

any of the 4 data, respectively ($p > 0.05$). **Conclusion:** These findings indicate that the neck traction can break the pain-guarding reflex in core muscles and increase the stability of the neck spine.

0523FP16

EFFECT OF VARIOUS BOWLER'S THROWING STYLES TO MUSCULOSKELETAL INJURIES OF UPPER EXTREMITY

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Purpose: Biomechanical analysis of various bowler's throwing styles can help understand related injury mechanisms and thus reduce injury risk. This study investigates the effects of various throwing styles to musculoskeletal injuries of upper extremity during tenpin bowling. **Materials and Methods:** Twenty-eight amateur bowlers were recruited and divided into groups, straight ($n=7$), hook ($n=7$), and spin ($n=7$), according to their accustomed bowling style. Field experiments synchronized a data logger and a camcorder to record bowler upper-limb kinematics and EMGs in a bowling game. Bowler wrist and elbow angles and four EMG values (biceps brachii, triceps brachii, and wrist flexor and extensor muscles) in the dominant upper extremity were measured. EMG data were normalized to a maximal voluntary contraction (MVC). **Results:** At ball release, high muscle loads, exceeding 100%MVC, were found in the wrist flexors and extensors of hook bowlers, while high exertion was observed in the wrist extensor of spin bowlers. Spin throws exhibited larger wrist radial deviation and peak-to-peak changes in wrist angular velocities during forward swing than did straight and hook throws. **Conclusion:** Hook throws require relatively high loading in both wrist flexors and extensors through extensors conducting eccentric contraction at ball release. Spin throws generated great wrist angular acceleration for lift movements. Repetitive eccentric extensor contraction of hook throws and great wrist angular acceleration of spin throws may raise the risk of hand-arm injuries. Injury prevention and training strategies should focus on enhancing wrist muscle strength and using proper techniques or devices.

Miscellaneous 3

0523FP17

FACTORS ASSOCIATED WITH FATTY ATROPHY OF SUPRASPINATUS AND INFRASPINATUS IN BRAIN-INJURED PATIENTS

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Purpose: To investigate factors that have correlation with fatty atrophy of supraspinatus or infraspinatus muscle in stroke or braininjured patients. **Materials and Methods:** Sixty hemiplegic patients who had brain lesions over two weeks were included. Ultrasonography of bilateral shoulders was performed with the palm on thigh in sitting position. Fatty atrophy was graded as 0, 1 and 2 by visibility of outer contours, pennate pattern, central tendon and echogenicity. Function of upper extremity was examined by Fugl-Meyer assessment score and Modified Barthel index. Pain-free range of motion, pain, spasticity and motor power of both shoulders, Brunnstrom stage and rotator cuff tear were also measured. **Results:** Fatty atrophy was observed in 20 (33%) out of 60 patients (in 17 supraspinatus and 10 infraspinatus). Inter-rater agreement between two physiatrists

was $k=0.582$ for supraspinatus and $k=0.483$ for infraspinatus. Fugl-Meyer assessment score, Modified Barthel index, Brunnstrom stage and motor power of shoulders were significantly lower in patients with fatty atrophy of supraspinatus or infraspinatus than in patients without atrophy ($p < 0.05$). Rate of rotator tendon tear was higher in hemiplegic side than in contralesional side in both groups, whereas the rate showed no significant difference between two groups. Painfree range of motion, spasticity and hemiplegic shoulder pain did not show significant difference between two groups. **Conclusion:** Fatty atrophy of supraspinatus or infraspinatus muscle has correlation with decreased function of hemiplegic upper extremity. The rate of rotator cuff tear is not increased in patients with fatty atrophy. Therapeutic interventions to prevent fatty atrophy can be applied on hemiplegic shoulder to improve function of upper extremity.

0523FP18

WET-CUPPING: AN ALTERNATIVE THERAPY FOR PAIN RELIEF

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Purpose: To evaluate the response of innate and adaptive immunity after wet cupping histomorphology. Stress is a natural stimulus triggering inhibition of pain. Previous study revealed that wet-cupping attenuated pain. Immune cells have been shown to contain numerous opioid peptides such as beta-endorphin (END), met-enkephalin (ENK), and dynorphin-A (DYN), although the predominant opioid peptide involved in immune-cell mediated antinociception is thought to be END. Inflammation of peripheral tissue leads to increase functionality of opioid receptors on peripheral sensory neurons and to stimulate local production of endogenous opioid peptides. **Materials and Methods:** In this study, 14 Wistar male rats were randomly divided into 7 groups : group 1, control rats without treatment; group 2, response treatment after 1 h; group 3, response treatment after 3 h; group 4, response treatment after 6 h; group 5, response treatment after 24 h; group 6, response treatment after 72 h; group 7, response treatment after 168 h. We counted total mast cell, macrophage, lymphocyte and PMN in each group. **Results:** Macrophages and mast cells are dominant in 6–24 h after treatment. PMN is dominant in 72 h after treatment and lymphocyte dominant in 168 h after treatment. **Conclusion:** We assumed that wet-cupping can relieve pain because of expression immune cells, macrophage and mast cell at acute phase and lymphocyte and PMN at chronic phase.

0523FP20

CLINICAL FEATURES IN CHILDREN AND ADOLESCENTS WITH CORPUS CALLOSAL MALFORMATIONS

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Purpose: Malformation of corpus callosum causes a variety of developmental disorders. Callosal malformations are frequently associated with other central nervous system and/or somatic anomalies. We retrospectively analyzed clinical features of corpus callosal agenesis/hypoplasia and accompanying central nervous system and somatic anomalies. **Materials and Methods:** We reviewed the patients who undertook the brain magnetic resonance imaging (MRI) in our hospital between 2006 and 2011. Thirty-four patients (23 males and 11 females, 1 year to 17 years old) manifested agenesis/hypoplasia of the corpus callosum. **Results:** Callosal malformation was isolated in 12 patients, and was associated with other central nervous system malformations in 13 patients. Both central and non-central nervous system abnormalities were accompanied in 6 patients, while somatic anomalies were accompanied in three patients. Among these 34 patients, 21