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Evaluation of Cervical Proprioception and its Association with Disability in Neck Pain: A Cross Sectional Study

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ABSTRACT

Aims: The aim of this study to evaluate cervical proprioception and its relationship with disability in neck pain. **Methods:** This was cross sectional study to explore association between cervical proprioception and disability in neck pain. 91 patients were examined for cervical proprioception by laser tracking method or JPE for flexion, extension, right rotation and left rotation. Neck disability index questionnaire was filled by patients for checking disability and laser tracker was used for proprioception. **Results:** Most of the participants 52.7% had mild disability. Patients were from age 18-65 years having mean age 37.8± 10.7, the mean score of neck disability index was 14.9±8.0, the chi square test showed no association for flexion, extension and right rotation with proprioception as their P- values are 0.299>0.05, 0.442>0.05, 0.694>0.05 and left rotation showed significant association between left rotation and proprioception. Most of the participants 80.2% had forward head posture. Majority 47.7% were in age between 20-30 and having mean age 33.8±8.8. The mean score of neck disability index was 5.88±4.9. The chi square test showed no significant association (P>0.05) between forward head posture and neck pain. **Conclusion:** This study concluded that cervical proprioception has no significant association with disability in neck pain.

INTRODUCTION

Neck pain is feeling of discomfort posteriorly in head and neck region between the occipital condyles and C7 vertebral prominence (1) . Neck Pain is from the most common musculoskeletal problems and many people visit physical therapy clinics for this reason (2). Neck pain can be acute (0-4 weeks), sub-acute (4-12 weeks) or chronic (more than 12 weeks) (3). Neck pain may cause weakness of proprioception(4). Proprioceptive weakness is present in many problems including low back pain, knee osteoarthritis, and complex regional pain syndrome (5).

The term proprioception was introduced by Sherrington to give details of receptors, position sense and movements(6). Proprioception has two subtypes i.e. sense of static body posture and sense of movements which is known as kinesthesia (6). Cervical proprioception is the sense of position of cervicocephalic region in space, showing the systemic interaction between efferent and afferent receptors to check the position and movement (7). People with the ages 15–74 years report a point prevalence ranging from 5.9% to 38.7%. (8). Approximately 10% of individuals experience neck discomfort at least a week in a month, and 80% percent subjects experience neck pain per year where 20-30% is acute neck pain (1). Prevalence of neck pain in the general people of United States is 15.1% every three months (9).

Neck pain has the probability to become chronic issue so it is important to know the risk factors that could encourage prevention and early diagnosis (9). Risk factors can be categorized as modifiable and non-modifiable. Modifiable are those risk factors in which the individual patient or health professional can take measures to change them e.g. depression, strength, range of motion while non-modifiable are those risk factors in which the individual

patient or health professional can't take measures to change them e.g. age, gender, number of previous episodes (9). Obesity, physical inactivity, poor general health and trauma are also risk factors for experiencing neck pain (10). Neck pain has many causes but the leading cause is improper ergonomics at work, sitting and maintaining neck in inadequate position for long period of time (8). Neck pain may cause weakness of proprioception(9). A study reported that people with neck pain have incongruent relocation and this incongruence is related to pain intensity (10). Chronic neck pain may be associated with reduced head and neck movement and position sense (6). Proprioceptive weakness is present in many problems including low back pain, knee osteoarthritis, and complex regional pain syndrome (10). Proprioceptive weakness most likely exists in subjects with neck discomfort relative to normal population when quantified by a relocating error (10). The term proprioception was introduced by Sherrington to give details of receptors, position sense and movements(11). Proprioception has two subtypes i.e. sense of static body posture and sense of movements which is known as kinesthesia (11). Cervical proprioception is the sense of position of cervicocephalic region in space, showing the systemic interaction between efferent and afferent receptors to check the position and movement (12). Proprioceptive exercises and joint position training are beneficial and also decrease discomfort and disability (13). Neck pain has many causes but the leading cause is improper ergonomics at work, sitting and maintaining neck in inadequate position for long period of time (14). Neck pain is least commonly caused by tumors, systemic arthropathy (e.g. rheumatoid arthritis, ankylosing spondylitis), infections, thyroid disorders, oesophageal obstruction or reflux disease (1). Non traumatic neck pain can be categorized on the basis of pain source. Neck pain can be of mechanical component like cervical inter vertebral disc, cervical zygapophyseal joints, facet joints, ligaments and atlantoaxial joints or it can be of neuropathic component like radiculopathy secondary to nerve compression or irritation or it can be of both mechanical and neuropathic (14).

MATERIAL AND METHODS

This study was a cross sectional study. It was conducted in Khyber teaching hospital and Habib physiotherapy complex Peshawar. The study was completed within six months from April 2021 to September 2021. The study included 91 patients through non-probability convenience sampling technique on the basis of following inclusion criteria: Neck pain as main presenting complaint, both Males and females, Age 18-60 years, both acute and chronic, diffuse.

Some individuals were excluded from the study based on the following criteria: Neck pain as main presenting complaint, Both Males and females, Age 18-60 years, both acute and chronic, diffuse.

After the approval from graduate committee and ASRB, permission was taken from the concerned wards/departments through official permission letters in order to conduct the study. All the willing participants were briefed about the purpose and procedure of this study and then data was collected. The agreed participants were screened through inclusion and exclusion criteria. Data was collected using following data collection tools:

- Neck disability index questionnaire.
- Laser tracker method for proprioception. In this method patient was seated 90cm away from the wall with tracker chart. Laser pointer was centered on target and then patient was instructed to close his/her eyes and move the head all the way to the right and left. 6 trials were performed in directions: flexion, extension, right and left rotation. Distance from the starting point to the relocated point was noted for each trial. If the mean value of each direction lies in 5-6cm so it is considered normal and if the distance is more than 6cm it is considered abnormal. Quality and speed of movement was also noted during the movements.

RESULTS

A total of 91 patients were included in the study. The mean age of the patients was 37.8 ± 10.76 years. Out of total 91 patients, 55 (60.4%) patients were male while 36 (39.5%) were female.

Table 1

Demographic Information

Variables	(%/M ± S.D)
Male	55(60.4%)
Female	36(39.6%)
Age	37.8±10.76

The number of patients was 91, out of which 7.7% i.e. (n=7) were with no disability, followed by 52.7% i.e. (n=48) were with mild disability, 23.1% i.e. (n=21) were with moderate disability and 16.5% i.e. (n=15) were with severe disability.

Table 2

NDI Categories

NDI Categories	Frequency	Percent
No disability	7	7.7
Mild disability	48	52.7
Moderate disability	21	23.1
Severe disability	15	16.5

The number of patients was 91, out of which 59.3% i.e. (n=54) flexion were with normal flexion while 40.7% i.e. (n=37) were with impaired flexion.

Table 3

Showing Flexion

Flexion	Frequency	Percent
Normal	54	59.3
Impaired	37	40.7

The number of patients was 91, out of which 68.1% i.e. (n=62) were with normal extension while 31.9% i.e. (n=29) were with impaired extension.

Table 4

Showing Extension

Extension	Frequency	Percent
Normal	62	68.1
Impaired	29	31.9

The number of patients was 91, out of which 65.9% i.e. (n=60) were with normal right rotation while 34.1% i.e.

(n=31) were with impaired right rotation.

Table 5
Shows Right Rotation

Right Rotation	Frequency	Percent
Normal	60	65.9
Impaired	31	34.1

The number of patients was 91, out of which 63.7% i.e. (n=58) were with normal left rotation while 36.3% i.e. (n=33) were with impaired left rotation.

Table 6
Shows Left Rotation

Left Rotation	Frequency	Percent
Normal	58	63.7
Impaired	33	36.3

Association of Proprioception and NDI

Flexion and NDI

Out of 91 patients, there was no significant association between flexion and NDI as the P- value is 0.299 which is greater than 0.05(>0.05 shows no association).

Extension and NDI

Out of 91 patients, there was no significant association between extension and NDI as the P-value is 0.442 which is greater than 0.05.

Right Rotation and NDI

Out of 91 patients, there was no significant association between right rotation and NDI as the P-value the 0.694 which is greater than 0.05.

Left Rotation and NDI

Out of 91 patients, there is significant association between left rotation and NDI as the P- value is 0.028 which lesser than 0.05.

Table 7
Association of Proprioception and NDI

Variables	Normal	Imapired	P-Value	NDI Categories			
				No Disability	Mild Disability	Moderate Disability	Severe Disability
Flexion category	54 (59.3%)	37 (40.7%)	0.299	7 (7.7%)	48 (52.7)	21 (23.1%)	15 (16.5%)
Extension category	62 (68.1%)	29 (31.9%)	0.442				
Rt. Rotation	60 (65.9%)	31 (34.1%)	0.694				
Lt. Rotation	58 (63.7%)	33 (36.3%)	0.028				

Association of Age, Gender and NDI

Age and NDI

Out of 91 patients, there is no significant association between age and NDI as the P-value was 0.569 which is greater than 0.05.

Gender and NDI

Out of 91 patients, there is no significant association between gender and NDI as the P-value is 0.065 which is greater than 0.05.

Table 1
Showing Association of Gender, Age and NDI Categories

Particular	(%M ± S.D)	P-Value	NDI Categories			
			No Disability	Mild Disability	Moderate Disability	Severe Disability
Age	37.8 ± 10.76	0.569	7 (7.7%)	48 (52.7)	21 (23.1%)	15 (16.5%)
Male	55(60.4%)	0.065				
Female	36(39.6%)					

DISCUSSION

NP is defined as any stiffness or pain experienced posteriorly in the cervical region somewhere in between the occipital condyles and C7 vertebral prominence (1). NP is one of the most common MSK problems and it is one of the reason for the clinical visits (3). Neck pain can be categorized on the basis of duration as acute (0-4 weeks), sub-acute (4-12 weeks) or chronic (more than 12 weeks) (6). Many conditions causes disability in life, NP is fourth commonest cause for disability in life (7). Improper ergonomic at work, sitting and maintaining neck in inadequate position for long period of time is the leading cause of NP (14). Proprioceptive weakness most likely exists in neck pain population relative to normal population when quantified by a joint repositioning error (JPE) (10).

In this study we evaluated the cervical proprioception using laser tracker method (cervical proprioceptive errors or JPEs) and its association with neck disability. The patients participated in this study were 91 in total from age 18 to 65 having mean age of 37.8 ± 10.76 years. We checked proprioception or JPE for flexion, extension, right rotation and left rotation. The mean score for flexion was 5.3± 1.9, for extension was 5.37± 1.88, for right rotation was 5.36±1.85 and for left rotation was 5.4±1.82. These scores show no impairment as it is less than 6 cm (<6cm is normal).In contrast other studies reported different age categories. In a study with age categories ranging from 30-60 years concluded that proprioception is impaired in population with cervical spondylosis as compared to healthy group and there is a significant association between neck pain intensity and cervical proprioception impairment demonstrated in terms of larger JPE (29).According to previous researches chronic neck pain has positive association with impaired proprioception and neuromuscular imbalances (4).

The total number of patients was 91, out of which 7.7% i.e. (n=7) were with no disability, followed by 52.7% i.e. (n=48) were with mild disability, 23.1% i.e. (n=21) were with moderate disability and 16.5% i.e. (n=15) were with severe disability. According to a systemic review conducted which concluded that there is positive association between proprioception and chronic idiopathic neck pain (25). According to a study chronic neck pain due to overuse, trauma and muscle weakness neuromuscular structure disturbs which alters neutral position and this alteration leads to impaired proprioception (5). A study conducted in France shows a significant changes in head repositioning absolute error between healthy participants and those with neck discomfort (26). Our study is in contrast to other previous

studies as our study showed no association; this is may be due to different population, lower sample size, methodological differences and most of the population was before the age of 40. In contrast to other studies a study conducted in UK is quietly related to our study as it does not show any association (18).In this study we checked neck disability index categories, which are no, mild, moderate, severe and complete disability. Among them the most reported category was mild disability, Similarly, a study conducted by Debbe Rand in Israel 69. We also checked the association of age and neck disability but it shows no significant association as its P-value is 0.569 which is greater than 0.05. In addition, we associated the neck disability with gender which also showed no association having P-value of p= 0.065 which is greater than 0.05. our results of no association is supported by a study conducted and it has not shown any association (31).

CONCLUSION

This study concluded that there is no significant association between cervical proprioception and disability in neck pain.

The findings of this research are noteworthy because it gave a snapshot of some population in Peshawar.

This study should be conducted on provincial level and longitudinal study should be performed for good inter and intra rater reliability. Population and sample size should be larger.

REFERENCES

1. Ferrari R, Russell AS. Neck pain. Best Practice & Research Clinical Rheumatology. 2003;17(1):57-70. https://doi.org/10.1016/s1521-6942(02)00097-9
2. Bogduk N. The anatomy and pathophysiology of neck pain. Physical Medicine and Rehabilitation Clinics. 2003;14(3):455-72. https://doi.org/10.1016/s1047-9651(03)00041-x
3. Letafatkar A, Rabiei P, Alamooti G, Bertozzi L, Farivar N, Afshari M. Effect of therapeutic exercise routine on pain, disability, posture, and health status in dentists with chronic neck pain: a randomized controlled trial. International archives of occupational and environmental health. 2020;93(3):281-90. https://doi.org/10.1007/s00420-019-01480-x
4. Kapreli E, Vourazanis E, Billis E, Oldham J, Strimpakos N. Respiratory dysfunction in chronic neck pain patients. A pilot study. Cephalalgia. 2009;29(7):701-10. https://doi.org/10.1111/j.1468-2982.2008.01787.x
5. Yang J, Lee B, Kim C. Changes in proprioception and pain in patients with neck pain after upper thoracic manipulation. Journal of physical therapy science. 2015;27(3):795-8. https://doi.org/10.1589/jpts.27.795
6. Palmgren PJ, Andreasson D, Eriksson M, Hägglund A. Cervicocephalic kinesthetic sensibility and postural balance in patients with nontraumatic chronic neck pain–a pilot study. Chiropractic & osteopathy. 2009;17(1):1-10. https://doi.org/10.1186/1746-1340-17-6
7. Hesby BB, Hartvigsen J, Rasmussen H, Kjaer P. Electronic measures of movement impairment, repositioning, and posture in people with and without neck pain—a systematic review. Systematic reviews. 2019;8(1):1-23. https://doi.org/10.1186/s13643-019-1125-2
8. Ghamkhar L, Kahlaee AH, Nourbakhsh MR, Ahmadi A, Arab AM. Relationship between proprioception and endurance functionality of the cervical flexor muscles in chronic neck pain and asymptomatic participants. Journal of manipulative and physiological therapeutics. 2018;41(2):129-36. https://doi.org/10.1016/j.jmpt.2017.08.006
9. Gonçalves C, Silva AG. Reliability, measurement error and construct validity of four proprioceptive tests in patients with chronic idiopathic neck pain. Musculoskeletal Science and Practice. 2019;43:103-9. https://doi.org/10.1016/j.msksp.2019.07.010
10. Harvie DS, Hillier S, Madden VJ, Smith RT, Broecker M, Meulders A, et al. Neck pain and proprioception revisited using the proprioception incongruence detection test. Physical therapy. 2016;96(5):671-8. https://doi.org/10.2522/ptj.20150210
11. Alahmari KA, Reddy RS, Silvian P, Ahmad I, Nagaraj V, Mahtab M. Influence of chronic neck pain on cervical joint position error (JPE): comparison between young and elderly subjects. Journal of back and musculoskeletal rehabilitation. 2017;30(6):1265-71. https://doi.org/10.3233/bmr-169630
12. de Vries J, Ischebeck B, Voogt L, Van Der Geest J, Janssen M, Frens M, et al. Joint position sense error in people with neck pain: a systematic review. Manual therapy. 2015;20(6):736-44. https://doi.org/10.1016/j.math.2015.04.015
13. McCaskey MA, Schuster-Amft C, Wirth B, Suica Z, de Bruin ED. Effects of proprioceptive exercises on pain and function in chronic neck-and low back pain rehabilitation: a systematic literature review. BMC musculoskeletal disorders. 2014;15(1):1-17. https://doi.org/10.1186/1471-2474-15-382
14. Popescu A, Lee H. Neck pain and lower back pain. Medical Clinics. 2020;104(2):279-92. https://doi.org/10.1016/j.mcna.2019.11.003
15. Cohen SP, Hooten WM. Advances in the diagnosis and management of neck pain. Bmj. 2017;358. https://doi.org/10.1136/bmj.j3221
16. Kim R, Wiest C, Clark K, Cook C, Horn M. Identifying risk factors for first-episode neck pain: a systematic review. Musculoskeletal Science and Practice. 2018;33:77-83. https://doi.org/10.1016/j.msksp.2017.11.007
17. Cohen SP, editor Epidemiology, diagnosis, and treatment of neck pain. Mayo Clinic Proceedings; 2015: Elsevier. https://doi.org/10.1016/j.mayocp.2014.09.008
18. Rix GD, Bagust J. Cervicocephalic kinesthetic sensibility in patients with chronic, nontraumatic cervical spine pain. Archives of physical medicine and rehabilitation. 2001;82(7):911-9. https://doi.org/10.1053/apmr.2001.23300
19. Côté P, van der Velde G, Cassidy JD, Carroll LJ, Hogg-Johnson S, Holm LW, et al. The burden and determinants of neck pain in workers: results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. Journal of manipulative and physiological therapeutics. 2009;32(2):S70-S86. https://doi.org/10.1016/j.jmpt.2008.11.012
20. Chiu TT, Leung AS. Neck pain in Hong Kong: a telephone survey on prevalence, consequences, and risk groups. Spine. 2006;31(16):E540-E4. https://doi.org/10.1097/01.brs.0000225999.02326.ad
21. Côté P, Cassidy JD, Carroll LJ, Kristman V. The annual incidence and course of neck pain in the general population: a population-based cohort study. Pain. 2004;112(3):267-73. https://doi.org/10.1016/j.pain.2004.09.004

22. Ozen T, Tonga E, Polat MG, Bayraktar D, Akar S. Cervical proprioception accuracy is impaired in patients with axial spondyloarthritis. Musculoskeletal Science and Practice. 2021;51:102304. https://doi.org/10.1016/j.msksp.2020.102304
23. Jensen I, Harms-Ringdahl K. Neck pain. Best Practice & Research Clinical Rheumatology. 2007;21(1):93-108. https://doi.org/10.1016/j.berh.2006.10.003
24. Chen X, Treleaven J. The effect of neck torsion on joint position error in subjects with chronic neck pain. Manual therapy. 2013;18(6):562-7. https://doi.org/10.1016/j.math.2013.05.015
25. Stanton TR, Leake HB, Chalmers KJ, Moseley GL. Evidence of impaired proprioception in chronic, idiopathic neck pain: systematic review and meta-analysis. Physical therapy. 2016;96(6):876-87. https://doi.org/10.2522/ptj.20150241
26. Roren A, Mayoux-Benhamou M-A, Fayad F, Poiraudeau S, Lantz D, Revel M. Comparison of visual and ultrasound based techniques to measure head repositioning in healthy and neck-pain subjects. Manual therapy. 2009;14(3):270-7. https://doi.org/10.1016/j.math.2008.03.002
27. Yin W, Bogduk N. The nature of neck pain in a private pain clinic in the United States. Pain Medicine. 2008;9(2):196-203. https://doi.org/10.1111/j.1526-4637.2007.00369.x
28. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. The lancet. 2012;380(9859):2163-96.
29. Reddy RS, Tedla JS, Dixit S, Abohashrh M. Cervical proprioception and its relationship with neck pain intensity in subjects with cervical spondylosis. BMC musculoskeletal disorders. 2019;20(1):1-7. https://doi.org/10.1186/s12891-019-2846-z
30. León-Hernández JV, Marcos-Lorenzo D, Morales-Tejera D, Cuenca-Martínez F, La Touche R, Suso-Martí L. Effect of laterality discrimination on joint position sense and cervical range of motion in patients with chronic neck pain: a randomized single-blind clinical trial. Somatosensory & motor research. 2019;36(2):136-43. https://doi.org/10.1080/08990220.2019.1626706
31. Demaille-Wlodyka S, Chiquet C, Lavaste J-F, Skalli W, Revel M, Poiraudeau S. Cervical range of motion and cephalic kinesthesis: ultrasonographic analysis by age and sex. Spine. 2007;32(8):E254-E61. https://doi.org/10.1097/01.brs.0000259919.82461.57