

ORIGINAL RESEARCH ARTICLE

Prevalence of Anterior Head Translation in Patients with Neck Pain.

Wani S.K.¹, Samal Subrat², Priyanka Ostwal³ & Rubiya Quazi³

¹Associate Professor, ²Assistant Professor, ³Post Graduate student, Department of Musculoskeletal Physiotherapy, MGM's Institute Of Physiotherapy, Aurangabad, Maharashtra, India.

Abstract:

Background: This study aims to identify the relationship between anterior head translation (AHT) and neck pain and find out the prevalence of anterior head translation in patients with neck pain.

Methods: A cross-sectional observational study was done in a hospital setting on 88 subjects aged between 30-70 years, of both genders who were medically diagnosed with neck pain. Anterior head translation was measured on a cervical radiograph.

Results: The demographic data include age, duration and severity of symptoms. Mean anterior head translation was found to be 11.01 ± 7.66 mm for total population. Out of which 55% of the test population (48 subjects) were having anterior head translation between 0 - 15 mm, and 37% of the test population (33 subjects) were having anterior head translation more than 15 mm, while only 8 % of the study population (7 subjects) showed anterior head translation within normal limits. Females (11.01 ± 7.66 mm) were found to have greater anterior head translation than males (10.97 ± 7.545 mm). A positive correlation was found between duration of symptoms and the anterior head translation ($r = 0.019$, $p = 0.86$) and a negative co-relation between numerical pain rating scale (NPRS) and anterior head translation ($r = -0.021$, $p = 0.82$).

Conclusion: Prevalence of anterior head translation in patients of neck pain was 37%. This finding of our study alerts Physical Therapists towards the concurrent correction of anterior head translation in patients with chronic pain.

Keywords: Neck pain, anterior head translation, duration of symptoms, lateral cervical x-ray.

Introduction:

Normal neck function underpins successful performance of activities of daily living. Neck pain is a common symptom and produces a high level of morbidity by affecting occupational and recreational activities [23]. It is increasing in intensity, frequency and severity of episodes. As people are increasingly sedentary, live fast-paced and hectic lives, they place more stress and strain on the upper back and neck regions of their spines. Fejer R, Kyvik KO, Hartvigsen J, (2006) [9] conducted a review of different

observational studies of neck pain around the world, which showed that its 1-year prevalence ranged from 16.7 to 75.1 % for the entire adult population (aged 17-70 years) with a mean of 37.2%. The annual incidence of chronic neck pain in general population was found to be 14.6% and each year, 0.6% of the population develops disabling neck pain. Women are more likely than men to develop neck pain with incidence rate ratio of 1.67. In an another study done by Griegel – Morris P et al, (1992) [13].

Address for correspondence:

Dr. Wani S.K.

Associate professor,

Department of Musculoskeletal Physiotherapy,
MGM's Institute Of Physiotherapy,
Aurangabad, Maharashtra, India.

Email: wanisuren@gmail.com

How to cite this article:

Wani S.K., Samal Subrat, Priyanka Ostwal & Rubiya Quazi; Prevalence of Anterior Head Translation in Patients with Neck Pain.. International Journal of current Medical and Applied sciences; 2016, 9(2), 78-83.

Access this Article Online



Quick Response Code

Website:

www.ijcmaas.com

Subject:

Physiotherapy
Sciences

To identify the incidence of postural abnormalities like anterior head translation; revealed that anterior head translation was prevalent in 66% of population and associated with an increased incidence of cervical, interscapular, and headache pain.

Neck posture and movement occurs through interplay between muscle, nerves, and the brain. As neck pain develops there appears to be a reduction in our ability to properly place and correct head and neck posture towards a more neutral and therefore balanced position. Dolan K, Green A, (2006) [6] has stated that when the posture or integrity of the neck is compromised, it is easily susceptible to strain, tension, fatigue leading to neck pain.

Edmondston S et al, (2007) [7]; Solomonow M, (1998) [38] have identified anterior head translation as a clinical entity that is a significant factor in a variety of musculoskeletal pain syndromes. Since we live in a forward facing world, the repetitive use of computers, TV, video games, trauma and even backpacks have forced the body to adapt to a forward head posture. Restak RM, (1979) [34] has stated that repetitive movements in a certain direction will strengthen nerve and muscle pathways to move that way more readily. It is the repetition of forward head movements combined with poor ergonomic postures and/or trauma that causes the body to adapt to anterior head translation.

Ideally, the head should sit directly on the neck and shoulders, like a golf ball sits on a tee. The weight of the head is more like a bowling ball than a golf ball, so holding it forward, out of alignment, puts a strain on your neck and upper back muscles. The result can be muscle fatigue and an aching neck. Because the neck and shoulders have to carry this weight all day, there is isometric contraction, causing neck muscles to lose blood, get damaged, fatigue, strain, and cause pain. In addition, Gore DR, et al, (1986) [12] have found out that AHT (anterior head translation) flattens the normal neck curve, resulting in disc compression, damage and early arthritis. Harrison DD et al, (1999) [18] have said that inn cervical biomechanics, AHT is increased with forward head posture, forward flexion (x-axis rotation), or a combination of both. The effect of posture on health is becoming more evident. The consequence of those observations had already been estimated by John Lennon et al, (1994) [17] as that many symptoms, including pain, may be moderated or eliminated by improving posture”.

Therefore the accurate measurement of position of head on neck is essential to correct the posture and to advise the exercises for cervical spine. Harrison DE et al, (2002) [17] have shown various methods for assessing the position of head on neck (Anterior head translation) such as the linear excursion measurement device (LEMD) which measures the displacement of C7 spinous relative to the tragus or helix of the ear or to the posterior aspect of the eye, body postural photographs where either the C7 or

Acromio Clavicular – joint of the shoulder is measured relative to the External Auditory Meatus or similar location, the CROM (cervical range of motion) device, a simple plumb line measurement of the ear to the shoulder, a horizontal angular measurement of the C2 spinous relative to T1 or C7, and lateral cervical x-ray analysis where the horizontal displacement of either C1 or C2 is compared to a vertical line originating at T1 or C7 respectively. Traditional lateral cervical radiography is one of the valid and reliable methods of assessing the anterior head translation (Johnson GM, 1998) [24].

Proper posture maintains the musculoskeletal balance equilibrium and poor posture might result in muscle imbalance that causes a faulty relationship among various body parts. Forward head posture is one of the most common cervical abnormalities that predispose individuals toward pathological conditions like neck pain. Because of these associated problems, assessment of head posture has become increasingly important in clinical practices in evaluating and designing treatment regimens for patients with neck pain. Furthermore there is very little literature available discussing the anterior head translation as a cause or effect of chronic neck pain. Therefore this study aimed at to find out the prevalence of anterior head translation in Indian patients with chronic neck pain using traditional lateral Cervical-radiography, and hence aiding in deciding the physiotherapeutic exercise regime.

Methodology:

Study design: Cross - sectional Observational Study

Study setting: Musculoskeletal Physiotherapy (Out Patient Department), MGM Hospital, Aurangabad.

Study Population: This study has been done on 88 Patients, comprising of 56 females and 32 males.

Participants: In the present study 88 participants from the Physiotherapy Department aged 30 and above complaining of neck pain since at least 1week to several months were recruited. Head postures of these individuals were evaluated by using the traditional lateral cervical radiograph. An informed and written consent was obtained from each subject to participate in this study. All the patients were evaluated for duration of symptoms and pain using Numerical Pain rating scale. The position of head on neck was assessed by measuring anterior head translation on a lateral cervical radiograph provided by the patients to determine the prevalence of forward head posture.

Materials used: Cervical x-ray (lateral view) , Measuring scale(mm), Erasable marker.

Inclusion criteria:

Both Male and Female patients with neck pain (acute, sub acute and chronic stage), between the age group of 30 – 70 years, were included in the study and their lateral cervical radiographs were taken.

Exclusion criteria:

Patients having congenital cervical deformities, cervical fracture or trauma, cervical surgery, idiopathic scoliosis, bone cancer, torticollis, neurological motion disorders, any hearing impairment, visual impairment not corrected by glasses, and temporo – mandibular surgery were excluded from the study.

Anterior Head Translation (AHT) measurement:

Each participant had a lateral cervical X-ray taken by an experienced radiographer at the Department of Diagnostic Radiology of the MGM Hospital.

In cervical biomechanics, AHT is increased with forward head posture, forward flexion (x-axis rotation), or a combination of both. The amount of AHT is measured with a standard radiograph in a lateral view. AHT can eliminate the soft-tissue constraint when compared with the other surface landmark measuring method [19].

Procedure:

To measure AHT on the X-ray film the posterior superior body of the C2 vertebra and the posterior inferior body of the C7 vertebra were marked in the radiograph by an erasable marker. AHT was measured as the horizontal distance of the posterior superior body of the C2 vertebra to a vertical line drawn superiorly from the posterior inferior body of C7 vertebra (Figure 1, appendix A). All evaluated radiographs were original in quality and were numbered.

Validity and reliability: This measurement method has a high intra observer reliability (ICC = 0.99-1.00) and interpreter reliability (ICC = 0.99-1.00), with small mean absolute differences of the observer measurement (Harrison DE et al, 2002; Yip Ch et al, 2008; Wilford CH et al, 1996) [16,43].

Results:

Statistical analysis was carried out using SPSS (statistical package for social sciences) Version 14, using formulae for prevalence and Pearson’s correlation test. The results are described in the tables (appendix B). Characteristics of 88 subjects are shown in Table 1 out of which 64% were female and 36% were males. The age of the participants was 40.44 ± 8.035 ranging from 30 to 70 years (Values throughout the article are expressed as mean ± standard deviation). The duration of the neck pain was 4.011 ± 5.63 weeks, ranging from 1 week to several months. Across the entire sample of neck pain population, the mean of the Anterior Head Translation (AHT) was found to be 11.01 ± 7.66 mm on lateral cervical radiographs. The percentage of prevalence of anterior head translation in patients with neck pain was found to be 37%, with a positive correlation (r value = 0.019) between anterior head translation and duration of symptoms, and a negative correlation (r value = -0.024) was found between the anterior head translation and the intensity of symptoms.

Table 1: Mean and Standard deviation of patients with AHT, Duration of symptoms, and NPRS.

| Descriptive data | MALES | | FEMALES | |
|----------------------|-------|-------|---------|------|
| | Mean | SD | Mean | SD |
| AHT (mm) | 10.97 | 7.545 | 11.01 | 7.66 |
| Duration of symptoms | 4.01 | 5.61 | 4.01 | 5.63 |
| NPRS | 5.088 | 1.88 | 5.125 | 1.88 |

Table 2 : Associations between AHT from X-ray measurement with NPRS (Numerical pain rating scale) and Duration of symptoms of patients with neck pain .

| Descriptive data | Duration of Symptoms | | NPRS | |
|------------------|----------------------|---------|--------|---------|
| | r | p-Value | r | p-Value |
| AHT | 0.019 | 0.861 | -0.024 | 0.823 |

Discussion:

According to Deed E. Harrison (1994) [16] in asymptomatic persons, the AHT was found to be nearly 15mm. And the patients with AHT >15mm were considered as having forward head posture and may be associated with neck pain.

Yip CH et al, (2008); Willford et al, (1996) [43] further stated that poor head posture is generally

accepted as one of the causes for neck pain because poor postural awareness and habitual poor postures may result in greater loading on the supporting structure and may cause sensitization and pain. Currently, upright posture evaluation is recommended as part of the comprehensive physical examination of the cervical spine. However, head posture is a difficult concept to capture, which is usually assessed subjectively or by complicated

procedures. A clinically convenient, reliable, and valid assessment tool for head posture is needed.

This study aimed at finding out the prevalence of forward head posture in patients with neck pain using cervical lateral radiograph. In the present study 88 neck pain patients with mean age of 40.44 ± 8.035 years with mean duration of symptom of 4.011 ± 5.63 weeks were included. Out of which 36% were males whereas 64% were female patients.

In this study the Anterior head translation is calculated by using lateral cervical x-ray film. The mean anterior head translation in a present sample of neck pain population was found to be $11.01 \text{ mm} \pm 7.66 \text{ mm}$ and is considered less as compared to the standardized reference values given by Deed E. Harrison (1994) [16] in his study on 252 asymptomatic subjects, where he found that the average amount of AHT was 15.0mm (standard deviation of 10.0mm).

Consistent with the findings of Yip et al (2008) [43], the mean AHT demonstrated in his study was 18.0 mm, which lies within the range of 15 to 21 mm. However, Harrison et al(1994) [16] suggested that anterior weight bearing of the head causes flexion of the lower cervical spine and extension of the upper-cervical spine, which increases magnitude of AHT. A number of studies also recommended that subjects with forward head posture were more prone to neck disorder or abnormal stress over the neck structure.

Chiu et al., (2002) [3]; Good et al., (2001); Haughie et al., (1995) [23] have stated in their studies that the forward head posture is commonly observed in patients with neck disorders and along with neck flexion it is thought to be a risk factor for neck pain. Headaches have also been investigated regarding their association with a forward head posture, including cervicogenic, post-concussional and chronic tension-type headaches.

This is supported by the systematic review done by Silva et al (2010) [35] identifying 11 studies in which measurements of head posture were compared in individuals with and without neck pain. The review found that only 4 out of the 11 studies demonstrated a greater angle of forward head posture in the neck pain group.

In addition, the study carried out by Straker et al (2009) [37] also found no difference between the neck posture of adolescents with prolonged neck pain and symptom free adolescents. In another study done by Hanten, Olson et al's (2000) [15] contrastingly suggest symptom free subjects had a greater forward head posture than subjects with cervical pain. In contrast, Silva et al (2009) and Lau et al (2010) [35] found a significant difference in the cervical posture of an adult neck pain patient population when compared to a matched asymptomatic group.

Looking at the quality of the research, it is appropriate to point out that methodological weaknesses exist in a number of the studies in which no significant difference head posture is

contradictory, and the notion that neck pain patients exhibit significant forward head postural changes is far from conclusive from the literature to date.

Further according to our results the prevalence of AHT in neck pain patients was only 37 % out of which 58% were females and 42% were males.

This result of our study was not exactly comparable with the findings of Griegel-Morris P et al (1992) [13], who aimed to identify the incidence of postural abnormalities of the cervical, thoracic, and shoulder regions in two age groups of healthy subjects and to explore whether these abnormalities were associated with pain revealed postural abnormalities, were prevalent forward head was 66%, and those with an anterior head translation had an increased incidence of cervical, interscapular, and headache pain.

Furthermore the association of AHT with duration of symptoms and NPRS was also explored with Pearson correlation coefficient test to confirm the correlation between AHT (measured on lateral cervical x-ray) with duration of symptoms and NPRS of patients with neck pain and we found a moderate positive correlation of AHT with duration of symptoms ($r = 0.019$, $p = 0.86$) and a negative correlation with NPRS ($r = -0.021$, $p = 0.82$) the correlation evaluated in this study suggested that more the duration of neck pain more chances of increase in AHT and developing forward head posture however AHT cannot be correlated with the intensity of neck pain. In fact as per our findings the chronic neck pain patients demonstrating less intensity of neck pain and were found to have increased AHT.

The research study by Harrison DE et al (2005) [16] done on "The Impact of Positive Sagittal Balance in Adult Spinal Deformity"; addressed the correlation between individuals with forward head posture (positive sagittal balance) to their overall health and symptoms. An individual's measured health status decreased significantly with a forward head posture and was proportional to the amount of anterior head translation.

In future study can be done on large sample size and by measuring the degree (angle) of anterior head translation. In future cause and effect relationship for head posture and pain and disability can be investigated, which is crucial for clinicians to assess and treat their patients, and comparison of AHT in symptomatic patients and asymptomatic individuals can be done.

In summary of this study, the prevalence of forward head posture is 37% out of 88 patients with neck pain. Additionally, an increased AHT percentage in Indian neck pain females was 58% and in males was 42% out of 33 patients which shows more AHT than normal range. In addition, increased AHT was found in females with age group of 30 to 40 years as well as in males. According to this study females having

chronic neck pain are more prone for development of forward head posture than males.

Conclusion:

Prevalence of anterior head translation in neck pain patients was found to be 37% out of which 58% (N=19) & 42% (N=14) were females and males respectively. A moderate positive correlation was observed in AHT and duration of neck pain however a negative relationship was found between intensity of neck pain and AHT. This study alerts physical therapy practitioners to address the correction of anterior head translation along with conventional treatment in patients with neck pain.

Acknowledgement

We sincerely acknowledge our deep sense of gratitude and hearty thanks to the Principal, MGM's Institute of Physiotherapy, Orthopaedicians, MGM Hospital, Aurangabad for his co-operation throughout the study. The authors express their sincere gratitude to all then patients who kindly participated in the study.

References:

1. Anabela G. Silva, T. David Punt, Paul Sharples, João P. Vilas-Boas, et al.; *Archives of Physical Medicine and Rehabilitation*, 2009;90 (4):669-674.
2. Burgess-Limerick, R., Gaze angle, heterophoria, and neck biomechanics: implications for the height of visual displays. Paper presented at the Proceedings of the 36th Annual Conference of the Ergonomics Society of Australia Inc., Adelaide, Australia. 2000.
3. Chiu TW, Ku WY, et al. A Study on the Prevalence of and Risk Factors for Neck Pain Among University Academic Staff in Hong Kong, *Journal of Occupational Rehabilitation* 2002; 12(2): 77- 91.
4. Cohen J. *Statistical power analysis for the behavioral sciences*, 2nd edn. Hillsdale, NJ: Lawrence Erlbaum, 1988; ch 3,,75-78.
5. Devereaux MW. Neck pain. *Med Clin North Am.*;2009;93:273-284.
6. Dolan, KJ, & Green, A. Lumbar spine repositioning sense: The effect of a 'slouched' posture. *Manual Therapy* 2006; 11: 202-207.
7. Edmondston, S.J., Chan, H.Y., Ngai, G.C.W., Warren, M.L.R., Williams, J.M., Glennon, S., & Netto, K. ; Postural neck pain: An investigation of habitual sitting posture, perception of 'good' posture and cervicothoracic in aesthesia . *Manual Therapy*; 2007; 12: 363-371.
8. Sheilah Hogg – Johnson et al , The Burden and Determinants f Neck Pain. *Eur Spine J.* 2008; 17(1): 39–51.
9. Fejer R, Kyvik KO, Hartvigsen J. The prevalence of neck pain in the world population: A systematic critical review of the literature. *Eur Spin J.*2006;15(6):834-48.
10. Fernandez-de-las-Penas, C., Alonso-Blanco, C., Cuadrado, M. L., & Pareja, J. A. . Forward head posture and neck mobility in chronic tension-type headache: a blinded, controlled study. *Cephalalgia*; 2006;26:314–319.
11. Garrett TR, Youdas JW, Madson TJ ; Reliability of measuring forward head posture in a clinical setting. *J Orthop Sports PhysTher* ; 1993;17:155–60.
12. Gore DR, Sepic SB, Gardner GM. Roentgenographic findings of the cervical spine in asymptomatic people. *Spine*; 1986; 6: 591-69.
13. Griegel-Morris P, Larson K, Mueller-Klaus K, Oatis CA. Incidence of common postural abnormalities in the cervical shoulder, and thoracic regions and their association with pain in two age groups of healthy subjects. *PhysTher* 1992;72:425-31.
14. Grimmer, K. An investigation of poor cervical resting posture. *Aust J Physiother* ;1997;43: 7-16.
15. Hanten, W. P., Olson, S. L., Russell, J. L., Lucio, R. M., & Campbell, A. H. 2000. Total excursion and resting head posture: normal and patient comparisons. *Archives of Physical Medicine Rehabilitation*; 81: 62-66.
16. Harrison DE, Harrison DD, Cailliet R, Troyanovich SJ, Janik TJ, Holland B. Cobb method or Harrison posterior tangent method: Which to choose for lateral cervical radiographic analysis. *Spine*; 2000;25(16):2072-78.
17. Harrison DE, Holland B, Harrison DD, Janik TJ. Further Reliability Analysis of the Harrison Radiographic Line Drawing Methods: Crossed ICCs for Lateral Posterior Tangents and AP Modified Risser-Ferguson. *J Manipulative PhysiolTher*, 2002, 25(2):93-98.
18. Harrison DD et al, The efficacy of cervical extension compression traction combined with diversified manipulation and drop table adjustments in the rehabilitation of cervical lordosis – a pilot study. *J Manipulative PhysiolTher* 1994; 17(7): 454-464.
19. Harrison DD, Harrison SO, Croft AC, Harrison DE, Troyanovich SJ. Sitting biomechanics part I: Review of the literature. *J Manipulative PhysiolTher.* 1999;22(9):594-609.
20. Horton, S.J., Johnson, G.M., & Skinner, M.A.; Changes in head and neck posture using an office chair with and without lumbar roll support. *Spine* 2010; 35(12); 542-548.
21. Chaudhary Bakhtiar S, et al, Forward head posture is the cause of 'straight spine syndrome' in many professionals. *Indian J Occupat and Environmental Med* 2000 ; 4 (3):122-124.
22. Jackson BL, Harrison DD, Robertson GA, Barker WF. Chiropractic biophysics lateral cervical film analysis reliability. *J Manipulative PhysiolTher* 1993;16:384.
23. Jesse Cannone; Prognostic factors for neck pain in general practice. *The Official Guide To Back and Neck Pain*, Pain 2004;110(3):639-45.
24. Johnson GM.; The correlation between surface measurement of head and neck posture and the anatomic position of the upper cervical vertebrae. *Spine.* 1998;23(8):921-27.
25. John Lennon, BM, MM, C. Norman Shealy, Roger K. Cady, William Matta Richard Cox and William F. Simpson ; Postural and Respiratory Modulation of Autonomic Function, Pain & Health. *AJPM* 1994, 4. (1).
26. J McAviney, et al, Determining the relationship between cervical lardosis and neck complaints. *J Manipulative Physiol Ther*, 2005 (Mar); 28 (3): 187 - 193.
27. T.T.W. Chiu, et al (2002), A study on the prevalence of and risk factors for neck pain among university academic staff in Hong Kong. *Journal of Occupational Rehabilitation*; 2002; Jun; 12 (2): 77 – 91.

28. W.Y.Lee, et al ; *The relationship between forward posture and temporomandibular disorders.* *JOrofac Pain* 1995 (Spr); 9 (2): 161 - 167.
29. *Damaging effects of forward head posture.* *Mayo Clinic Health Letter.* March 2000, 18, 3.
30. Merskey, H., & Bogduk, N. (Eds.). *Classification of Chronic Pain; Descriptions of Chronic Pain Syndromes and Definitions of Pain Terms.* Seattle: IASP Press.1994.
31. Griegel Morris P et al; *Incidence of common postural abnormalities in the cervical, shoulder and thoracic regions and their association of pain in two age groups of healthy subjects.* *PhysTher.* 1992 Jun; 72 (6): 425 - 31.
32. PP Vidal, W Graf and A Berthoz.; *The Orientation of the Cervical Vertebral Column in Unrestrained Awake Animals.* *Experimental. Brain Research.* Springer-Verlag 1986.
33. Rene Cailliet. ; *Neck and Arm Pain.* FA Davis Company. Philadelphia,1991.
34. Restak R.M. *The Brain: The Last Frontier* NY Warner Books.1979.
35. Silva A, Sharples P, and Johnson M ; *Studies comparing surrogate measures for head posture in individual with and without neck pain.* *Physical Therapy Reviews*,2010, 15: 12-22.
36. Silva A, Punt T, Sharples P, Vilas-Boas and Johnson M : *Head posture and neck pain of chronic nontraumatic origin: A comparison between patients and pain-free persons.* *Archives of Physical Medicine and Rehabilitation* 2009; 90: 669-674.
37. Straker L, O'Sullivan P, Smith A and Perry M : *Relationship between prolonged neck/shoulder pain and sitting spinal posture in male and female adolescents.* *Manual Therapy*,2009, 14: 321-329.
38. Solomonow M ; *The short term effects of joint mobilization on acute mechanical low back pain dysfunction in collegiate athletes.* *Spine*;1998, 23(23): 2552-2562.
39. Szeto, G. P. Y. Straker, L. M. & Raine, S. *A field comparison of neck and shoulder postures in symptomatic and asymptomatic office workers.* *Applied Ergonomics*, 2002, 33, 75 – 84.
40. "The Impact of Positive Sagittal Balance in Adult Spinal Deformity", *Spine Magazine*, 30(18):2024-2029.
41. Watson, D. H., &Trott, P. H. *Cervical headache: an investigation of natural head posture and upper cervical flexor muscle performance.* *Cephalalgia*.
42. Willford CH, Kisner C, Glenn TM, Sachs L. *The interaction of wearing multifocal lenses with head posture and pain.* *J Orthop Sports PhysTher.* 1996; 23 (3): 194 - 99.
43. Yip CH, Chiu TT, Poon AT. *The relationship between head posture and severity and disability of patients with neck pain.* *Man Ther.* 2008;13 (2):148 -54.

Conflict of interest:

No source of funding. None declared.