behind the patient. If the spinal lesion involved one side, unilateral SNAG was applied to the affected side. If the lesion was bilateral, a bilateral SNAGs technique to the spinous process was applied. This has been followed for first two weeks.

Self-Stretching exercises for upper trapezius, cervical extensors, levator scapulae and pectoralis major were done in each session for eight weeks. Each muscle is stretched for a hold of 10 sec per repetitions for 10 repetitions. Active movements of neck and shoulder were performed in each session. Sessions were carried 3 times a week for 8 weeks.

Treatment Protocol for Group B

The control group received minimal intervention. In the first session, patients were educated about the precautions to prevent neck pain and were given posture education and advice. The treatment advised

to them is hot pack application for 15-20 in comfortable position. The same stretching exercises given to the experimental group were also advised to the control group. Followed by isometric exercises with a dosage of one set of 10 repetitions with five seconds hold, 10 seconds rest between the repetitions :Isometric exercises for neck flexors, extensors, side flexors (both sides) and rotators (both sides) for first four weeks.

For the next four weeks, the patient followed the same protocol with increase in hold time up to 10 sec and two sets of 10 repetitions each. Active movements of neck and shoulder were performed in each session. The treatment session was five times a week for 8 weeks.

(a)

(b)

(c)

(d)

(e)

Fig1:(a) Patient taking hot pack **(b)** Therapist giving SNAGs at C4-C5 spinous process **(c)** Passive stretching of pectoralis major **(d)** Cervical flexors strengthening exercises with theraband **(e)** Scapular strengthening exercise.

MEASUREMENT OF OUTCOME VARIABLES

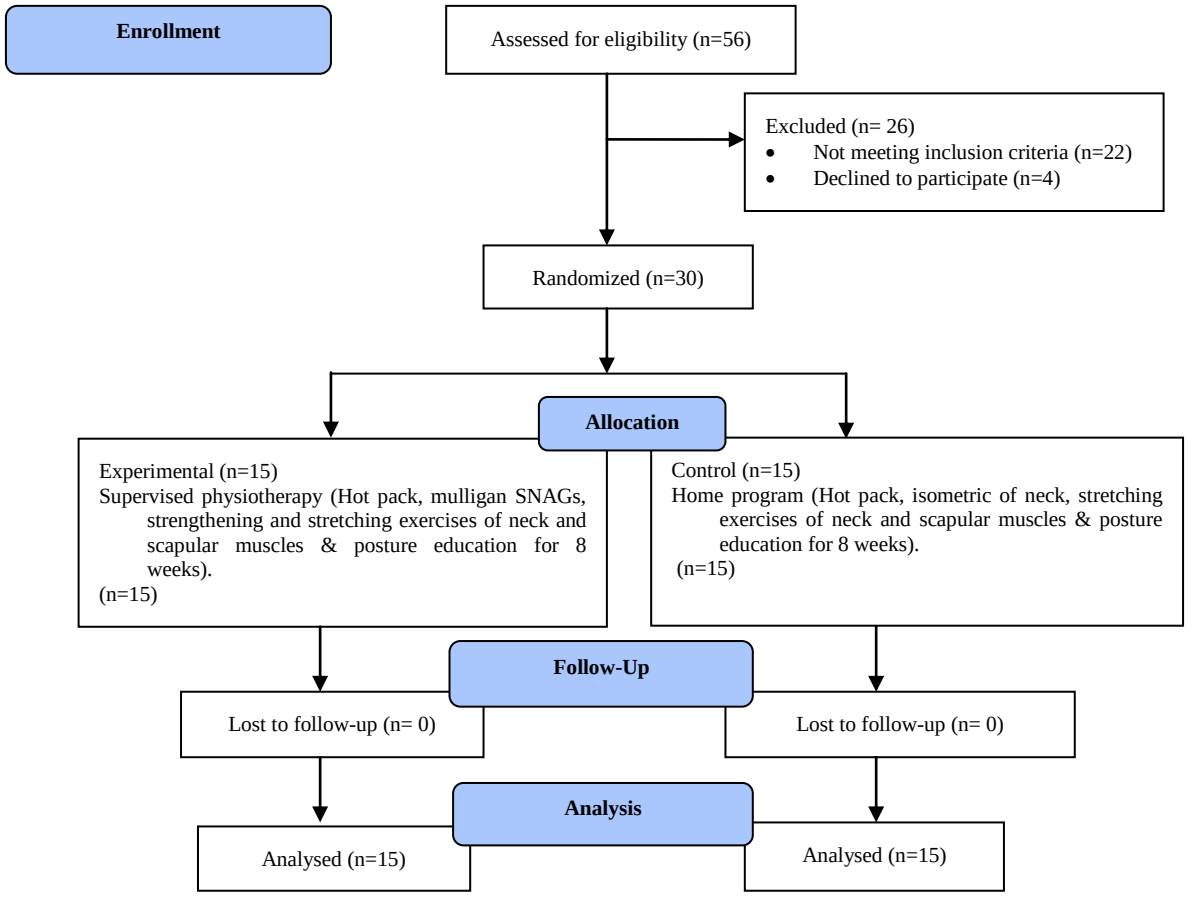
Clinical assessments were made at baseline and post treatment. Patient self-reported questionnaires were used to assess pain, functional disability, HRQOL and Sleep. All the questionnaires were used in original format and language. Pain was rated by 11 item Numerical Pain Rating Scale (NPRS). NPRS have fair to moderate test-retest reliability in MNP. [16] Functional disability was assessed by Neck disability index (NDI). The NDI has been demonstrated to be a reliable and valid tool for the assessment of neck disability. [17]

The research and development (RAND) 36 item health survey 1.0 questionnaire is the most widely used HRQoL survey instrument in the world today. It is comprised of 36 items with 8 subscales selected from a larger pool of items used in the RAND Medical Outcome Study (MOS). In many studies, all the sacles of Rand SF-36 were reported to have good internal consistency and face validity, and all items corresponds to health-related issues. Physical component summary scores (PCS) and mental component summary scores (MCS) are often used to express the health related quality of life using RAND SF-36. [18]

Sleep quality was assessed by Pittsburgh sleep quality index (PSQI) questionnaire. The PSQI is a 19-item self-rated questionnaire for evaluating subjective sleep quality over the previous month. The clinical and psychometric properties of the PSQI have been formally evaluated by several research groups. The PSQI has a sensitivity of 89.6% and specificity of 86.5% for identifying cases with sleep disorder, using a cut-off score of 5. [19]

STATISTICAL ANALYSIS - The version used for data analysis was SPSS 21.0. Data were assessed by a Shapiro-Wilk test for the normality of the distribution scores. The demographic characteristics and the baseline criterion measures were compared between the control and experimental group using independent t-test. Fifteen participants in each group (n=15) were assessed during the experiment. To test for the difference between groups, mixed ANOVA with group (Experimental and control), time (Pre and Post treatment) and interaction effect (Group and Time) was employed. The confidence interval used was 95% with level of significance set at $p<0.05$.

FLOW CHART OF THE STUDY



RESULTS

All the variables were normally distributed except NPRS scores. No significant difference was found in demographic characteristics between the groups. (Table-1) Also there was no significant difference in baseline criterion measures between the groups. (Table-2)

Analysis for the main effect of time for NPRS F (1,1) =860.05, p<0.001; NDI F (1,1) =573.84, p<0.001; PSQI F(1,1) 1017.68 p<0.001; ISI F (1,1) =237.75, p<0.001; RAND SF-36 PCS F (1,1) 120.14, <0.001 & RAND SF-36 MCS F (1,1) =148.56, p<0.001 yielded a significant results for both the groups. (Table-3)

Analysis of variance for between the groups for NPRS F (1,1) = 16.28, p<0.001; NDI F(1,1) = 4.88, p=0.036; PSQI F (1,1) 7.99, p=0.009 ; ISI F(1,1) = 5.45, p<0.01; RAND SF-36 PCS F (1, 1) 41.51, p<0.001 & RAND SF-36 MCS F(1,1) = 18.36, p<0.01 revealed a significant result for the group showing that experimental group had better improvement in all the parameters assessed than the control group. (Table-3)

Also the group X time effect for NPRS F (1,1) = 87.43, p<0.001; NDI F (1,1) = 47.15, p<0.001; PSQI F(1,1) 87.17 p<0.001; ISI F (1,1) = 21.05, p<0.001; RAND SF-36 PCS F (1,1) 59.91, p<0.001 & RAND SF-36 MCS F (1,1) = 51.95, p<0.001 shows a significant interaction for the experimental group. (Table-3)

Table 1: Comparison of Demographic Data between Groups

Variable	Control Mean (SD)	Experimental Mean (SD)	Independent *t*-test (*p*-value)
Age (years)	27.2 (4.67)	26.2 (4.82)	0.761
Height (cm)	163.6 (9.6)	163.90 (9.15)	0.637
Weight (kg)	58.70 (6.47)	58.66 (6.17)	0.613
BMI (W/H^2)	21.90 (1.28)	21.78 (1.28)	0.883

Abbreviations: BMI: body mass index; W: weight; H: height; data are presented as Mean (SD); significant difference=p<0.05

Table 2: Comparison of Baseline Criterion Measures between Groups

Variable	Control Mean (SD)	Experimental Mean (SD)	Independent *t*-test (*p*-value)
NPRS	6.53 (0.99)	6.86 (0.99)	0.604
NDI	53.92 (10.89)	56.72 (11.40)	0.622
PSQI	9.73 (1.43)	9.53 (1.72)	0.733
RAND SF-36 (PCS)	54.99 (9.01)	50.54 (8.48)	0.175
RAND SF-36 (MCS)	48.18 (9.72)	47.52 (10.20)	0.988

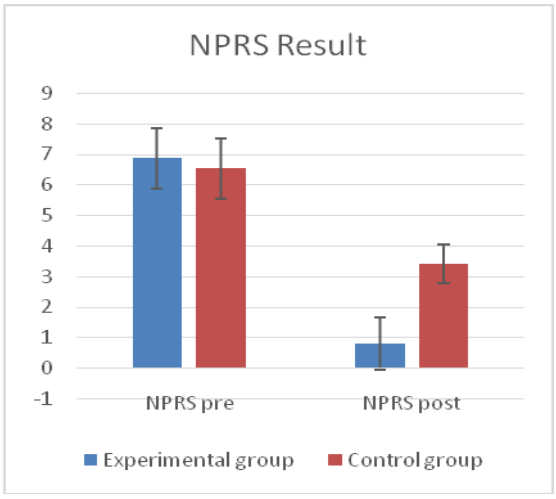
Abbreviations: NPRS: numerical pain rating scale; NDI: neck disability index; PSQI: Pittsburgh sleep quality index; PCS: physical component summary; MCS: mental component summary

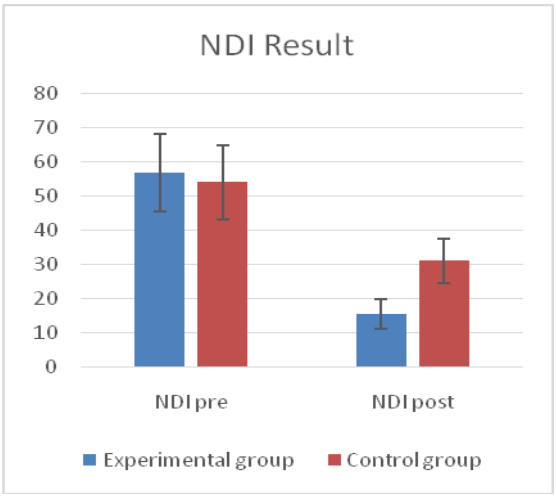
Table- 3: Summary of Mixed ANOVA

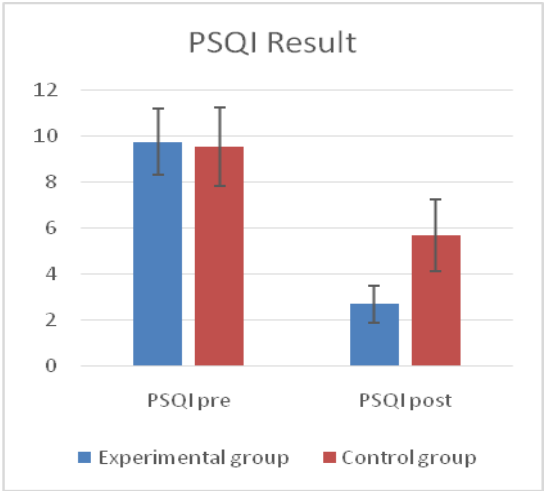
Dependent variable	Source	Df	*F*	*p*-value	Partial eta squared
NPRS	Group (G)	1	16.28	<0.001*	0.368
	Time (T)	1	860.05	<0.001*	0.96
	G X T	1	87.43	<0.001*	0.75
NDI	Group (G)	1	4.88	0.036*	.148
	Time (T)	1	573.84	<0.001*	.953
	G X T	1	47.15	<0.001*	.627
PSQI	Group (G)	1	7.99	0.009*	0.22
	Time (T)	1	1017.68	<0.001*	0.97
	G X T	1	87.17	<0.001*	0.75
RAND SF-36 (PCS)	Group (G)	1	41.51	<0.001*	0.59
	Time (T)	1	120.14	<0.001*	0.81
	G X T	1	59.91	<0.001*	0.68
RAND SF-36 (MCS)	Group (G)	1	18.36	<0.001*	0.39
	Time (T)	1	148.56	<0.001*	0.84
	G X T	1	51.95	<0.001*	0.65

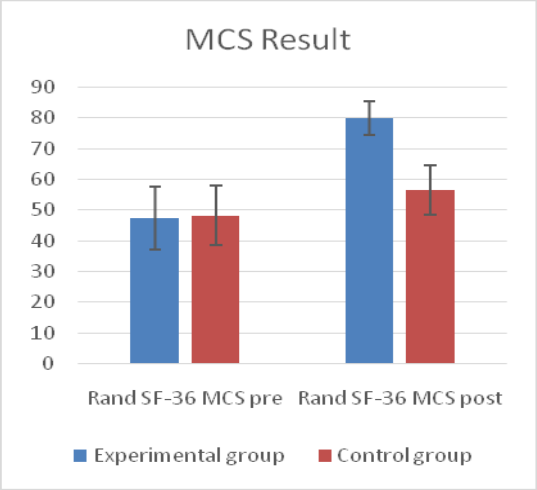
Abbreviations: NPRS: numerical pain rating scale; NDI: neck disability index; PSQI: Pittsburgh sleep quality index; PCS: physical component summary; MCS: mental component summary.

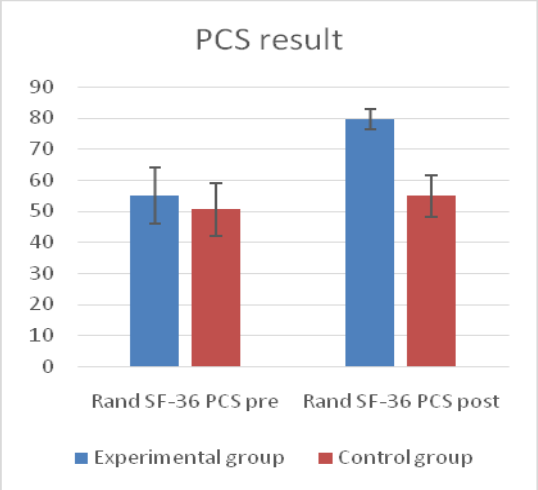
GRAPHICAL REPRESENTATION OF DATA











DISCUSSION

The results of the present study suggest that there is a significant improvement in all outcomes measures in both the groups. However, improvement in the experimental group was statistically significant than the control group post treatment in all the outcome measures assessed.

Previous studies have reported that multimodal treatment i.e. (therapeutic exercise, manual therapy with patient education and advice) is effective in reducing pain and improving functional disability. [20,21] There are various systematic reviews which also favour the result of our study and recommend the use of strengthening, endurance and stabilization exercises. [22,23] The findings of the present study concur with previously published studies on chronic neck pain. The possible mechanism involved in the improvement of experimental group is that strength and endurance training might have improved coordination, increased motor unit recruitment, and increased firing rate in each unit. [24] Exercises reduce the fear of pain thereby increasing ROM. [25] Pain reduction and improvement in neck ROM helps in overcoming the restriction of the activities improving the functional ability. The components of NDI are directly related to the patient's pain. [26] The reduction in NDI scores seen in the experimental group may be due to the reduction of pain. Therefore, it may be concluded that the use of strengthening and endurance exercises for cervical muscles as well scapular stabilization exercises in the present study might have led to improvement in pain and thereby decreasing functional disability in both the groups. Another intervention used in our study is manual therapy i.e. Mulligan SNAGs in the experimental group. The control group did not receive any such interventions, which might be a reason for better improvement in the experimental group than the control group. The underlying mechanism of the effect of cervical SNAGs thought to be either purely mechanical, reflexogenic or a combination of the two. [27]

Although previous researches show evidence of beneficial effects of physiotherapy interventions on neck pain and functional disability, the impact of physiotherapy on HRQOL was seldom assessed. In our study, we reported highly significant improvement in HRQOL in the experimental group compared to control group. HRQOL measurements have been rarely reported as outcome variable in interventional studies exploring chronic neck pain. The Rand SF-36 HRQOL measurement was applied in two short-term interventional studies treating chronic neck pain. [28,29] One study compared the effects of spinal manipulation combined with neck exercises, rehabilitative neck exercises alone, and spinal manipulation alone on neck pain. After 11 weeks of intervention, minor improvements were observed in all

outcome measures including SF-36, but they did not reach statistical significance. [28] In another study the effects of therapeutic exercises and sleeping with neck support pillows in patients with neck pain was assessed. The patients were treated for 6 weeks and the primary assessment was performed at 12 weeks. No statistically significant differences in HRQOL were detected among the groups. [29]

On the contrary, the experimental group in our study we had statistically significant improvement in HRQOL as measured by RAND SF-36 (PCS & MCS) in compared to the control group. In our study, the reduction in pain and improved functional disability may be one factor responsible for the significant enhancement in HRQOL. As we discussed earlier, the treatment protocol and the duration of the protocol used were different, which can account for the differences in our results compared to the previous studies measuring HRQOL. Other reasons such as chronicity of pain, patient's characteristics like age, ethnicity and genetic variation between the patients in the present study compared to the above two studies might be responsible for the improvement observed in our study.

Sleep as an independent outcome variable that has never been assessed in interventional studies in chronic MNP. To the best of our knowledge, this is the first study that assessed sleep after giving physiotherapy intervention in chronic MNP. Therefore, there is lack of literature to support or negate the results of our study. Nevertheless, there is some evidence suggesting that sleep is affected in chronic MNP patients [14,15] and sleep was found to be associated with pain & functional disability in chronic MNP patients. [14] Therefore it might be possible that if pain and disability reduces it might lead to improved sleep quality as there is evidence that sleep disturbances in chronic pain increase sensitivity towards pain. [30] So, it may be concluded that sleep and pain are interdependent to each other, if pain reduces then sleep quality will be improved or vice versa. This can be thought as a possible reason for the positive results obtained in our study. Also experimental group had statistically significant improvement in sleep quality compared to the control group, the possible explanation might be the overall significant improvement in the other three variables in the experimental compared to control group which may have leads to improved sleep quality in experimental group than the control group.

LIMITATIONS OF THE STUDY

- The sample size used was small to generalize the result.
- No follow up was done to see if the improvement was maintained or not.
- Objective measures such as ROM, strength and endurance of the muscles, electrophysiological models were not measured, which can further strengthen the finding of the result.
- Other factors associated with pain such as anxiety, fear, uncomfortable sleep position medication side effect or work place features should also be assessed to see if they have any relationship with functional disability, HRQoL and sleep quality.

CONCLUSION

The present study shows that chronic MNP patients have moderate to severe functional disability, reduced HRQOL and sleep quality. The intervention of therapeutic exercise, manual therapy, with posture education and advice given to the experimental group brings about an improvement in pain, functional disability, HRQOL and sleep quality. This improvement was reflected by statistically significant decrease in NPRS, NDI and PSQI scores with a statistically significant improvement in the RAND SF-36(MCS& PCS) scores in the experimental group as compared to the control group.

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Conflict of Interest- None

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