REPEATABILITY AND NORMATIVE VALUES OF MEASURING SCATIC NERVE EXCURSION DURING THE STRAIGHT LEG RAISE WITH B-MODE ULTRASOUND
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PURPOSE: To assess the repeatability and normative values for scatic nerve excursion measured with B-mode ultrasound during SLR.

RELEVANCE: SLR assesses the mechanism sensitivity of the lumbarosacral nerve roots and scatic nerve. However, no in vivo data exist on how much nerve movement occurs during SLR. Nerve movement has been repeatedly measured in the upper-limb nerves and scatic nerve during a modified slump test using a process called sckle tracking. However, small movements occurred during the slump test, and these may be more amenable to successful tracking. Because greater movement is likely during SLR using knee extension, repeatability is required.

METHODS: Sixteen asymptomatic subjects (9 men; range, 16-68 years) lay on a randomly selected side, and the scatic nerve was scanned in the midposterior thigh. Nerve excursion was measured during knee extension from 90° to 0°, with the ankles in plantar grade, with the hip flexed (HF) to 30° and 60°. Subjects returned 1 week later, and measurements were repeated. Ultrasound data were analyzed offline using frame-by-frame cross-correlation analysis. ICC, r, was used to assess repeatability with standard error measurements (SEMs) and 95% confidence intervals (CIs).

RESULTS: In 30° of HF, excursion ranged from 6.4 to 14.7 mm (mean ± SD, 9.92 ± 2.2 mm), ICC was 0.92 (95% CI: 0.79, 0.97), and SEM was 0.69. In 60° of HF, excursion ranged from 5.1 to 20.2 mm (mean ± SD, 12.4 ± 4.4 mm), ICC was 0.96 (95% CI: 0.90, 0.99), and SEM was 0.87.

CONCLUSIONS: Excellent repeatability of measures was found. Large variations in scatic nerve excursion during the SLR occurred. Greater nerve excursion ensued with increased ranges of HF, which is in contrast to studies in the upper limb, when less nerve excursion occurred with more proximal tensioning.

IMPLICATIONS: Measurement of scatic nerve excursion during SLR using sckle tracking is repeatable. Values found can be compared to future studies on symptomatic populations.

SONOGRAPHY ASSESSMENT OF THE MEDIAN NERVE DURING CERVICAL LATERAL GLIDE AND LATERAL FLEXION: IS THERE A DIFFERENCE IN NEURODYNAMICS?
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PURPOSE: The purpose of this study was to show that a cervical lateral glide (CLG) causes a larger amount of median nerve movement in the arm and hand region than contralateral flexion (CLF) of the cervical spine.

RELEVANCE: There is clinical evidence that the CLG improves neurodynamics and alleviates pain in patients who suffer from neurogenic arm pain. However, effective nerve movement has not been investigated using ultrasound imaging (US).

METHODS: In this study, 27 healthy volunteers (mean ± SD age, 24.7 ± 3.25 years;19 women) were recruited. The Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire was answered. Transverse and longitudinal median nerve movement during CLF and CLG were measured by US. In the longitudinal plane at the middle and distal forearm, Transverse at upper arm and wrist. RESULTS: In the transverse plane, CLG produced a significantly larger amount of median nerve movement than CLF (ie, at the wrist: CLF, 0.9 ± 0.30 mm; CLG, 1.2 ± 0.35 mm; P = 0.005). Even in the longitudinal plane, the amount of median movement is larger for both locations of measurement when applying the CLG compared to the application of CLF (ie, at the middle forearm: CLF, 2.2 ± 0.64 mm; CLG, 3.3 ± 1.0 mm; P = 0.005).

CONCLUSIONS: The results of this study show that CLG resulted in a significantly larger amount of nerve movement in the arm and hand region compared to the movements observed with CLF.

IMPLICATIONS: Manual therapists may be aware that CLG and CLF both influence the median nerve in the arm and hand region. In clinical decision making, it should be taken into account that CLG results in a larger movement of the median nerve in the wrist/forearm and the upper arm.

IMPROVING THE MECHANICAL VALIDITY OF RADIAL AND ULNAR NERVE NEURODYNAMIC TESTING: AN OBSERVATION OF STRAIN DURING UPPER-LIMB POSITIONING
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RELEVANCE: The mechanical validity of the radial and ulnar nerve neurodynamic tests is based on their ability to selectively increase strain of the intended nerve. However, this has not been established.

PURPOSE: To determine which upper-limb position results in the greatest strain of the radial and ulnar nerves, respectively, and the greatest difference in strain between the intended nerve and the other 2 nerves.

METHOD: Strain of the median, radial, and ulnar nerves was measured using buckle-force transducers bilaterally in 10 embalmed human cadavers. Each limb was placed in the currently used test position for the radial (scapular depression, elbow extension, arm internal rotation, and wrist flexion) and ulnar (shoulder depression, abduction and external rotation, elbow flexion, forearm pronation and wrist/finger extension) nerves, as well as variations of these tests. Multiple 1-way analyses of variance with Bonferroni post hoc tests compared the mean strain differences between each position for a given nerve and between the 3 nerves in each position.

RESULTS: The current radial nerve test with shoulder abduction and extension, wrist ulnar deviation and thumb flexion (composite position [radial]) produced significantly greater strain of the radial nerve than the current test alone (P<.05) and created the greatest difference in strain between the radial and the other 2 nerves (P<.05). The current ulnar nerve test with shoulder horizontal abduction and the composite position (ulnar) (the current test with shoulder horizontal abduction and internal rotation) produced significantly greater strain of the ulnar nerve compared to the current test alone (P<.05).

CONCLUSION: The composite position (radial), the current ulnar nerve test with shoulder horizontal abduction, and the composite position (ulnar) are mechanically valid.

IMPLICATIONS: The clinical application of these positions should improve detection of radial or ulnar nerve pathology and allow differentiation between the 3 major nerves of the arm in patients with cervicobrachial pain.

CAN PATIENTS WITH SEVERE TENNIS ELBOW BE DIFFERENTIATED ON THE BASIS OF CERVICAL SPINE PALPATION AND NEURODYNAMIC TESTS?
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PURPOSE: To evaluate cervical palpation and neurodynamic test responses in people with unilateral lateral epicondylalgia (LE) of varying pain and disability.

RELEVANCE: Previous studies have shown beneficial effects of treatment by manual therapy applied to the neck or upper-limb neural tracts, but it is unknown whether cervical joint signs or neurodynamic test responses differ according to severity in individuals with and without LE.

METHODS: A cross-sectional, case-control cohort study was used to evaluate physical examination responses of the cervical spine and radial nerve in 164 patients with unilateral LE and 62 age- and gender-matched healthy control participants. Participants were excluded if they had experienced neck pain that interfered with daily activities, work, or saw a healthcare practitioner. Cluster analysis was used to subgroup the LE participants into mild, moderate, or severe subgroups based on the Patient-Rated Tennis Elbow Evaluation (PRTEE) questionnaire. Physical exam-
RATIONALE: Lumbar spine ROM is conventionally described using multiple measures, focusing on the cardinal planes. This is impractical for clinical research, because not all patients present with the same impairments, and these impairments may not be evident with cardinal plane movements.

METHODS: Eleven participants with a recent history of low back pain (LBP) were recruited for 3 testing sessions. In each session, participants performed 3 series of 8 randomly ordered lumbar spine movements (at 45° intervals around the full circle), through the full pain-free ROM. Movements were acquired using a 3-D electromagnetic motion-capture system (TrakSTAR), with sensors at L1 and S1, and measured based on the position of L1 in the transverse plane of S1. For each series of 8 movements, an ellipse (least-squares fit) and a cubic spline were fit to the end-range positions to provide an approximation of the available ROM about the full 360°. The area of these shapes provides a measure of overall ROM, whereas the center point provides a measure of movement distribution/symmetry. Between-session reliability was determined for these 2 variables using the intraclass correlation coefficient (ICC2,1) model.

RESULTS: ICC values were moderate for ellipse center position, 0.57 and for area, 0.58. For spline center position, 0.64 and for area, 0.57.

CONCLUSION: These results, for both the ellipse and spline fit, do not support the use of this measure in its current form.

IMPLICATIONS: These results may have been influenced by the novelty of the movement patterns, as many subjects displayed movement patterns that deviated from the instructions provided. Future research will focus on improving the reliability of these measures by providing subjects with visual feedback during the movement testing.

INTERPRETING THE ROTATION STRESS TEST FOR THE ALAR LIGAMENTS: WHAT SHOULD BE CONSIDERED NORMAL RANGE?

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PURPOSE: The rotation stress test has been proposed as 1 technique for premanipulative screening for alar ligament disruption. Although authors agree that some rotation will occur during the test, estimates of range of rotation during a normal test are subject to variation, with published opinions ranging between 20° and 40°. No formal evaluation has been undertaken to examine the range of rotation occurring during testing of individuals with intact alar ligaments.

RELEVANCE: Understanding maximum range of rotation achieved during a normal rotation stress test is necessary in order to assess whether a test response is indicative of ligament incompetence.

METHODS: Sixteen individuals underwent MRI in neutral and end-range rotation stress test positions using proton density-weighted sequences in a 3-Tesla system. Rotation stress tests were performed in supine lying within the MRI bore. Measurements made followed a standardized protocol relative to position of the axis in axial section, whereby the foramina transversaria were in alignment, creating a reference plane. The position of the occiput in the head-neutral position was estimated by calculating the angle formed between a line joining the foramina lacerum and the reference plane. Measurements were repeated in the test position. Total rotation of the occiput was calculated as the difference in measured angles between the neutral and test positions. The procedure was repeated and measurements recorded on 4 separate occasions. Reliability of measurements for each image was assessed by estimation of ICCs.

RESULTS: Rotation of the occiput relative to a stabilized axis ranged between 1.7° and 21.5°. The mean ± SD range of rotation calculated was 10.6° ± 5.1°. Reliability of measurements ranged from 0.75 to 0.96.

CONCLUSIONS: Normal range of rotation occurring during this alar liga-