Evidence-based Practice Initiative – MCU

Multi-Cervical Unit (MCU) specific references:


ABSTRACT: A knowledge of neck strength is important for developing conditioning protocols and for evaluating the relationship between neck strength and head and neck injury, but very few studies have examined neck strength in relationship to athletic participation. The purpose of this study was to quantify isometric neck strength in collegiate and high school athletes. We hypothesized that (a) male athletes would have significantly greater neck strength than females; (b) collegiate athletes would be significantly stronger than high school athletes; and (c) neck strength would vary significantly with head posture. A total of 149 subjects participated (77 men and 72 women; 90 college and 59 high school level). Flexion, extension, and lateral flexion neck strength were measured in neutral and rotated head and neck postures. Neck strength varied significantly according to participants’ sex, age, and posture ($p < 0.05$). Male college students were stronger than those in all other groups (female college students, male high school students, and female high school students). The average female neck strength was 61, 54, and 56% of the average male neck strength for extension, flexion, and lateral flexion, respectively. High school athletes' neck strength was 75, 68, and 65% of collegiate athletes' neck strength for extension, flexion, and lateral flexion, respectively. On average, neck strength was the greatest for extension compared with other force directions. The subjects showed large variation in neck strength with posture, but in general, there were no consistent trends among the subjects. This finding suggests that those whose neck strength was considerably lower in non-neutral postures may consider training to increase strength in rotated postures. These data provide important baseline information for future studies evaluating injury risk or training protocols.

Use of MCU: musculoskeletal evaluation of cervical strength (isometric).


ABSTRACT:
Objective: To investigate the efficacy of intermittent cervical traction in the treatment of chronic neck pain over a 12-week follow-up.
Design: A randomized controlled trial.
Setting: Hospital-based outpatient practice.
Subjects: Seventy-nine patients with chronic neck pain.
Interventions: Subjects were randomly assigned to either experimental group (n=39, mean
age=50.5±9.8) or control group (n=40, mean age=48.8±9.1). Experimental group received intermittent cervical traction and control group received infrared irradiation alone; twice a week over a period of six weeks. 

**Outcome measurements:** The values of Chinese version of the Northwick Park Neck Pain Questionnaire (NPQ), verbal numerical pain scale (VNPS), and cervical active range of motion (AROM) were measured at baseline, six-week and 12-week follow-up. 

**Results:** No significant differences were found between the two groups in the NPQ \( (P>0.05) \), VNPS \( (P>0.05) \) and AROM \( (P>0.05) \).

*Use of MCU: musculoskeletal evaluation of cervical range of motion and isometric strength.*

---


**ABSTRACT:**

**Study Design:** Controlled laboratory study using a cross-sectional, repeated-measures design. 

**Objectives:** To quantify maximal voluntary isometric neck forces in healthy subjects and individuals with whiplash-associated disorder (WAD), using an objective measurement system to evaluate the test-retest properties of these strength measurements and to assess the links between neck strength, pain, kinesiophobia, and catastrophizing in patients with WAD. 

**Background:** The prognosis of WAD is difficult to predict due to a lack of objective measurement methods and to our limited understanding of Neck Disability Index (NDI), the Tampa Scale for Kinesiophobia (TSK), and the Pain Catastrophizing Scale (PCS). 

**Methods and Measures:** Fourteen subjects with chronic WAD grade I or II and an age-matched, healthy group (n = 28) participated in this study. Cervical strength was measured with the Multi-Cervical Unit (MCU) in 6 directions, and pain was measured with a visual analog scale. Individuals in the WAD group completed the Neck Disability Index (NDI), the Tampa Scale for Kinesiophobia (TSK), and the Pain Catastrophizing Scale (PCS). 

**Results:** Significant deficits in strength were observed for the individuals in the WAD group compared to the healthy group, particularly in extension, retraction, and left lateral flexion \( (P<.05) \). The MCU demonstrated good intra-tester reliability for the healthy group \( (ICC = 0.80-0.92) \) and the WAD group \( (ICC = 0.85-0.98) \), and small standard errors of measurement for both groups. No significant association was found between neck strength and NDI, TSK, and PCS. 

**Conclusion:** The MCU demonstrated good test-retest properties for healthy subjects and individuals with WAD. Cervical strength was lower in individuals with WAD; however, the strength deficits were not clearly linked with psychological factors. 

*Use of MCU: musculoskeletal evaluation of cervical strength (isometric).*

ABSTRACT: Neurologic, radiological inspection of 30 men (middle age is 36,5 ± 7,5) with a muscular-tonic syndrome at a cervical osteochondrosis. According to an index of a muscular syndrome on 3 degrees of weight 3 groups of patients are allocated. Diagnostics by device MCU allows to reveal authentically and precisely dysfunction in the certain group of muscles of a neck and to spend their adequate training, promoting duly correction. The medical technique of device MCU leads to full recourse muscular-tonic and liquidations of a painful syndrome at muscular-tonic syndrome I and to II degree, significant recourse of expressiveness of syndromes at sick of a cervical osteochondrosis with muscular-tonic a syndrome of III degree. Formation of a correct muscular stereotype provides achievement of proof medical effect, preventive maintenance of a reflex painful syndrome in a cervical department of a backbone and prevention of chronic disease.

Use of MCU: musculoskeletal evaluation of cervical range of motion and isometric strength and treatment to increase strength.


ABSTRACT:
Introduction: Neck injuries signify a physical fitness and human system problem with high operational significance. The prevalence of injuries in tactical aviators has been reported to be as high as 84%, although few report engaging in neck-specific strengthening exercises. It is generally believed that neck strengthening may result in fewer neck injuries. This study was designed to investigate the effects of 12-wk of cervical strength training (3 d per wk\(^{-1}\)) on isometric strength, dynamic strength, and hypertrophy in a sample of military men.

Methods: Participants were tested for each of the above-mentioned variables before and after the training program as well as at 4-wk intervals, and results were compared with a control group that performed no cervical resistance training.

Results: Results indicated significant improvements in isometric strength and dynamic strength, typically occurring as early as 4-wk and improving throughout the 12-wk period. Modest increases in neck circumference were also noted.

Discussion: These findings have implications for military personnel at risk of neck injury in their occupational activities.

Use of MCU: musculoskeletal evaluation of cervical strength (isometric and dynamic) treatment to increase strength.

ABSTRACT:
Objective: To compare two neck strength training modalities.
Background: Neck injury in pilots flying high performance aircraft is a concern in aviation medicine. Strength training may be an effective means to strengthen the neck and decrease injury risk.
Methods: The cohort consisted of 32 age-height-weight matched participants, divided into two experimental groups; the Multi-Cervical Unit (MCU) and Thera-Band tubing groups (THER), and a control (CTRL) group. Ten weeks of training were undertaken and pre-and post-isometric strength testing for all groups was performed on the MCU. Comparisons between the three groups were made using a Kruskal-Wallis test and effect sizes between the MCU and the THER groups and the THER and CTRL groups were also calculated.
Results: The MCU group displayed the greatest increase in isometric strength (flexion 64.4%, extension 62.9%, left lateral flexion 53.3%, right lateral flexion 49.1%) and differences were only statistically significant ($p < 0.05$) when compared to the CTRL group. Increases in neck strength for the THER group were lower than that shown in the MCU group (flexion 42.0%, extension 29.9%, left lateral flexion 26.7%, right lateral flexion 24.1%). Moderate to large effect sizes were found between the MCU and THER as well as the THER and CTRL groups.
Conclusions: This study demonstrated that the MCU was the most effective training modality to increase isometric cervical muscle strength. Thera-Band tubing did however produce moderate gains in isometric neck strength.

Use of MCU: musculoskeletal evaluation of cervical strength (isometric) and treatment to increase strength.

___________________________________________


ABSTRACT:
Objective: To investigate the effect of transcutaneous electrical nerve stimulation (TENS) on acupuncture points and neck exercise in chronic neck pain patients.
Design: A randomized clinical trial.
Setting: Hospital-based practice.
Subjects: Two hundred and eighteen patients with chronic neck pain.
Interventions: Subjects were randomized into three groups, receiving either (1) TENS over the acupuncture points plus infrared irradiation (TENS group); (2) exercise training plus infrared irradiation (exercise group); or (3) infrared irradiation alone (control); twice a week for six weeks. Outcome measures: The values of verbal numeric pain scale, Northwick Park Neck Pain Questionnaire, and isometric neck muscle strength were assessed before, at the end of the six-week treatment, and at the six-month follow-up.
Results: Results demonstrated that after the six-week treatment, significant improvement in the
verbal numerical pain scale was found only in the TENS group (0.60+2.54, p=0.027) and the exercise group (1.57+2.67, p<0.001). Though significant reduction in Northwick Park Neck Pain Questionnaire score was found in all three groups, post-hoc tests showed that both the TENS and the exercise group produced better improvement (0.38 +0.60% and 0.39 +0.62% respectively) than the control group (0.23+0.63%). Significant improvement (p= <0.001 to 0.03) in neck muscle strength was observed in all three groups, however, the improvement in the control group was not clinically significant and it could not be maintained at the six-month follow-up.

**Conclusions:** After the six-week treatment, patients in the TENS and exercise group had a better and clinically relevant improvement in disability, isometric neck muscle strength, and pain. All the improvements in the intervention groups were maintained at the six-month follow-up.

**Use of MCU:** musculoskeletal evaluation of cervical strength (isometric) and treatment to increase strength.

---


**ABSTRACT:**

**Study Design:** A randomized controlled trial with single-blind outcome assessments.

**Objective:** To evaluate the efficacy of a neck exercise program in patients with chronic neck pain.

**Summary of Background Data:** The effect of exercise for patients with chronic neck pain has been investigated in a number of studies. The efficacy is, however, questionable.

**Methods:** A total of 145 patients were randomly allocated into an exercise (n = 67) and a non-exercise (control) group (n = 78). Patients in the control group were given infrared irradiation and neck care advice. In addition to infrared irradiation and advice, patients in the exercise group had undergone an exercise program with activation of the deep neck muscles and dynamic strengthening of the neck muscles for 6 weeks. Subjective pain and disability and isometric neck muscle strength were measured at baseline, 6 weeks, and 6 months. Analysis was by intention-to-treat.

**Results:** At week 6, the exercise group had a significantly better improvement in disability score ($P = 0.03$), subjective report of pain ($P = 0.01$), and in isometric neck muscle strength ($P = 0.57–0.00$) in most of the directions than the control group. However, significant differences between the two groups were found only in the subjective report of pain and patient satisfaction at the 6-month follow-up.

**Conclusions:** At week 6, patients with chronic neck pain can benefit from the neck exercise program with significant improvement in disability, pain, and isometric neck muscle strength in different directions. However, the effect of exercise was less favorable at 6 months.

**Use of MCU:** musculoskeletal evaluation of cervical strength (isometric) and treatment to increase strength.

ABSTRACT:
Summary of Background Data: People with chronic neck pain respond variably to exercise therapy. The likely success of exercise for chronic neck pain cannot be predicted.
Study Design: This prospective study tested the relationship between patient characteristics assessed prior to intervention and response to an exercise program for chronic neck pain.
Objectives: To investigate whether responders differed from non-responders with respect to presenting characteristics.
Method: Data were collected on 336 consecutive patients receiving physiotherapy for chronic neck pain. Subject age, sex, duration of symptoms, compensation status, Neck Disability Index (NDI) item and total scores, cervical spine range of movement, and isometric strength were assessed prior to treatment. Response to therapy was defined as a change of 14/100 or more NDI points. Subjects received a progressive, concentric/ eccentric, strengthening program using computerized equipment designed for cervical spine assessment and rehabilitation. Logistic regression formulae for predicting outcome at the completion of the program were developed on one sample (n = 122) data and tested on another (n = 214).
Results: In the first sample, NDI scores and item responses predicted response or non-response with approximately 70% accuracy. When tested on the second sample, a prediction model using NDI item scores predicted responders (positive predictive value 56%) and non-responders (negative predictive value 74%) with considerable loss of responder prediction accuracy. Participants with low initial NDI scores (higher functional ability) appeared to benefit less from the exercise program.
Conclusions: Functionally able patients may benefit less from exercise for chronic neck pain than those with greater functional limitations.

Use of MCU: musculoskeletal evaluation of cervical range of motion and isometric strength and treatment to increase strength.


ABSTRACT: External stimulus/loading initiates adaptations within skeletal muscle. It has been previously found that the cervical area has the highest loading while performing flying maneuvers under +Gz. The first purpose of this study was to examine the neck muscle response to the physical environment associated with flight training, incorporating limited exposure to +Gz force, in a Pilatus PC-9 aircraft. The second purpose was to examine the short-term range of movement (ROM) response to flight training. Isometric cervical muscle strength and ROM was monitored in 9 RAAF pilots completing an 8-mo flight-training course at Pearce Airbase in Western Australia, and in 10 controls matched for gender, age, height, and weight. Isometric cervical muscle strength and ROM were measured at baseline and at 8 mo
using the multi-cervical rehabilitation unit (Hanoun Medical, Downsview, Ontario, Canada). Results indicated that an increase in pilot neck strength was limited to flexion while in a neutral position. No strength changes were recorded in any other site in the pilots or for the controls. These findings suggest that short-term exposure to the physical environment associated with flight training had a limited significant effect on increasing isometric cervical muscle strength. No significant changes were observed in pilot ROM, indicating that short-term exposure to flight does not affect ROM.

*Use of MCU: musculoskeletal evaluation of cervical strength and range of motion.*


**ABSTRACT:**

**Objective:** To examine the test–retest reliability and construct validity of cervical active range of motion and isometric neck muscle strength as measured by the Multi Cervical Rehabilitation Unit (Hanoun Medical Inc., Ontario).

**Design:** A cross-sectional study.

**Setting:** Institutional practice.

**Subjects:** Twenty-one patients with neck pain and 25 healthy volunteers.

**Methods:** After a trial-run session, active range of motion (AROM) was measured in the subsequent two sessions, with 2–3 days in between. During each session, three measurements were taken for each direction (flexion, extension, lateral flexions and rotations). The measurement of isometric strength was after a 15-minute break following completion of the measurement of AROM. Three measurements were made for each of the six directions (flexion, extension, lateral flexions, protraction and retraction). The software of the Multi Cervical Rehabilitation Unit automatically recorded and calculated the maximum AROM and isometric strength.

**Results:** There was a good to high level of reliability in the measurement of AROM for both groups of subjects, with intraclass correlation coefficients (ICCs) ranging from 0.81 to 0.96. Results also demonstrated very good to excellent reliability in isometric strength measurement (ICCs ranged from 0.92 to 0.99). Moreover, there was a significant difference in isometric neck muscle strength ($p = 0.001$) and in AROM ($p = 0.034$) between the two groups.

**Conclusions:** The Multi Cervical Rehabilitation Unit was found to be reliable and valid for testing the cervical active range of motion and isometric neck muscle strength for both normal and patient subjects.

*Use of MCU: musculoskeletal evaluation of cervical range of motion and isometric strength.*

**ABSTRACT:**

**Objective:** To describe the maximal isometric neck muscle strength in healthy Chinese volunteers, in six different directions, as measured by a Multi Cervical Rehabilitation Unit.

**Design:** A standardized cross-sectional observational study.

**Setting:** A university rehabilitation unit.

**Subjects:** Ninety-one healthy volunteers aged 20–84.

**Methods:** During the measurement the subject was instructed to do three consecutive steady contractions as hard as possible, with a 10-second rest in between each contraction and a 2-minute rest between different directions. The peak isometric strength for each of the six directions (flexion, extension, lateral flexions, protraction and retraction) was calculated.

**Results:** No significant difference was found in muscle strength between different age groups. Isometric muscle strength in the direction of right lateral flexion was significantly greater than that to the left in men ($p = 0.030$), but no difference was found in women ($p = 0.297$). Isometric strength in all directions in men was 1.2–1.7 times that than in women (all $p < 0.028$). Correlations between physical measurements (height and weight) and strength values were all insignificant in both genders.

**Conclusion:** Men have approximately 20–70% greater isometric neck muscle strength than women. Both men and women can maintain high levels of cervical muscle strength in six different directions up to their seventh decade. There is no significant correlation between physical measurements and isometric neck muscle strength.

*Use of MCU: musculoskeletal evaluation of cervical strength (isometric).*

---

**Supporting Evidence:**

Davison M, De Nardis R: **A twelve-item symptom intensity rating scale for cervical spine dysfunction.** Spine. 2011;36(5):E307-E312

**ABSTRACT:**

**Study Design:** Retrospective cohort study.

**Objective:** To evaluate the internal consistency, construct validity, and test-retest reliability of the Symptom Intensity Rating Scale (SIRS) in a clinical sample of people with cervical spine dysfunction.

**Summary of Background Data:** The SIRS was developed by experienced clinicians at the Melbourne Whiplash Centre as an assessment tool and outcome measure for people with cervical spine dysfunction. The 12-item scale rates the severity of neck, shoulder, shoulder blade and arm pain, neck and arm weakness, headaches dizziness nausea neck stiffness, pins and needles, and numbness.

**Methods:** Internal consistency was explored by item-item and corrected item-total correlations, Cronbach alpha, and Principle Components analysis. Construct validity was examined by
correlation of SIRS scores with Neck Disability Index (NDI) scores, and with cervical range of motion (ROM). Test-retest reliability was determined by examining a subset of patients with NDI scores that changed by less than 10% points.

**Results:** A dataset of 397 cases was analyzed. Missing data for the SIRS was very low. Item intercorrelations ranged from weak (<0.3) to moderate (>0.6). Corrected item-total correlations ranged from 0.35 to 0.63. Cronbach alpha was 0.85. Principle Components Analysis identified 2 correlated subscales. SIRS total scores were correlated with NDI scores at initial \((r = 0.574)\) and final \((r = 0.757)\) assessment. Correlations between initial SIRS scores and ROM were absent or weak, and correlations between final SIRS and ROM were stronger. Test-retest reliability Intraclass Correlation Coefficient (2,1) of the SIRS for a subset of 65 cases with unchanged NDI scores was 0.858 (95% CI, 0.766–0.913). The standard error of measurement was 8 points and the Minimum Detectable Change (90% confidence) 18.7 points.

**Conclusion:** The SIRS is a sufficiently reliable, internally consistent scale that can be used to make valid inferences about symptom severity in ambulatory patients with cervical spine dysfunction.

---


**ABSTRACT:** Neck pain is a growing aeromedical concern for military forces on an international scale. Neck pain prevalence in the global military helicopter community has been reported in the range of 56.6 – 84.5%. Despite this high prevalence, historically, research examining helicopter aircrews has focused predominantly on low back pain. A number of recent studies have emerged examining flight-related factors that are hypothesized to contribute to the development of flight-related neck pain. Loading factors such as the posture adopted during flight, use of night vision goggles, and vibration have all been found to contribute to neck pain and muscular fatigue. Prolonged or repeated exposure to these loading factors has been hypothesized to perpetuate or contribute to the development of neck pain. Despite the high number of helicopter aircrew personnel that suffer from neck pain, very few individuals seek treatment for the disorder. The focus of medical personnel should, therefore, be directed toward a solution that addresses not only the issue of muscular fatigue, but the hesitancy to seek treatment. Previous research in military and civilian populations have used exercise therapy as a treatment modality for neck pain and have found improved endurance capacity in the neck musculature and reduced self-reported neck pain.

---

Al-Bedewy EF, Al-Shorbagy NH: **A recommended training program for developing cervical muscles strength and it effect on performance effectiveness of defense against bridge block and waist turnover.** World J Sport Sci. 2010;3(S):995-1002
ABSTRACT: Bridging is one of the basic wrestling skills as it is used in defense or attack. This skill is directly dependent on neck muscles as over-arching helps in better results either in attack or in defense. This research aimed at designing a training device for cervical muscles strength to be used in a training program, identifying the effect of the training program on developing cervical muscles strength and identifying the effect of the training program on developing the technical performance of bridge block and waist turnover. Sample was purposefully chosen from Gharbia Greco-roman Wrestling Team (16 wrestlers) and divided randomly into two groups (8 wrestlers each) to form the experimental and control group. The researchers used the quasi-experimental approach. Results showed statistical significant differences between the control and experimental groups on the post-tests in favor of the experimental group. The recommended program is characterized by calibrating exercises according to the individual differences and abilities of each wrestler. This allowed for adaptation and development of cervical muscles strength. The increase in cervical muscles strength, in turn, led to performing bridges more effectively as support was on the feet from one point and the forehead from the other. This increases the load on cervical muscles. With the increase of cervical muscles strength, there was a correspondent increase in performing bridges. The researchers recommend the use of the recommended training program and the device for developing cervical muscles strength.


ABSTRACT:

Context: Proper conditioning of the neck muscles may play a role in reducing the risk of neck injury and, possibly, concussions in contact sports. However, the ability to reliably measure the force-time–based variables that might be relevant for this purpose has not been addressed.

Objective: To assess the between-days reliability of discrete force-time–based variables of neck muscles during maximal voluntary isometric contractions in 5 directions.

Design: Cohort study.

Setting: University research center.

Patients or Other Participants: Twenty-six highly physically active men (age = 21.6 ± 2.1 years, height = 1.85 ± 0.09 m, mass = 81.6 ± 9.9 kg, head circumference = 0.58 ± 0.01 m, neck circumference = 0.39 ± 0.02 m).

Intervention(s): We used a custom-built testing apparatus to measure maximal voluntary isometric contractions of the neck muscles in 5 directions (extension, flexion, protraction, left lateral bending, and right lateral bending) on 2 separate occasions separated by 7 to 8 days.

Main Outcome Measure(s): Variables measured were peak force (PF), rate of force development (RFD), and time to 50% of PF (T50PF). Reliability indices calculated for each variable comprised the difference in scores between the testing sessions, with corresponding 95% confidence intervals, the coefficient of variation of the typical error of measurement (CVTE), and intraclass correlation coefficients (ICC [3,3]).

Results: No evidence of systematic bias was detected for the dependent measures across any movement direction; retest differences in measurements were between 1.8% and 2.7%, with corresponding 95% confidence interval ranges of less than 10% and overlapping zero. The
CVTE was lowest for PF (range, 2.4%–6.3%) across all testing directions, followed by RFD (range, 4.8%–9.0%) and T50PF (range, 7.1%–9.3%). The ICC score range for all dependent measures was 0.90 to 0.99.

**Conclusions:** Discrete variables representative of the force-generating capacity of neck muscles under isometric conditions can be measured with an acceptable degree of reliability. This finding has possible applications for investigating the role of neck muscle strength-training programs in reducing the risk of injuries in sport settings.


ABSTRACT: The purpose of this study was to compare surface electromyography (EMG) activation levels of selected neck muscles for two common neck-training modalities (Thera-Band and Cybex). Seventeen asymptomatic subjects (eight men and nine women) with a mean age 23.4 years were recruited. EMG activation normalized to maximal voluntary isometric contraction (MVIC) was measured with subjects performing exercises with green, blue, and black Thera-Bands and 50%, 70%, and 90% of 3RM for the Cybex modality. Four variables were used to depict exercise intensity: average and peak EMG activation in the concentric and eccentric phases. Significant differences (P # 0.05) in EMG activation were evident when comparing intensities of the Cybex modality with each other and when comparing the Cybex intensities with Thera-Band intensities in most cases. Minimal differences were found among differing intensities of Thera-Band. Thera-Band exercise resulted in low-level EMG activation (range, flexion 3.8–15.7% MVIC; range, extension 20.2–34.8% MVIC); therefore, such exercise may be useful in rehabilitation programs. Cybex exercise (range, flexion 20.9–83.5% MVIC; range, extension 40.6–95.8% MVIC) may be useful for occupation-related injury prevention. However, exercise prescription should be undertaken with care as the mechanical loading on passive spinal structures is unknown.


**Aim of the Guideline**
The Orthopaedic Section of the American Physical Therapy Association (APTA) has an ongoing effort to create evidence-based practice guidelines for orthopaedic physical therapy management of patients with musculoskeletal impairments described in the World Health
Organization’s International Classification of Functioning, Disability, and Health (ICF).

The purposes of these clinical guidelines are to:

Describe evidence-based physical therapy practice including diagnosis, prognosis, intervention, and assessment of outcome for musculoskeletal disorders commonly managed by orthopaedic physical therapists

- Classify and define common musculoskeletal conditions using the World Health Organization’s terminology related to impairments of body function and body structure, activity limitations, and participation restrictions

- Identify interventions supported by current best evidence to address impairments of body function and structure, activity limitations, and participation restrictions associated with common musculoskeletal conditions

- Identify appropriate outcome measures to assess changes resulting from physical therapy interventions in body function and structure as well as in activity and participation of the individual

- Provide a description to policy makers, using internationally accepted terminology, of the practice of orthopaedic physical therapists
- Provide information for payers and claims reviewers regarding the practice of orthopaedic physical therapy for common musculoskeletal conditions

- Create a reference publication for orthopaedic physical therapy clinicians, academic instructors, clinical instructors, students, interns, residents, and fellows regarding the best current practice of orthopaedic physical therapy


ABSTRACT:

Background: Neck muscles are responsible for directing the head and for maintaining its posture. As a result, the muscular mechanical output is correspondingly moderate but not insignificant as evidenced by a positive therapeutic effect when reconditioning is indicated.

Special Features: Cervical muscle strength (CS) measurement and interpretation occupy a unique niche in the domain of muscle performance. Due to the wide variety of devices and protocols, a vast range of strength scores has been reported, denying the formation of reliable reference values.

Methods: A literature search based on the keywords “cervical/head/neck” strength was conducted. The search yielded 34 relevant papers which were reviewed according to preset criteria.
**Summary:** Overall studies indicate that compared to normal subjects patients suffering from neck-related disorders present with significant reduction in CS, whereas women are weaker than men by about 40%. Noteworthy a significant drop in CS in both sexes is delayed until the seventh decade. In terms of its reproducibility, CS findings have been investigated using primarily relative parameters, and hence, the associated error is not yet established. Therefore, application of CS as a clinical outcome measure, particularly for assessing change due to intervention, should be critically conducted.


**ABSTRACT:**

**Objective:** To determine if conservative treatments (manual therapies, physical medicine methods, medication, and patient education) relieved pain or improved function/disability, patient satisfaction, and global perceived effect in adults with acute, subacute, and chronic mechanical neck disorders (MND) by updating 11 systematic reviews of randomized controlled trials (RCT).

**Methods:** Two independent authors selected studies, abstracted data, and assessed methodological quality from computerized databases. We calculated relative risks and standardized mean differences (SMD) when possible. In the absence of heterogeneity, we calculated pooled effect sizes.

**Results:** We studied 88 unique RCT. The mean methodological quality scores were acceptable in 59% of the trials. We noted strong evidence of benefit for maintained pain reduction [pooled SMD -0.85 (95% CI -1.20, -0.50)], improvement in function, and positive global perceived effect favoring exercise plus mobilization/manipulation versus control for subacute/chronic MND. We found moderate evidence of long-term benefit for improved function favoring direct neck strengthening and stretching for chronic MND, and for high global perceived effect favoring vertigo exercises. We noted moderate evidence of no benefit for botulinium-A injection [pooled SMD -0.39 (95% CI -0.25, 0.47)]. We found many treatments demonstrating short-term effects.

**Conclusion:** Exercise combined with mobilization/manipulation, exercise alone, and intramuscular lidocaine for chronic MND; intravenous glucocorticoid for acute whiplash associated disorders; and low-level laser therapy demonstrated either intermediate or long-term benefits. Optimal dosage of effective techniques and prognostic indicators for responders to care should be explored in future research.
Netto KJ, Burnett AF, Coleman JL: **Neck exercises compared to muscle activation during aerial combat maneuvers.** Aviat Space Environ Med. 2007;78:478-84

**ABSTRACT:**

**Introduction:** Performing specific neck strengthening exercises has been proposed to decrease the incidence of neck injury and pain in high performance combat pilots. However, there is little known about these exercises in comparison to the demands on the neck musculature in flight.

**Methods:** Eight male non-pilots performed specific neck exercises using two different modalities (elastic band and resistance machine) at six different intensities in flexion, extension, and lateral bending. Six Royal Australian Air Force Hawk pilots flew a sortie that included combinations of three +Gz levels and four head positions. Surface electromyography (EMG) from selected neck and shoulder muscles was recorded in both activities.

**Results:** Muscle activation levels recorded during the three elastic band exercises were similar to in-flight EMG collected at +1 Gz (15% MVIC). EMG levels elicited during the 50% resistance machine exercises were between the +3 Gz (9–40% MVIC) and +5 Gz (16–53% MVIC) ranges of muscle activations in most muscles. EMG recorded during 70% and 90% resistance machine exercises were generally higher than in-flight EMG at +5 Gz.

**Discussion:** Elastic band exercises could possibly be useful to pilots who fly low +Gz missions while 50% resistance machine mimicked neck loads experienced by combat pilots flying high +Gz ACM. The 70% and 90% resistance machine intensities are known to optimize maximal strength but should be administered with care because of the unknown spinal loads and diminished muscle force generating capacity after exercise.

---


**ABSTRACT:**

**Study Design:** Cross-sectional descriptive study.

**Objectives:** To determine the maximal isometric strength of the flexor, extensor, and rotator muscles of the cervical spine in healthy females of working age to document reference values for diagnostic and rehabilitation purposes.

**Background:** Reference values for the isometric strength of the cervical muscles have often been based on small samples. To date, reference values for rotator muscles of the cervical spine have not been published.

**Methods and Measures:** The group consisted of 220 volunteer healthy females in 4 age groups (20-29 years, n = 57; 30-39 years, n = 51; 40-49 years, n = 51; 50-59 years, n = 61) from Jyväskylä, Finland. Isometric cervical muscle strength in flexion, extension, and rotation was evaluated with a specially designed measurement system.

**Results:** Across all age groups, mean (±SD) maximal isometric neck strength was 73.8 ± 20.0 N in flexion and 190.8 ± 31.3 N in extension. Mean (±SD) rotation strength was 8.1 ± 2.3 Nm to the right and 7.9 ± 2.3 Nm to the left. Absolute strength values did not differ among the age
groups. A weak but significant correlation between body mass and neck flexion ($r = 0.31, P<.01$) and extension ($r = 0.25, P<.01$) strength was found. Intra-tester reliability varied from 0.87 to 0.96.

Conclusions: Women aged 20 to 59 years appear to have similar absolute isometric neck muscle strength levels. Thus these values can be used as reference for the working-age female population.