111 HEAD INJURY IN A PROFESSIONAL MOTORCYCLIST: Decisions in return to competition.

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The patient is a 27 year old international motorcyclist who was involved in a high speed accident whilst competing in a 500cc Grand prix. When the trackside medical team arrived, he was conscious with a Glasgow Coma Score of 13. He was evacuated to hospital and on arrival deteriorated to a GCS level of 4. Urgent CT Brain scan revealed a base of skull fracture and an acute right subdural haematoma with subtentorial herniation. This was surgically evacuated and he had a prolonged stay in ICU with intracranial pressure monitoring and barbituate coma therapy. Total period of unconsciousness was 14 days. He made a rapid physical and cognitive recovery following this. Neuropsychological (NP) testing 3 months post injury revealed deficits in relation to speed of information processing with other functions such as memory, planning and problem solving being intact. By 6 months post injury, his NP testing had returned to the normal range. Reaction times which had been assessed preinjury had returned to their baseline levels.

Decisions regarding return to competition became the major management issue. His cognitive function had returned to baseline and their were no physical injuries limiting participation.

Differential diagnosis: Traumatic Brain Injury
Concussion

Final diagnosis: Concussion
Fractured base of skull
Right subdural haematoma

Management:
1. The immediate management of head injury
2. Rehabilitation issues in elite athletes
3. Decision about further sport participation

Follow up: The patient has returned to international competition succesfully without further problems.

A-26 SLIDE BIOMECHANICS—MUSCULOSKELETAL

112 MUSCLE RECRUITMENT PATTERNS ASSOCIATED WITH DIFFERENT SHOULDER EXERCISES: ASSESSMENT USING MRI

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Using the proper MRI technique, exercise-induced enhancement of muscle shows the specific muscle(s) involved in a given movement. Therefore, MRI was used to assess muscle recruitment patterns for different exercises typically utilized for physical rehabilitation of the rotator cuff. Five subjects were imaged before and after performing "Jobe's exercise" (JE), lying dumbell raise (LDR), and military press (MP) to determine the contribution of the supraspinatus, subscapularis, infraspinatus, teres minor, deltoid, and trapezius during these movements. Resistance was applied using 4 sets of 15 repetitions at an amount normalized to the subject's body weight. Coronal images were obtained using a "fast" short tau inversion recovery sequence. Signal intensity was measured in regions of interest before and after exercise at comparable section locations for images that showed each of the muscles. The deltoid, supraspinatus, and infraspinatus were mainly involved in each of the exercises (% change, $p<0.01$),while the subscapularis and trapezius contributed to a lesser degree. The supraspinatus appeared to be exercised best by the LDR. None of the exercises worked the teres minor. These data have important implications for physical rehabilitation of the rotator cuff.

113 LEG STIFFNESS AND STRIDE FREQUENCY IN RUNNING.

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As humans and other animals run, their legs behave like simple mechanical springs. As speed is increased, the stiffness of the leg remains constant in running humans as well as in other mammals that trot and hop. All of these animals bounce off the ground in less time at higher speeds due to changes in the geometry of the limb while the foot is on the ground rather than due to changes in leg stiffness. This general principle of an invariant leg stiffness during forward running is remarkable and has led to speculation that physiological and mechanical constraints may limit adjustments to the leg stiffness during forward running. The present study investigated whether it is possible for the stiffness of the leg to be altered during forward running to accommodate changes in stride frequency at a given speed. I hypothesized that it is possible to adjust leg stiffness for different stride frequencies because it is known that leg stiffness can change by more than two -fold when people hop in place at different frequencies. To test the hypothesis, human subjects ran at 2.5 m $\cdot$ s^{-1} using a range of stride frequencies from 26% below to 35% above their preferred stride frequency. The subjects ran on a treadmill with a force platform mounted in it, and ground reaction force data were used to calculate the stiffness of the leg. I found that the stiffness of the leg more than doubled between the lowest and highest stride frequencies (5.12 ± 0.20 to 11.22 ± 0.28 kN $\cdot$ m^{-1}, SE). This adjustment to leg stiffness led to a 80% reduction in the vertical oscillations of the center of mass and a 30% reduction in the time of foot-ground contact between the lowest and highest stride frequencies. In conclusion, although leg stiffness is remarkably constant in forward running at different speeds, it is possible for leg stiffness to be adjusted to allow humans to run in a spring-like manner over a range of stride frequencies. This finding has implications for understanding how the musculoskeletal system is adjusted for running on different surfaces and for the design of spring-based prostheses for running.

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114 EMG INVESTIGATION OF THE GASTROCNEMIUS MUSCLE IN RELATION TO HEEL RAISE FOOT POSITION

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A prevailing assumption among many weight trainers is that variations of foot position during the heel raise exercise will lead to discriminate development of specific areas of the gastrocnemius muscle. This study evaluated the EMG activity of the two heads of the gastrocnemius muscle at different foot positions during this exercise. Subjects (7 female, 8 male, ages 18-50) each performed three heel raises on a Smith Machine with an added resistance that equaled their current workout weight for this lift. The foot positions were: inward toe point (ITP), forward toe point (FTP), and outward toe point (OTP). The speed of the lift was controlled (5 sec) with the concentric and eccentric phases of approximately equal duration. The foot placement order was randomized among subjects to reduce any order effect. Bipolar surface electrodes, placed at the middle of each muscle head, were used to determine the root mean square (rms) of the EMG amplitude for each foot position across both heads. A repeated measures ANOVA revealed a significant difference between the ITP (rms = 108.1 µV) and the OTP (rms = 89.1 µV) for the lateral gastrocnemius head ($p <.03$). However, there was no significant difference for the lateral gastrocnemius when comparing ITP and FTP or FTP and OTP. In addition, there was no significant difference in electrical activity between the three foot placements for the medial gastrocnemius head. These data indicate that by choosing the FTP or the ITP, weight trainers can elicit the greatest contractile activity in both the medial and lateral gastrocnemius heads, respectively. Therefore, allowing for maximal comfort and stability, it is suggested they choose either the forward toe point or inward toe point position.

115 DIFFERENCES IN EMG ACTIVITY DUE TO HANDGRIP POSITION DURING THE LAT PULLDOWN

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Males (N=11, age 18-46 yrs) were tested to determine which of three handgrip positions produced the greatest level of activity in specific areas of the latissimus dorsi muscle. EMG was collected using bipolar surface electrodes (interelectrode distance, 2cm) at two positions on the latissimus dorsi; one placed one inch dorsal to the outermost edge of the widest portion of the muscle and the other placed in the same horizontal plane and 10-15cm medial to the first. Data collected included root mean squares (rmsEMG), changes in mean power frequency (MPF) and changes in rmsEMG (ΔRMS). The lat pulldown conditions were: front wide grip with palms pronated (FWG), back wide grip with palms pronated (BWG), and front narrow grip with palms supinated (FNG). Data were collected on two separate days under all three conditions using twelve repetitions at 70% MVC with a three minute rest period between each set. The sequence was randomized to reduce any order effect. Separate ANOVA's revealed significantly higher rmsEMG values and a significantly greater drop in MPF for the FWG and BWG conditions versus the FNG condition ($p=.0001$). No significant differences were found between the muscle areas for any specific grip. Significant interactions were detected for muscle area by day and hand positon by day for ΔRMS values. The increases in rmsEMG between the first and last rep were significantly higher for the outer latissimus dorsi during FWG than any other handgrip ($p=.0001$). In addition, the FWG produced a higher ΔRMS for the outer versus the inner area of the latissimus dorsi ($p=.039$). These data suggest that using a wide grip, front or back, is more effective than a narrow grip in eliciting greater activity in the entire latissimus dorsi and that wide grip front pulls have a greater potential for targeting the lateral latissimus dorsi.