Conservative Management of Mechanical Neck Pain in a Helicopter Pilot

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BACKGROUND: Acute and chronic spinal symptoms such as neck pain may limit flying performance significantly and disqualify the pilot from flight duty. Mechanical neck pain is very common among pilots because of their exposure to vibration, $+G_Z$ forces, helmet weight, poor neck posture during air combat maneuvers, previous neck injuries, and poor treatment plans for such injuries. Successful treatment of such injuries requires appropriate therapeutic procedures as well as an aeromedical assessment. The aim of this case study was to demonstrate the benefits of conservative procedures such as spinal manipulation and mobilization therapy (SMMT) and exercise therapy (ET) in treating chronic mechanical neck pain in an Iranian commercial helicopter pilot.

CASE REPORT: A 36-yr-old male patient presented to the clinic with moderate, intermittent nonradicular chronic neck pain and limited range of motion over a 2-yr period. The patient was treated with cervical and upper thoracic SMMT followed by home ET for 5 wk. After this period, the patient reported significant recovery and improvement in range of motion in his neck.

DISCUSSION: Mechanical neck pain is very common among helicopter pilots. Although Air Force and Navy waiver guides recommend nonsteroidal anti-inflammatory medications as well as SMMT and ET, there are currently very few published studies that examine the benefits of manual and exercise therapy for treating mechanical neck pain in commercial and military pilots. Based on the results of this study, it seems that SMMT and ET may be a safe and effective in treatment of uncomplicated mechanical neck pain in helicopter pilots.

KEYWORDS: mechanical neck pain, manipulation, mobilization, helicopter pilot.

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Airplanes, helicopters, cars, and other transportation systems can apply low-frequency vibrations to the entire body of pilots and passengers. Prolonged exposure of the human body to this type of vibration can cause musculoskeletal disorders.[13] Helicopters, in particular, are increasingly used for rescue, sightseeing tours, military operations, passenger, and logistic transportation. Recent studies have demonstrated that neck pain is common among helicopter pilots because they are exposed to a higher amount of low-frequency vibration and noise levels than fixed-wing aircraft pilots.[10] Neck pain in pilots can cause personal suffering and reduce pilots' operational capabilities and productivity, which can result in high financial costs because of loss of active flight crews.[12] The causes of musculoskeletal injuries in helicopter pilots include long-duration flight times, G forces, whole-body vibration, helmets and headgear, and awkward postures during the flight.[2] In addition to the use of nonsteroidal anti-inflammatory medications (NSAIDs), over-the-counter (OTC) analgesics, and muscle relaxants, the U.S. Air Force and the U.S. Navy Waiver Guides recommend spinal manual therapy and exercise therapy to manage mechanical nonradicular neck and back pain.[14,15] In spite of these recommendations and the high prevalence of neck pain among pilots, I only found one study that examined the use of cervical manipulation and exercise therapy for treating mechanical neck pain in a military fighter pilot.[7] This case report presents the case of a commercial helicopter pilot who was suffering from uncomplicated mechanical neck pain. The patient responded well to conservative interdisciplinary management, including spinal mobilization and manipulation therapy (SMMT) in the cervical and upper thoracic regions, therapeutic exercise therapy (ET), and myofascial release therapy.

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CASE REPORT

The patient consented to publication of his personal health information without revealing personal identifiers. A 36-yr-old male commercial helicopter pilot presented to the clinic with moderate, intermittent chronic neck pain and limited range of motion that had lasted for 2 yr. Initially, the pain was very mild and then it started to get worse gradually with increasing muscle stiffness. The pain was mostly located on the left side of his neck. The pain was dull and aching, distributing in a nonradicular pattern over the trapezius area bilaterally. It was aggravated by head rotation and lateral flexion mostly to the left side while checking the "six" position during flying and turning the head toward the left shoulder when driving and flying. Rest and using NSAIDS and OTC analgesics alleviated the pain for a short period. The pain did not interfere with the patient's sleep or awaken him.

On a few occasions, his neck pain resulted in a headache. He described such headaches as nonthrobbing without nausea, dizziness, or visual disturbance. They were mostly localized in the occipital area. They were responsive to NSAIDS and rest. The patient's visual analog pain scale, which is used to rate the severity of neck pain, ranged from 2/10 to 5/10. He did not report radicular pain, weakness, numbness, or paresthesia in his upper or lower extremities. He also reported no dizziness, vertigo, visual disturbance, or bladder or bowel incontinency.

The neck disability index score was 16%.[16] The patient did not report any history of head trauma, major accident, or serious systemic illnesses. He was very healthy and fit, undertaking aerobic and strengthening exercises regularly in the upper extremities. He indicated that he did not smoke or drink. He also denied using any kind of food supplements or energy drinks. Moreover, he indicated that he enjoyed his job and had a healthy social life.

On physical exam, there was no obvious muscular atrophy or misalignment deformity in his cervical, thoracic, or lumbar spine. During active neck movement, he experienced reduced range of motion (ROM) on left rotation, right rotation, and left lateral flexion due to pain and muscle stiffness. The doctor observed similar limitations in the above movements on passive ROM.

On motion palpation, the doctor also observed muscle stiffness and tenderness on the left side of the cervical and upper thoracic regions, including the superior and middle trapezius muscles and the sternocleidomastoid muscle. The neck pain distribution was not in a dermatome pattern. Special tests such as the axial compression test and the Spurling and Hoffman tests were negative. Neurological exam, including sensory, motor, and deep tendon reflexes in the upper and lower extremities, was negative.[9] Neurological special tests such as the Romberg test, heel to toe walk test, rapid alternating movements, and heel to shin test were normal.

There were no signs of infection or brain stem ischemia. A vertebral basilar artery test was negative. Importantly, there were no absolute contraindications (**Table I**) or red flag symptoms (**Table II**) in this patient that would preclude cervical spine manipulation.[7,11] Based on the neck pain task force classification, the patient was diagnosed with grade I mechanical neck pain with cervico-thoracic region dysfunction.[9] Considering the absence of any red flags for neck pain, the moderate level of the patient's symptoms, the lack of neurological signs and symptoms, and the lack of past traumatic events, imaging was not necessary, and the conservative management of the patient was started by the physician. Based on the patient's medical history and physical examination, no evidence contraindicated using SMMT in this patient.

Table I. Absolute Contraindications to Performing Cervical Spine Manipulation.

• Acute fracture	• Tumor
• Acute soft tissue injury	• Vascular disease
• Dislocation	• Infection
• Osteoporosis	• Vertebral artery abnormalities
• Ligamentous rupture	• Acute myelopathy
• Ankylosing spondylitis	• Connective tissue disease
• Instability	• Recent surgery
• Rheumatoid arthritis	• Anticoagulant therapy

Consistent with the U.S. Navy Aeromedical Reference and Waiver Guide[15] and the U.S. Air Force Waiver Guide,[14] cervical and upper thoracic SMMT, along with home ET, were started for this patient. The patient received treatment 3 times a week for 5 consecutive weeks, completing 15 sessions in total. Each treatment session included heat pack therapy, cervical spine mobilization, upper thoracic spine manipulation, and a home exercise therapy prescription. The patient was advised to stop flying during the treatment period.

The delivery methods for manipulation and mobilization are very different. Joint mobilization requires applying smaller movements within the joint's physiological range at regular intervals, whereas manipulation requires applying a single

Table II. Red Flags for Neck Pain.

• Coughing or sneezing makes the pain radiate
• Progressive neurological deficits
- Loss of muscular strength
- Paresthesia, facial/intraoral anesthesia or paresthesia
- Loss of bowel or bladder control
- Loss of balance and coordination, dizziness, or vertigo
- Dysarthria, dysphagia
- Visual disturbances, blurred vision, diplopia
- Drop attacks
• Signs of instability or spinal cord compromise
- Inability to move neck due to severe pain or feeling instability
• Nausea
• Tinnitus
• Any symptom listed above aggravated by position or movement of the neck
• Vascular deficit, previous diagnosis of vertebral basilar insufficiency
• Signs or symptoms of infection
• History of trauma, accident, blunt or whiplash injuries, neck surgery, cervical dislocation, cancer, bone disease, neurological disease, systemic diseases, immunosuppressed patients such as HIV/AIDS, inflammatory arthritis, or recent corticosteroid use
• No change or worsening of patients' symptoms after multiple manipulations

The presence of any red flag in a patient necessitates further investigation before starting treatment.

impulse of high velocity and low amplitude beyond the physiological range of the joint.[5]

In each session, the patient was instructed to lay in the prone position on the manipulation table. Initially, the heat pack was applied on the cervical and upper thoracic regions for 10 min. Then the patient was positioned in the supine position with his arms crossed over his chest and each hand on the opposite shoulder. The patient's knees were positioned in 90° flexion with the plantar surface of both feet resting on the table. The palm of the doctor's hand contacted over the spinous process of T4. The other hand stabilized the head, neck, and upper thoracic spine of the patient. Gently, the doctor gradually flexed the thoracic spine until the doctor felt slight tension in the tissues at the doctor's contact point. Then the doctor applied a high-velocity, low-amplitude force downward toward the table in a cephalad direction.[6] This procedure usually results in a popping or cracking sound.

Subsequently, the cervical spine was mobilized in the supine position. The doctor held the patient's head in a secure position with his stabilization hand. Then the doctor positioned his other hand (the therapy hand) on the appropriate contact point (here, the desirable facet joint). The point of contact for the doctor's therapy hand was the radial side of the index finger's proximal phalanx. The contact point on the patient's cervical spine was the facet joint that needed to be mobilized. With the stabilization hand, the doctor rotated the patient's head and upper cervical spine around the therapy hand contact to bring the facet joint to tension. Finally, low amplitude force was applied gently to the targeted facet joint through the therapy hand contact point. The mobilization pressure was held for less than 1 s and then released.[6] Usually, the mobilization process was repeated one or two times for the same segment and then continuously repeated for all the other cervical segments. Both sides of the cervical spine were mobilized in this manner.

After the SMMT procedure, the doctor performed a myofascial release technique on the cervical muscles, such as the sternocleidomastoid, scalene, and trapezius.[1] The goals of this technique were to stretch and release muscle stiffness, increase blood perfusion, and improve cervical rotations and lateral flexions. At the end of the session, the ROM in active and passive cervical movements was measured, and the results were compared to the cervical ROM prior to the session as well as to previous sessions.

Before discharging the patient, the doctor prescribed home ET.[12] The patient was instructed in the ET procedure and asked to perform the exercises in front of the physician to confirm that he understood how to perform the exercises properly at home. The ET included stretching exercises for the cervical and pectoral muscles for the first seven sessions. The prescription included stretching three times a day, maintaining the stretch for 10 to 30 s at mild to moderate intensity. The patient was advised against stretching that further aggravated his neck. The home exercise plan was modified at each consecutive visit based on the patient's progress.

After eight therapy sessions, the patient's neck pain had been alleviated and his cervical ROM had improved to some extent. At that point, the doctor added cervical muscle strengthening isometric exercises to the patient's ET plan. He instructed the patient to perform isometric exercises by standing upright and pushing his head against a ball that was held against the wall, holding the push for 5-10 s. The patient was advised to perform this exercise for all cervical motions (e.g., flexion, extension, lateral flexion, and rotations on the right and left sides). He was also advised to perform the strengthening exercises described above for two to three sessions per week. Each session consisted of two sets of those exercises with two repetitions for each position. The patient was further advised to exercise at low to mild intensity and avoid inducing or provoking pain.

After 15 sessions, the patient had full cervical ROM largely without pain, except for mild residual tenderness to palpation on the middle trapezius muscle on the left side. The neck disability index was 0/50. The patient was advised that he could return to flying, but he should continue ET at least twice per week. The patient returned for an office visit 1 mo later and demonstrated full recovery in his cervical ROM with no pain. He reported no subsequent cervical or upper thoracic pain for the 6 mo following completion of this treatment.

DISCUSSION

Mechanical neck pain is one of the most common neck disorders. It affects about 45 to 54% of the general population at some point in their lives. Studies have demonstrated that neck pain is especially common in helicopter pilots. The prevalence of neck pain in the global military helicopter community has been reported in the range of 56.6–84.5%.[12] Factors such as whole-body vibration, poor cockpit sitting posture (e.g., "helo-hunch"), and the use of night-vision goggles and helmet-mounted displays have all been found to contribute to neck pain and muscle fatigue.[12] Although helicopter pilots experience lesser $+G_z$ forces while flying than fighter pilots, they are exposed to lower vibration frequencies with greater amplitudes. A flight test on a helicopter with a typical pilot configuration demonstrated that the low-frequency resonant vibration on the pilot's helmet was consistent with the frequency range of human abdominal and spine resonant frequencies. Moreover, recent studies have demonstrated that long-term exposure to such frequencies may lead to occupational health issues such as damage to the pilot's spine and neck.[3,12] These neck issues can cause severe pain and fatigue, which can interfere with a pilot's safe operation of his aircraft. Ultimately, it can result in disability, and grounding of pilots and cabin crew.

The anatomical sources of mechanical neck pain include the muscles, ligaments, and joints of the cervical spine.[7] Mechanical neck pain has been defined as local, nonradicular pain in the area between the neck and shoulder which is aggravated by neck movement or palpation of the cervical spine. A patient's medical history and physical exam can help the doctor differentiate uncomplicated mechanical neck pain from radicular neck pain. Usually diagnostic and laboratory tests are not necessary for the evaluation of grade I and II mechanical neck pain unless red flags are present.[8] Prolonged use of NSAIDs, OTC pain

medications, and muscle relaxants are not recommended because their side effects may disqualify pilots from flying. Immobilization by a cervical collar is also not recommended for the treatment of neck pain.[7] Upper thoracic manipulation, cervical mobilization, exercise therapy, and the myofascial release technique are commonly used by chiropractors, osteopaths, and physiotherapists to treat uncomplicated neck pain. It appears that all of these methods provide long-term benefits for neck pain without causing moderate or serious adverse side effects.[1,4,17] In addition, one study demonstrated that neck and shoulder exercise therapy for neck pain is effective in reducing new cases of neck pain in air force helicopter pilots.[12] Although the U.S. Air Force and Navy waiver guides recommend manual therapy, physical therapy, and exercise therapy to manage neck and back pain in pilots, the effectiveness of manual therapy has not been reported in the literature.[14,15] In addition, based on waiver guides, manual therapy and exercise therapy do not disqualify pilots from flying. It is theoretically reasonable that pilots with mechanical neck pain may benefit from conservative therapeutic methods such as spinal manipulation or mobilization, the myofascial release technique, and neck muscle strength and endurance exercises.

In conclusion, although mechanical neck pain is a very common musculoskeletal symptom among helicopter pilots, there are only a few studies and almost no case reports addressing the benefits of manual therapy in management of neck pain in helicopter pilots. This case study describes the treatment of a helicopter pilot who was suffering from prolonged mechanical neck pain. The pain was interfering with his job performance and was not alleviated completely by using OTC pain killers and NSAIDs. The patient responded favorably to conservative management therapy, including cervical mobilization and upper thoracic manipulation, exercise therapy, and myofascial release therapy. It seems that applying these conservative therapies can help with management of function and pain for non-complicated mechanical neck pain in helicopter pilots. Hopefully this report will lead to further study of the conservative treatment and prevention of neck pain in pilots.

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REFERENCES

1. Ajimsha MS, Al-Mudahka NR, Al-Madzhar JA. Effectiveness of myofascial release: systematic review of randomized controlled trials. J Bodyw Mov Ther. 2015; 19(1):102–112.
2. Butler BP, Allen NM. Long duration exposure criteria for head supported mass. Fort Rucker (AL): U.S. Army Aeromedical Research Lab; 1997:59.
3. Chen Y, Zimcik D. Development of adaptive seat mounts for helicopter aircrew body vibration reduction. J Vib Control. 2009; 15(12):1809–1825.
4. Fernández-de-las-Peñas C, Palomeque-del-Cerro L, Rodríquz-Blanco C, Gómez-Conesa A, Miangolarra-Page JC. Changes in neck pain and active range of motion after a single thoracic spine manipulation in subjects presenting with mechanical neck pain: a case series. J Manipulative Physiol Ther. 2007; 30(4):312–320.
5. Gemmell H, Miller P. Relative effectiveness and adverse effects of cervical manipulation, mobilisation and the activator instrument in patients with sub-acute non-specific neck pain: results from a stopped randomised trial. Chiropr Osteopat. 2010; 18:20.
6. Gibbons P, Tehan P. Manipulation of the spine, thorax and pelvis. Edinburgh (Scotland): Churchill Livingstone; 2000:68-69.
7. Green BN, Dunn AS, Pearce SM, Johnson CD. Conservative management of uncomplicated mechanical neck pain in a military aviator. J Can Chiropr Assoc. 2010; 54(2):92–99.
8. Guzman J, Haldeman S, Carroll LJ, Carragee EJ, Hurwitz EL, et al. Clinical practice implications of the Bone and Joint Decade 2000–2010 Task Force on neck pain and its associated disorders: from concepts and findings to recommendations. Spine (Phila Pa 1976). 2008; 33(4, Suppl.):S199–S213.
9. Haldeman S, Carroll L, Cassidy JD, Schubert J, Nygren A. The Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders: executive summary. Spine. 2008; 33(4, Suppl.):S5–S7.
10. Hart SG. Helicopter human factors. In: Wiener EL, Nagel DC, editors. Human factors in aviation. San Diego (CA): Academic Press; 1988: 591–638.
11. Puentedura EJ, March J, Anders J, Perez A, Landers MR, et al. Safety of cervical spine manipulation: are adverse events preventable and are manipulations being performed appropriately? A review of 134 case reports. J Man Manip Ther. 2012; 20(2):66–74.
12. Salmon DM, Harrison MF, Neary JP. Neck pain in military helicopter aircrew and the role of exercise therapy. Aviat Space Environ Med. 2011; 82(10):978–987.
13. Seidel H. Selected health risks caused by long-term, whole-body vibration. Am J Ind Med. 1993; 23(4):589–604.
14. U.S. Air Force Waiver Guide. U.S. Air Force, 2014. [Accessed Jan. 2015]. Available from: http://www.wpafb.af.mil/shared/media/document/AFD-130118-045.pdf.
15. U. S. Navy Aeromedical Reference and Waiver Guide. 2014. [Accessed Jan. 2015]. Available from:http://www.med.navy.mil/ sites/nmotc/nami/arwg/Documents/Waiver Guide/ Waiver_Guide_Complete_130604.pdf.
16. Vernon H. The Neck Disability Index: state-of-the-art, 1991–2008. J Manipulative Physiol Ther. 2008; 31(7):491–502.
17. Vernon H, Humphreys K, Hagino C. Chronic mechanical neck pain in adults treated by manual therapy: a systematic review of change scores in randomized clinical trials. J Manipulative Physiol Ther. 2007; 30(3):215–227.