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## Evidence for Neurological Crossover in Post-Isometric Relaxation Proprioceptive Neuromuscular Facilitation

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**Introduction:** Evidence for contralateral changes following unilateral strength exercise has been well documented. Corresponding evidence for contralateral changes in range of motion (ROM) following unilateral stretching is largely absent. Work from 1979 and 1981 showed crossover of stretch effect following proprioceptive neuromuscular facilitation (PNF), but the results are inconclusive as pronounced electromyography (EMG) activity in the contralateral limb suggests co-contraction occurred. In the current study, cases where contralateral EMG activity exceeded 2-SD over baseline were removed from analysis. Data from both the ipsilateral and contralateral limbs were analyzed to establish presence of change ( $\Delta$ ) ROM following unilateral PNF in both the upper and lower body.

**Methods:** Following local ethics committee approval and signing of ethical consent, 38 university field sport athletes were randomly assigned to upper body ( $n = 20$ ) or lower body ( $n = 18$ ) groups. Each participant undertook 2 randomly assigned, counterbalanced testing protocols: the experimental session where PNF was undertaken and the control session where only the measurement postures were undertaken. Pre-intervention measurements of both limbs were taken during a participant controlled, active, single-leg raise (SLR) for the lower body and participant controlled, active, external shoulder rotation (ExtRot) or horizontal shoulder abduction (HorAbd) for the upper body. Interventions for the lower body targeted either the dominant ( $n = 12$ ) or nondominant ( $n = 6$ ) limb; for the upper body, either the external shoulder rotators ( $n = 12$ ) or the horizontal shoulder abductors ( $n = 8$ ). The PNF isometric contractions were resisted using anchored straps, with a strain gauge in-line. ROM was measured using a fluid-filled goniometer.

**Results:** A mixed factorial ANOVA indicated that upper body response to PNF was more than twice that of the lower body, in both the treated and untreated limb. Crossover effect in the upper body was ~75% and ~50% in the lower body. All  $\Delta$ ROM were significant ( $P = .016$  to  $< .0001$ ) for both extremities and remained so at 3, 6, 9, 12, and 15 minutes postintervention.  $\Delta$ ROM at 15 minutes had decreased to ~25% of immediate postintervention.

**Conclusion:** Neurological crossover effects of stretch interventions are evident even in the absence of co-contraction. These effects are initially quite marked, but have a short time course with decay of effect closely parallel to the stretch effect on the treated limb.

## Student Perception of Learning in a General Medicine Course: An Evaluation of Teaching and Learning Strategies

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**Purpose of Study:** To determine students' perceived competence in basic general medical assessment skills and clinical decision making from different instructional methodologies. Additionally, various teaching strategies were assessed to measure aspects of learning.

**Description of Subjects:** Athletic training students enrolled in General Medicine in Athletic Training course in a Commission of Accreditation of Athletic Training Education-accredited curriculum.

**Experimental Methods and Materials:** Seventeen students were invited to participate in the study. Participants completed an instructor developed survey. The survey was administered at the beginning of the course and at the end of the conclusion of the course. The survey was validated against the course syllabus. Students rated their competence on a likert scale of 0 to 4 (0 indicating no skill and no use, 4 indicating a high level of skill and frequent use) for both assessment points. Further, students were also asked to evaluate the teaching methodologies in terms of increasing their competence on a scale of 0 to 4 (0 indicating not helpful and 4 indicating very helpful) at the conclusion of the course.

**Type of Data Analysis:** A Wilcoxon Signed Rank test was used to analyze the presurvey and postsurvey scores relative to student perception of improvement in basic general medical assessment skills and clinical decision making. Post survey means were also used to describe student rating of the various teaching methodologies utilized in the course.

**Results:** Response rates of 82.4% (14 of 17) presurvey and 70.6% (12 of 17) postsurvey were obtained. A Wilcoxon Signed Rank test revealed a significant increase in student perception for learning for basic general medical skill assessment ( $Z = 4.02$ ,  $P < .001$ ) and clinical decision making ( $Z = 5.57$ ,  $P < .001$ ). Perception of student learning for basic assessment skill increased from pre-survey (median = 1.86) to postsurvey (median = 3.17) and in clinical decision making from presurvey (median = 1.29) to postsurvey (median = 2.75). The 3 most effective teaching methodologies included providing clinical examples in class (mean = 3.40), individual proficiency testing (mean = 3.10) and lecture/labs experience (mean = 2.98).

**Conclusion:** The results demonstrate that participants perceived a significant increase in learning general medical assessment and clinical decision by using the instructional strategies

employed in this course. Of the 6 teaching methodologies incorporated, providing clinical examples, individual proficiency testing, and lecture/labs contributed the most to learning. The 3 teaching methods identified by students as most helpful should be retained or improved, whereas the other strategies should be developed and evaluated for instructional effectiveness.

## A Qualitative Examination of Health Care Professionals' Experience as Patient Educators

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**Introduction and Rationale:** This qualitative research study examined the nature of the patient education experience from the point of view of health care professionals in the Greater Toronto Area practicing for up to 10 years. Health care professionals' views and beliefs about this important aspect of health care have not been well studied. Patient education is defined as, "the process by which patients learn or acquire knowledge about his/her health status or condition and may involve learning in the cognitive, affective, and/or psychomotor domains." Most often, the health care professional is a part of this process, serving as a key source of information for patients.

**Methods:** The study explored 8 health care professional participants' views on the nature of patient education in their early and current practices by examining their feelings, beliefs, and uses of patient education, its role in their practices, and the perceptions of their roles as patient educators. Two extensive semi-structured interviews were conducted with each of the participants. The transcribed interviews underwent detailed qualitative analysis to determine response trends and consensus.

**Results:** The key findings revealed that the participants felt that, while they were well prepared in their undergraduate curricula to diagnose and treat patients, they were not as well prepared to be effective patient educators when they entered practice. Early in their careers, they did not understand or appreciate patient education's importance as a component of their practice. Over time, their beliefs and understanding of patient education changed and participants reported that with experience, they began to value patient education to a greater extent. Changing values reflected changing behaviors. For example, participants increased their time and efforts related to patient education with increased clinical experience. A variety of teaching aids were used, with wall charts and posters, 3-dimensional anatomical models, printed materials, and images from textbooks being among the most common. Most of the teaching described by the participants can be characterized as transmission with a one-way flow of information from the doctor to the patient. To a great extent, patient education involved speaking with individual patients. Participants reported encountering, throughout their careers, intrinsic and extrinsic barriers that interfered with the effectiveness of their patient education.

**Importance:** The findings suggest that curricular planners for preservice health care professional educational programs should consider developing specific undergraduate content aimed at improving students' patient education knowledge and skills.

## Association Between Hip and Shoulder Rotational Range of Motion in Collegiate Baseball Pitchers

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**Introduction:** Previous investigations have described hip and shoulder range of motion (ROM) of baseball athletes with and without shoulder injuries. In particular, dominant hip extension and shoulder external rotation (ER) were correlated in baseball athletes with a history of injury. Although relationships have been identified, the literature is limited on how ROM changes at one joint affect another in throwing athletes.

**Rationale:** To observe shoulder and hip internal rotation (IR) and ER at the beginning and end of a competitive baseball season.

**Experimental Methods:** Prior to the start of the season, 14 pitchers volunteered. Each participant signed an informed consent form approved by the university. The investigator measured passive hip and shoulder IR and ER using a standard digital inclinometer (Baseline Evaluation Instruments, White Plains, NY) in random order, at the beginning and end of the season. The investigator collected shoulder ROM using the visual inspection method with the participant supine on a treatment table, with the arm positioned in 90/90°. The investigator measured hip ROM with the participant sitting upright with the legs hanging off the table, also in a 90/90° position. For statistical analysis, the investigator calculated the average of 2 measures for each motion at preseason and postseason. The investigator conducted repeated measures and correlational analyses using PASW version 18.0 software (SPSS, Inc, Chicago, Ill), with  $\alpha = 0.05$  set a priori.

**Results:** Preseason throwing shoulder (TS) IR was correlated with stride-leg IR ( $R = .59$ ,  $P = .02$ , while stride-leg ER and nonstride-leg rotational ROM were not correlated with TS IR ( $P > .05$ ). Changes in TS IR and ER were not associated with changed in stride or nonstride-leg IR or ER ( $P > .05$ ). Throwing shoulder IR increased 12.6° and ER increased 22.9° over the course of the season ( $F[1,13] = 7.41$ ,  $P = .02$ ;  $F[1,13] = 35.01$ ,  $P < .05$ , respectively). Non-TS IR did not change, whereas ER increased 22.4° ( $F[1,13] = 1.96$ ,  $P = .19$ ;  $F[1,13] = 22.82$ ,  $P > .001$ , respectively). Stride-leg IR increased 7.5°, whereas ER did not change ( $F[1,13] = 10.37$ ,  $P = .01$ ;  $F[1,13] = 0.17$ ,  $P = .69$ ). There was no effect of time for nonstride-leg IR or ER ( $F[1,13] = 3.92$ ,  $P = .07$ ;  $F[1,13] = 0.02$ ,  $P = .88$ ).

**Discussion:** Athletes with limited shoulder IR also exhibited limited IR at preseason, thus emphasizing the importance clinical attention to total kinetic chain flexibility. In addition, our results support previous research acknowledging the relationship between shoulder and hip ROM, which is also associated with injury in professional baseball players.

**Importance:** Shoulder ROM has been intensively investigat-

ed in the throwing athlete; however, hip ROM may also play a crucial role in injury prevention.

## Elite Athletes' Emotional Skills: The Forgotten Assessment for Athletic Therapists

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**Introduction:** Research suggests that interpersonal and intra-personal skills, including abilities for perceiving, understanding, utilizing, and managing emotion in oneself and others contribute to performance outcomes. Despite the promise of this literature, little research describing and interpreting the role of emotion in peak sport performance (PSP) is available.

**Purpose:** The purpose of the current study was to develop an interpretive description of elite athletes' lived experiences with emotion, exposing if and how they relate emotion to peak sport performance.

**Methods:** Data collection was guided by the following research questions from the perspective of elite athletes: (a) How do they describe their emotional experiences during various aspects of sport performance?; (b) What constitute emotionally laden moments in sport?; (c) What are their perceptions of their own emotions and the emotions of others during sport?; (d) How do emotions shape their thoughts?; (e) How do they utilize these thoughts?; (f) How do they describe understanding and dealing with their own emotions, and the emotions of others, during sport?; (g) How do they understand relationships between emotion and peak performance?; and (h) How is this knowledge acquired? The purpose was accomplished through semi-structured telephone interviews with 20 elite athletes about their experiences with emotion during PSP. Data were analyzed using a semiotic-informed interpretive description paradigm to describe and interpret the emotional experiences of athletes and their influence on the attainment and maintenance of PSP.

**Results:** In addition to recognizing emotion as a natural, yet variable part of elite sport influencing performance, athletes managed these experiences in exchange for opportunities at peak performance and recognized failing to align their emotions with social norms as decreasing their chances at peak sport performance.

**Discussion:** Principal findings' for a sport-specific ability model of emotional intelligence (EI) and the latent influences of emotion labor will be discussed in relation to the reciprocal performance-emotion relationship. Implications of EI on the prevention, treatment, and rehabilitation of athletic injuries, as well as a brief practical screening of emotional skills and labor for the athletic therapist, will be presented.

## Athletic Therapists as Medical Coordinators: A Multiple Case Study Examination

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**Introduction:** The diversity and size of sporting events continues to grow while unique locations are an increasingly popular means of attracting athlete entries. As recognized sports medicine

experts, athletic therapists are asked to prepare and provide care to a broader range of participants on an ever-increasing scale. The public's awareness of athletic therapists as sports medicine experts has also prompted novel events (eg, adventure races) and large participant groups to seek us out for their care.

**Rationale:** The evolving role of athletic therapists as medical coordinators challenges our efficiency as health care providers and reveals that we are often expected to plan and function as "incident commanders" with little or no background or training.

**Purpose:** The purpose of this study was to examine sporting events for challenges when athletic therapists occupy the dual role of medical coordinator.

**Methods:** A convenience sample of more than 250 sporting events from all levels of competition (high school, collegiate, recreational, professional, corporate, and Olympic) were reviewed for the intersections between athletic therapists' scope of practice and that of a medical coordinator. Using a multiple case study approach and recent changes in the Canadian emergency incident command system as a backdrop, challenges facing those in the dual role of athletic therapist/medical coordinator were identified. These situations were clustered into higher order themes. Following examination for human accountability and prevention, situational outcomes were used to create strategies reducing and preventing similar problems.

**Results:** Challenges encountered by athletic therapists functioning in the dual role of medical coordinator clustered into 5 primary groups (ie, human, course safety/security, equipment, communications, and weather) and demonstrate the diversity of difficulties facing athletic therapists who purposefully or inadvertently function as medical coordinators. Brief descriptions of each problem cluster are followed by suggestions for policy, procedural, or organizational changes that can minimize or prevent future incidents. Emphases are placed on the transferability of these skills across settings/sports, the importance of symbiotic relationships with other groups, and a sports medicine team approach promoting prevention and accountability.

## Percentage of Muscle Fatigue Unrelated with Time to Failure, Between No Vibration and Whole-Body Vibration Conditions During Submaximal Isometric Contraction

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**Introduction:** Exposure to whole-body vibration (WBV) training is shown to benefit muscular strength and power. Muscular fatigue is a physiological mechanism thought to be involved in achieving strength and power gains. The implication of fatigue is not well understood. The joint analysis of electromyography (EMG) spectrum and amplitude (JASA) to assess the rate of muscle fatigue found no correlation between vibration conditions and fatigue during a submaximal isometric contraction.

We were interested to determine whether a correlation exists between time to fatigue and percentage of muscular fatigue within single muscles in a nonvibration and a vibration condition.

**Rationale:** Sufficient time to fatigue and percentage fatigue correlations within a muscle for either vibration condition would support a relationship between the specific condition and muscular fatigue.

**Design:** A single group pretest-posttest study.

**Setting:** Controlled university laboratory setting.

**Participants:** Twenty-nine college level athletes ( $19.47 \pm 2.45$  years,  $172.23 \pm 8.08$  cm,  $73.3 \pm 11.87$  kg) with no current injury, previous surgery or conditions likely to affect participation.

**Methods:** Participants performed a one-leg squat at  $125^\circ$  on their dominant leg under 2 conditions (no vibration and vertical WBV at 30Hz-3mm). We adjusted knee angles using a goniometer and measured time to fatigue through the computer's timer. The vibration was generated by a Vibraflex 600 (Orthometrix Inc., Naples, Fla) platform. Surface EMG was collected for vastus medialis oblique (VMO) and gluteus medius (GlMed) muscles. We analyzed the EMG using the JASA method for rate of fatigue based on schematic position of data in a quadrant. We plotted the data using percentage time-to-fatigue as the x coordinate and percentage fatigue as the y coordinate and performed a Pearson correlation for the VMO and GlMed under no vibration and vibration conditions. The dependent variables were the rate of muscle fatigue (%) for VMO and GlMed and percentage time to fatigue (%). The EMG was analyzed using temporal changes for electrical activity (mV) and median frequency (Hz) to determine rate of fatigue.

**Result:** The correlation for GlMed no vibration was  $-0.206$  and  $-0.215$  with vibration, for VMO no vibration  $-0.076$  and  $-0.281$  with vibration.

**Discussion:** The correlation between measures is poor or moderate at best and indicates that other mechanisms besides muscular fatigue as measured by EMG are responsible for termination of the trial.

**Importance:** This result indicates that benefits of WBV may not occur due to fatigue. Further investigation of physiological mechanisms is required to understand the true nature of WBV.

## The Agreement Between an Online Diagnostic Questionnaire and Physician's Diagnosis for Patients Suffering an Acute Knee Injury

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**Introduction:** The Acute Knee Injury Clinic (AKIC) represents a culmination of research applied to clinical practice. The AKIC implements a new model of healthcare delivery that allows sport medicine physicians (SMP) the capability of managing a higher volume of patients via collaboration with a new health care practitioner, the nonphysician expert (NPE). This nonreferral-based clinic requires patients experiencing an acute knee injury to

first complete an online screening and diagnostic questionnaire. Information collected within these questionnaires is used to triage the severity of injuries and urgency. Use of online questionnaires to aid in the triage and management of patients is apparent; however, the paucity of evidence of the agreement or sensitivity of an online questionnaire for acute knee injuries is apparent.

**Objective:** To identify the agreement and sensitivity of an online diagnostic questionnaire and physician's diagnosis of a patient who has experienced an acute knee injury.

**Methods:** During the AKIC pilot study, 302 patients were seen, diagnosed, and managed. Data from each patient's questionnaire were compiled, incomplete records removed, and questionnaires de-identified. NPEs reviewed the data of 294 patients and provided a diagnosis of the injury based on entered data alone. Concurrently, a SMP reviewed the medical records of the same patients and provided a final diagnosis. Provision of diagnoses was done independently. Once rating was completed, enumeration of each rater's diagnosis was then compiled for analysis of agreement and sensitivity.

**Statistical Analysis:** Simple percent agreement was first used to measure overall agreement between NPEs' and SMP's diagnoses. Kappa and sensitivity calculations were completed via  $2 \times 2$  tables of ratings. For diagnoses of anterior cruciate ligament (ACL) or ligament injury, kappa statistic was calculated to measure agreement. Furthermore, the sensitivity of both ACL and ligament diagnoses was calculated.

**Results:** Overall simple agreement between NPE and SMP diagnoses was 61%. Kappa agreement for ACL and ligament diagnoses was .50 and .62, respectively. The sensitivity for ACL and ligament diagnoses was .58 and .80, respectively.

**Conclusion:** Results indicate the diagnosis of a patient's acute knee injury can be accurately predicted 61% of the time based on online history alone. When trying to specify ligament, cartilage, or other injuries, agreement decreases as anticipated. Agreement for aggregated ligament injury (ie, ACL, posterior cruciate ligament, lateral collateral ligament, medial collateral ligament) with adjustment for chance is .62, representing substantial agreement with high sensitivity at .80. In the diagnosis of ACL injury alone (ie, ACL, medial collateral ligament), the value of .50 represents moderate agreement with a moderate sensitivity at .58.

## Catastrophic Head Injury in Rodeo and Bull Riding Athletes

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**Introduction:** Rodeo, although entertaining, is a hazardous sport. Particularly, one study confirms bull riding as the most dangerous organized sport in the world. This increases the risk of suffering from concussions and other head injuries.

**Rationale:** The purpose of this study was to determine the nature, frequency, and incidence rates of catastrophic head injury in rodeo and bull-riding athletes.

**Methods:** This study was a retrospective and prospective

collection of head injury severity, head injury mechanisms, and helmet use in rodeo and bull-riding athletes. An online rodeo catastrophic injury registry was established to identify descriptive catastrophic injury data from high school, amateur, or professional North American rodeo and bull-riding athletes. Data collected included cases from 1989-2009. Cases were entered through media sources, rodeo personnel, general population, friends and family, medical personnel and allied health care professionals. Outcome measurements include fatalities, nonfatal injuries (resulting in permanent functional disabilities such as quadriplegia), and serious injuries (resulting without permanent functional disability such as skull fractures without residual brain dysfunction). Denominator estimation was determined via administrative records of amateur, high school, and professional rodeo and bull-riding associations in North America. Due to incomplete denominator data, incidence rates are likely overestimated.

**Results:** Injuries resulting from direct trauma to the head were classified as 3 adult and 2 adolescent fatalities; 5 adult nonfatal injuries; and 4 adolescent serious injuries. Cases were excluded if head injury mechanisms occurred but facilitated primary injury to other body parts. The incidence rate of catastrophic head injury for the entire data collection period (1989-2009) was 14 per 518,286 or 2.70 per 100,000 participants. The incidence rate of fatality for the entire data collection period was 5 per 518,286 or 0.96 per 100,000 participants.

**Discussion:** Regardless of the injury severity none of the cases that suffered a head injury were confirmed as wearing helmets: 8 cases were not wearing helmets and 6 were unknown. Head injuries occurred due to direct contact (head-to-head, stepped on, or kicked by animals,  $n = 12$ ; arena infrastructure collisions,  $n = 2$ ).

**Importance:** No fatalities due to head injury occurred in helmet-wearing participants. Although helmet testing protocols have been developed for rodeo and bull riding (American Society for Testing and Materials), it appears that wearing any helmet may have a protective effect against fatalities due to head trauma.

## Catastrophic Thoracic Injury in Rodeo and Bull Riding Athletes

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**Introduction:** In rodeo, bull riding and boys' steer riding have been reported as the rodeo events most likely to result in catastrophic injury. This study investigates the risk of catastrophic injuries to the thorax.

**Rationale:** The purpose was to determine the nature, frequency, and incidence rates of catastrophic thoracic injury in rodeo and bull-riding athletes.

**Methods:** Data were collected via retrospective and prospective collection of incidents identifying thoracic injury severity, thoracic injury mechanisms, and rodeo vest use in rodeo and bull-riding athletes. An online rodeo catastrophic injury registry was established to identify descriptive catastrophic injury data

from high school, amateur, or professional North American rodeo and bull-riding athletes. Data collected included cases from 1989-2009. Cases were entered through media sources, rodeo personnel, general population, friends and family, medical personnel, and allied health care professionals. Outcome measurements include fatalities, nonfatal injuries (resulting in permanent functional disabilities such as quadriplegia), and serious injuries (resulting without permanent functional disability such as spinal fractures or pneumothorax). Denominator estimation was determined via administrative records of amateur, high school, and professional rodeo and bull-riding associations in North America. Due to incomplete denominator data, incidence rates may be overestimated.

**Results:** Injuries resulting from direct trauma to the thorax were classified as 10 adult and 6 adolescent fatalities, and 5 adult and 1 adolescent serious injuries. Cases were included if head injury mechanisms occurred facilitating primary injury to the thorax. The incidence rate of catastrophic thorax injury for the entire data collection period (1989-2009) was 22 per 518,286 or 4.24 per 100,000 participants. The incidence rate of thoracic injury leading to fatality for the entire data collection period was 16 per 518,286 or 3.08 per 100,000 participants.

**Discussion:** Twelve fatal cases were confirmed wearing vests, 3 fatal cases were reported as vest wear "unknown," and 1 case did not wear a vest. Thoracic catastrophic injuries occurred due to direct contact (stepped on, kicked, or trampled by animals,  $n = 21$ ; being crushed in the chute,  $n = 1$ ).

**Importance:** Fatalities due to thoracic compression occurred in 12 participants wearing rodeo protective vests. We are unaware of rodeo protective vest testing protocols. Despite rodeo protective vests that were developed for rodeo and bull-riding athletes the protective effect of such vests is unknown.

## Recovery Strategies Aid Physiological Restoration, Perceived Recovery, and Repeated Sports Performance in Male Collegiate Athletes

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**Introduction:** Whether immediate postexercise recovery strategies can improve physiological and psychological restoration and subsequent performance remains equivocal.

**Rationale:** To determine the comparative effects of sports massage, contrast bathing, and passive recovery on enhancing blood lactate clearance, perceived recovery and subsequent adapted agility performance times postmaximal endurance test. It was hypothesized that massage and contrast bathing would have similar effects to passive recovery with respect to blood lactate clearance and repeated sports performance; no effect would be seen. In addition, it was hypothesized that massage and contrast bathing would lead to greater psychological regeneration than that of passive recovery.

**Experimental Methods and Materials:** Twelve male col-

legiate basketball players (age =  $20 \pm 3$  years), 3 interventions: massage (effleurage, petrissage, tapotement), contrast bathing (1 minute cold at  $8^\circ$  to  $10^\circ$ , 2 minutes hot at  $40^\circ$  to  $42^\circ$ , repeated 5 times), and passive (sitting) each 15 minutes in duration. Blood samples were drawn and analyzed for blood lactate concentration, muscles soreness, and perceived recovery ratings and subsequent adapted agility performance times for each test condition were the main outcome measures.

**Data Analysis:** A counterbalanced experimental design with repeated measures was used. The order of recovery strategy was determined by random assignment to a counterbalanced test sequence.

**Results:** No significant differences were found in blood lactate concentration between the 3 groups at any time point ( $P > .05$ ). Massage and contrast bathing were significantly more effective than passive recovery at decreasing muscle soreness ( $P = .004$ ;  $P = .001$ ) and increasing perceptions of recovery ( $P = .018$ ;  $P = .006$ ) postrecovery strategy. Passive recovery group was significantly slower than the contrast group in the subsequent performance test ( $P = .016$ ).

**Conclusion:** These findings provide some support for the psychological benefits of both massage and contrast bathing but raise some questions about their benefit on physiological restoration. A novel finding that passive recovery was significantly slower than contrast bathing provides scope for further research into the positive effects of contrast bathing on repeated performance.

## Accuracy of Meniscal Injury Diagnosis in an Anterior Cruciate Ligament Injured Knee

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**Purpose:** This investigation compared the accuracy of 3 methods of meniscal injury diagnosis that are commonly employed in clinical orthopaedics: clinical examination, magnetic resonance imaging (MRI), and arthroscopic surgery.

**Materials & Methods:** A retrospective review of charting was used to collect meniscal injury assessment data for 116 patients who had sustained an anterior cruciate ligament injury to one knee. Sensitivity and specificity of “hands on” clinical examination and MRI interpretation were determined using the results from arthroscopic surgery as the gold standard. Sixty-eight of the 116 patients had the presence of a meniscal lesion confirmed via surgery. Percent of agreement between clinical examination and MRI interpretation was examined. The findings of all 3 methods of meniscal evaluation were compared.

**Results:** Accuracy testing indicated that the sensitivity and specificity of initial clinical examination (0.49 per 0.49), MRI (0.86 per 0.46), and clinical examination by an orthopedic specialist (0.54 per 0.81) varied greatly, and when directly comparing

the findings of clinical examination against MRI, there were only moderate levels of agreement (range, 0.55 to 0.65) when a meniscal lesion was suspected. When comparing the findings from clinical examination, MRI, and arthroscopic surgery, complete agreement among all 3 methods of evaluation occurred in only 51% of the patients.

**Conclusion:** Our results serve to highlight the inaccuracies associated with meniscal injury assessment when evaluating an acutely traumatized knee joint and suggest that the incidence of secondary joint trauma associated with a severe ligament injury may be underpredicted.

(Research supported by ongoing funding from the Faculty of Medicine at the University of Manitoba, Pan Am Clinic Foundation, and Manitoba Medical Services Foundation.)

## Performing an Oblique Incision to Harvest a Semitendinosus Autograft During ACL Reconstructive Knee Surgery: Is There an Infra-Patellar Branch of the Saphenous Nerve “Safe Zone”?

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**Introduction:** The infrapatellar branch of the saphenous nerve (IBSN) is commonly traumatized during anterior cruciate ligament (ACL) reconstruction, with injury causing postoperative numbness, dysesthesia, and painful neuroma about the knee. Although a vertical incision is routinely used to harvest a semitendinosus autograft, recent surgical evidence suggests that an oblique incision may be superior for reducing IBSN injury.

**Purpose:** The purpose of this investigation was to calculate an oblique incision IBSN “safe zone” when performing an ACL reconstruction.

**Methods:** Following detailed dissection of 18 embalmed cadavers, the course and distribution of the IBSN was marked. Surgical landmarks were then identified and marked. Digital images were made of each dissection, and ImageJ processing and analysis software (National Institutes of Health, Bethesda, Md) was used to perform standardized measurements about an X/Y coordinate system, with the IBSN’s distribution being measured at angles of  $15^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ ,  $75^\circ$ , and  $90^\circ$ .

**Results:** Four variations in IBSN distribution were noted: 18 had 1 branch; 14 had 2 branches; 6 had 3 branches; and 1 had 4 branches. Average (SE) distance from inferior pole of the patella to the joint line was 1.83 cm (.163); from the joint line to the superior aspect of the tibial tubercle was 1.93 cm (.166). Average distances for branch #1 ranged from 1.95 cm at  $15^\circ$  to 1.19 cm at  $90^\circ$ ; branch #2 from 2.70 cm at  $15^\circ$  to 2.75 cm at  $90^\circ$ ; branch #3 from 2.73 cm at  $15^\circ$  to 2.83 cm at  $90^\circ$ ; and branch #4 from 2.74 cm at  $15^\circ$  to 3.23 cm at  $90^\circ$ .

**Conclusions:** Results provide detailed information about the

course and distribution of the IBSN and should assist surgeons with the establishment of oblique incision guidelines to avoid IBSN injury when performing an ACL reconstruction using a semitendonosis autograft.

(Research supported by ongoing funding from the Faculty of Medicine at the University of Manitoba, and Pan Am Clinic Foundation.)

## Ankle Taping Prophylaxis: Does Directionality Matter?

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**Introduction:** Ankle injuries are common in athletic activities. Applying external stabilization to prevent ankle injury is common and has clearly been shown to reduce the incidence of injury. A number of studies have demonstrated no difference in effectiveness of injury prevention between taping and bracing. However, the components that comprise the prophylactic ankle taping technique were not always described in detail and rarely described the directionality of heel locks. The purpose of the initial study was to validate an assessment tool to evaluate students' athletic taping competence. Data on the directionality of heel locks were not previously reported. Those data are the basis for purpose of this abstract: Are athletic therapists aware of the directionality of their heel locks?

**Rationale:** Heel locks are fundamental components of a prophylactic ankle taping technique.

**Methods:** Ten content experts acted as validators in the original study. Validators reported verbally and physically demonstrated their heel lock techniques they employed during the second phase of the content validation of the Technical Skill Assessment Instrument. The investigators took note of the variation in types of prophylactic taping techniques applied.

**Results:** There were 5 different heel lock directional patterns demonstrated by 10 content expert validators.

**Discussion:** It has been theorized that tape application is effective due to mechanical stability. Therefore, it is logical that directionality of tape application is important for injury prevention. Preventing ankle inversion is the primary goal for prophylactic ankle taping. Plantarflexion should be targeted for motion reduction in order to prevent ankle sprains. Heel locks are one component that could restrict the inversion and plantarflexion motion. There were 5 different permutations and combinations of heel locks from an expert group who taught these skills to future athletic therapists. Multiple types of heel locks do not support the concept that directionality matters. We would conclude that the expert validators involved in this study were not aware of the directionality of their heel locks.

**Importance:** Consensus on the directionality of heel locks was not the primary goal of the original study. However, there was considerable enlightenment to all expert validators when each shared their preference for heel lock directionality. Future

research needs to have better consensus and scientific evidence regarding the purpose of heel locks and, ultimately, their directionality. Once expert consensus and scientific evidence are achieved, studies measuring the effectiveness of tape to reduce ankle injury or re-injury will be more definitive.

## Effects of the Combination of Ultrasound and Transcutaneous Electrical Muscle Stimulation on Hamstring Range of Motion

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**Introduction:** Ultrasound (US) and transcutaneous electrical stimulation (E-stim) are common modalities used in the treatment of various pathologies. Although these 2 forms of modalities are common in the athletic training setting, there are limited data available on the effects of the use of these two modalities in combination (COMBO).

**Rationale:** Ultrasound and E-stim in combination with one another is thought to have positive clinical effects in treating myofascial trigger points, although data supporting these benefits are scarce. Thus, the purpose of this study was to evaluate the therapeutic effects of COMBO treatment on hamstring range of motion (ROM).

**Experimental Methods:** Six recreationally active graduate students volunteered to participate. Using a double-blind randomized design, the primary investigator measured hamstring ROM pretreatment and posttreatment while a co-investigator performed the treatments (COMBO and placebo). Participants were blinded to the purpose of the study and the types of treatments. Treatments were randomized to right and left hamstring. Both treatments consisted of a dispersive electrode placed on the distal biceps femoris tendon and US sound head isolated to 40-50 cm<sup>2</sup> near the common acupressure point of the medial biceps femoris for 7 minutes. The COMBO setting was 1MHz, 1.5 W/cm<sup>2</sup>, whereas the placebo treatment was the sham modality. The primary investigator exhibited excellent intrarater reliability (ICC<sub>3,1</sub> = 0.93) performing ROM measures. To measure ROM, participants were supine with hip and knee flexed to 90°; knee was then passively extended to the point of resistance. At the point of resistance, the measurement was taken. This process of ROM measurement, treatment, and ROM measurement was repeated for the contralateral hamstring, which received the opposite treatment.

**Results:** Results of the repeated measures multivariate analysis with treatment as the between variable did not reveal any significant interaction ( $F = 0.25, P = .63$ ). The COMBO treatment improved 1.8° from the initial measure of 73.0°, and the placebo treatment decreased 0.8° from the initial 75.2° measurement.

**Discussion:** The results revealed that the COMBO treatment did allow for a slight increase in hamstring ROM when used on the biceps femoris common acupressure point. These data can be used to develop future studies concerning COMBO modality use and acupressure point treatment on not only healthy muscles but on acute muscular injuries.

**Importance:** Lack of flexibility results in decreased movement efficiency and increased propensity for injury. Thus, the use of COMBO could prove to be a valuable therapeutic modality in improving ROM.

## The Relationship between Knee Pain and Body Weight in Early-Onset Knee Osteoarthritis

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**Purpose:** To examine the effect of “anti-gravity” exercise on knee pain and knee joint forces in an overweight/obese early-onset knee osteoarthritis population.

**Rationale:** Research has demonstrated that body weight is the number one modifiable risk factor associated with the onset and progression of knee osteoarthritis. However, the ideal amount of weight loss needed to reduce knee pain and optimize joint function is unknown. Until recently, the ability to provide instantaneous feedback to patients regarding the relationship between knee pain/function and weight loss has been very difficult. The introduction of a new anti-gravity treadmill, which utilizes a technology called Lower Body Positive Pressure, now enables our research team to study this relationship.

**Materials and Methods:** Twenty patients (body mass index, 33.6 kg/m<sup>2</sup>) with early-onset knee osteoarthritis walked for a period of 25 minutes at a speed of 1.4 m/s on the G-trainer (Alter-G Inc., Menlo Park, Calif). Subjects completed 2 randomized walking sessions (full weight bearing and unweighted). Measures included knee pain (using the visual analog scale), heart rate and knee joint forces (as measured using tri-axial accelerometry).

**Analysis:** Paired *t* tests and one- and two-way analyses of variance were used to detect differences.

**Results:** Mean pain and heart rate during full weight-bearing walking were 30.2 mm and 113 bpm, respectively. The most common level of unweighting was 10% of body weight, with a mean unweighting of 13.3%, providing a significant and immediate reduction in pain when walking ( $P < .05$ ). Mean pain and heart rate during unweighted walking were 20.9 mm and 110 bpm, respectively. Initial results indicate significant differences in knee joint forces between affected and unaffected knees.

**Conclusion:** Our results show that a mean unweighting of 13.3% of body weight was sufficient to successfully decrease subjects' pain. This level of weight loss (13% of body weight) is a realistic value for overweight/obese patients suffering from knee pain due to knee osteoarthritis. The G-trainer is able to instantly provide feedback regarding the effect of “weight loss” to overweight/obese individuals, and subjective feedback indicates that it is a viable rehabilitation device for those with knee osteoarthritis and other musculoskeletal disorders of the lower extremities. Future research should be directed at establishing the limitations

of this emerging technology in the management of knee pain and function in knee osteoarthritis and other lower body musculoskeletal disorders.

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## An Investigation in Comparing Stable and Unstable Rescuer Positions of Spine Boarding Extraction Protocols of Undocumented Injury Scenarios in a Gymnastics Pit

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**Introduction:** Data are limited defining protocols on spine boarding injured athletes who are prone or supine in a gymnastics pit. Currently, it is recommended that the rescuer is suspended in the prone position on a gymnastics mat across the pit in attempt to distribute the weight of the rescuer while reaching to secure the injured athlete. However, when the rescuer is positioned on the mat, it is postulated that the rescuer is in a position of decreased stability and thus a compromise of the ability to secure the injured athlete. There has yet to be documentation of stable and unstable rescuer positions when trying to spine board in a gymnastics pit.

**Rationale:** It was thus the purpose of this investigation to compare an unstable and stable rescuer positions for 3 different gymnastic pit cervical spine injury landing scenarios that have yet to be documented.

**Methods:** Two certified athletic trainers, 3 emergency medical technicians, 1 paramedic, and 6 graduate athletic training students investigated appropriate protocols for gymnastic pit extraction of 3 different landing scenarios based on unstable and stable rescue positions. An unstable position was defined when the rescuer had to position himself or herself in a prone position on a gymnastic mat extended over the foam blocks in the gymnastics pit. A stable position was defined when the rescuer entered the pit alongside the victim. A comparison was performed with the rescuer during an unstable and stable rescue position while the athlete was in the following landing positions: head first (feet sticking out), fetal prone, and supine. Upon completing each trial, rescuers reported perceived self-stability, ease of extraction, and movement of the athlete.

**Results:** It was reported that the stable surface provided more stability to the rescuer and enhanced control of the patient for all 3 injury scenarios. In addition, it was reported little difference in movement of the athlete between the 2 rescue positions for all three injury scenarios.

**Discussion:** The rescuers reported greater stability and control of the patient utilizing the stable surface rescue position as compared to what has previously been reported. A limitation was the self-reporting of athlete movement. Thus, it is warranted that future studies assess the movement utilizing motion analysis equipment.

**Importance:** This investigation questioned current spine board-

ing protocols. Furthermore, it solidifies the necessity for the sports medicine providers to establish and practice gymnastic pit extraction annually to maintain familiarity of the accepted protocols.

## Gluteus Medius to Adductor Muscle Activation Ratio: Effects on Dynamic Knee Valgus

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**Introduction:** Previous research has examined the hamstring to quadriceps muscle strength ratio and its relationship to knee injuries. The hamstrings and quadriceps muscles support the knee joint posteriorly and anteriorly, respectively. However, the knee also has muscular support medially and laterally. The primary muscle groups providing medial and lateral knee support are the adductors (medially), and gluteals (laterally). Based on the bio-mechanical function of the medial and lateral musculature about the knee, it is questioned why there are no known normative ratios as there are for the posterior and anterior musculature.

**Rational:** It was the purpose of this study to establish muscle activation ratios of the medial (adductor muscle group) and lateral musculature (gluteus medius) supporting the knee and evaluate those ratios to performance on a tuck jump assessment.

**Methods:** Nine female Division I NCAA tennis players ( $19.4 \pm 1.0$  years;  $264 \pm 5$  cm;  $61 \pm 7$  kg) deemed free of lower extremity injury for the past 6 months volunteered to participate. Participants reported for testing prior to any physical activity that day. Bipolar surface electrodes were attached over the muscle bellies of dominant gluteus medius and adductor muscle group. Manual muscle tests (MMTs) were performed recorded via Myo-System 1400L sEMG (Noraxon, Scottsdale, Ariz). The signal was full wave rectified and smoothed based on the smoothing algorithms of root mean squared at windows of 100ms. Once sEMG data were collected, ratios were generated for gluteus medius and adductor muscle activation. Following MMTs, a tuck jump assessment was performed. Data in the current study were analyzed using the statistical package SPSS 15.0 for Windows (SPSS, Inc, Chicago, Ill). Pearson's correlation was performed to determine the relationship between the muscle activation ratios and tuck jump assessment scores.

**Results:** There was no statistically significant correlation between muscle activation ratio and tuck jump scores ( $r = -0.417$ ).

**Discussion:** These results are only a generalization of a very small group of participants. It should be noted that further research should be conducted in attempt to increase external validity and establish a normative ratio.

**Importance:** The significance of these results is that although the number of participants was low, there was an interesting trend in that those who had lower discrepancies in their medial to lateral musculature activation performed better on the tuck jump assessment. With the established knowledge of neuromuscular factors playing a vital role in knee injury prevention, focus should also be addressed on the medial and lateral musculature supporting the knee.

## Moving the Machine: Creating an Athletic Training Learning Organization

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**Introduction:** The practice settings in which athletic trainers and therapists work continues to expand, limits in the education of practitioners in organizational and administrative leadership have been shown. This presentation aims to present both the skills, abilities, and knowledge needed by athletic trainers in a clinical managerial position, as well as presenting information on the learning-organization model.

**Rationale:** Organization and administration is one of the six domains of athletic training, as defined by the National Athletic Trainers' Association's Role Delineation Study. With this and the growth of the profession in mind, athletic trainers need continued tools to help them effectively manage and lead health care organizations.

**Methods:** A Delphi research methodology was used in June 2010 to survey athletic trainers working as hospital administrators in the United States. Three survey rounds were used to build consensus on which skills, abilities, and knowledge athletic trainers need to be successful as health care organization managers.

**Results:** The participants had an average age of 41.4 years and averaged 18.6 years of experience as a certified athletic trainer. Participants reported their experience being a mean of 7.4 years. The highest ranking statement was "A health care manager needs to be able to effectively manage and lead people," followed by "A health care manager must have a good grasp of business plan development." Two statements tied for third place ranking: "A health care manager needs to have a solid understanding of business practices and culture" scored the same as "A health care manager must have the ability to critically think and prioritize job tasks."

**Discussion:** Much of the leadership literature focuses on the relational abilities of leaders as they work within organizations. The results from this study seem to hold up relational and leadership issues as being important in health care organizations. The shared information showed the need to understand organizational culture, having the ability to build relationships, and the need to be skilled in conflict resolution. This is consistent with these findings and the health care management literature.

## An Investigation of Environmental and Physiological Factors as Predictors of Head Impact Severity

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**Introduction:** Recent anecdotal trends suggest a disproportionate number of head injuries in collegiate football players occur during preseason football camp. In warmer climates, this season also represents the highest risk for heat-related illness among collegiate football players. Because concussion and heat illness share many common symptoms, better understanding the poten-

tial relationship between environmental and physiological factors and biomechanical measures of head impacts is warranted.

**Rationale:** To understand how environmental and physiological factors affect biomechanical measures of head impact severity, and to determine whether an in-helmet thermistor could validly measure core body temperature.

**Methods:** Eighteen positionally representative NCAA Football Bowl Subdivision athletes participated in a prospective cohort study design. Head impact measures were recorded in real-time using accelerometer units as a part of the Head Impact Telemetry (HIT) System (Simbex, Lebanon, NH). A thermistor built into these units was capable of recording in-helmet temperature. CorTemp ingestible pills (HQ Inc, Palmetto, Fla) were used to record and transmit core body temperatures to a handheld recorder. A standard wet bulb globe temperature device recorded ambient temperature and relative humidity. Data were collected during four practice sessions (3 preseason; 1 in-season). Separate random intercepts general mixed linear models were employed to evaluate the effect environmental and physiological factors had on impact severity.

**Results:** While adjusting for all other factors in the model, ambient temperature ( $F_{1,606} = 11.26$ ;  $P < .01$ ) and wet bulb globe temperature ( $F_{1,606} = 11.95$ ;  $P < .01$ ) were statistically significant predictors of linear acceleration and rotational acceleration, respectively. The mean difference between thermistor and core temperature measures ( $6.25 \pm 4.51$ ) suggests the in-helmet thermistor was not a valid measure of core body temperature ( $t_{715} = 37.07$ ;  $P > .01$ ).

**Discussion:** Our study suggests that although impact severity may be statistically influenced by ambient and wet bulb globe temperature, the model estimates suggest these contributions may represent clinically meaningless differences. The environmental and physiological factors we evaluated do not appear to affect the severity of head impacts sustained by collegiate football players.

**Importance:** This is the first known study exploring how head impact severity may be affected by environmental and physiological conditions during football participation. As some in-helmet temperature products are beginning to emerge in the open market, our data would suggest that clinicians take extreme caution in these products' abilities to accurately represent core body temperature. Our results have allowed us an opportunity to identify factors affecting head impact severity that we may study in more detail in future work to reduce potential injury risk in collegiate football players.

## Effects of Osteopathic Treatment in the Vestibular Disturbed Concussed Athletic Population: A Pilot Project

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**Introduction:** This pilot study was designed to determine the effect of osteopathic treatment on vestibular disturbed concussed athletes as measured by the Balance Error Scoring System

(BESS) and the Dizziness Handicap Inventory short-form questionnaire (DHI-sf). The University of Calgary Conjoint Health and Research Ethics Board approved this project (Ethics ID# 22248).

**Methodology:** Athletes between the ages of 18-40 years experiencing unexplained vestibular symptoms a minimum of 1 month and a maximum of 12 months postconcussion were recruited for this project. Three male and 4 female consenting athletes were admitted to this study. Participants were screened for inclusion and exclusion criteria by a sport medicine physician. All participants were prescribed physical and mental rest, in association with an osteopathic treatment protocol. Baseline data for the DHI-sf and BESS were obtained prior to application of the osteopathic treatment protocol. Athletes were asked to complete the DHI-sf each day between treatments. An additional week of collection was undertaken after the last treatment. BESS measurements were taken prior to each osteopathic treatment, with the last occurring 1 week after the third and final treatment.

**Results:** The baseline score for the DHI-sf was found to be  $7.43/13 \pm 2.23$  identifying vestibular compromise. Upon study completion the group's average improved to  $11.29/13 \pm 1.38$ , ( $P < .01$ ). The BESS baseline for stable surface stances was  $10.86 \pm 7.95$ , foam  $22.14 \pm 2.73$ , and the total error score  $33.00 \pm 10.21$ . At completion, the scores were stable  $5.86 \pm 6.62$  ( $P < .05$ ),  $15.29 \pm 5.59$  ( $P < .05$ ), and total error score  $21.14 \pm 11.52$  ( $P < .01$ ). Of note, 24 of the 42 scores for the unstable surface were automatically assigned maximum error scores due to the subject's inability to complete the test.

**Discussion:** Osteopathic treatment appears to have a clinical effect in vestibular disturbed concussed athletes. The BESS and the DHI-sf appear to display clinical outcome measures with this population. The BESS data for the vestibular disturbed concussed population appears to be unique. Previously published baselines for nondescript concussed athletes were  $4.3 \pm 3.0$  for the stable surface scores and  $13.1 \pm 6.6$  for the foam scores. BESS total error scores for a normal population of ages 20-39 years was  $10.97 \pm 5.50$ . As this was an open case series pilot project with no control group, further investigation of osteopathic treatment for this population is encouraged.

## Subclavius Strengthening Increases Shoulder Stability: A Case Study

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**Background:** A 15-year-old male gymnast and football player complaining of right clavicle and shoulder pain had been kept out of play for the past year due to a fracture to his right radius and recurrent sternoclavicular joint, and from shoulder pain. Imagery was normal. Re-assessment after 3 weeks of minimal improvement revealed full range of motion (ROM) except for shoulder flexion, extension, and abduction, with pain at the end of all ranges except shoulder internal rotation and adduction. Shoulder strength, mostly shoulder abduction, was diminished. Posture

showed bilateral winging scapulae, with pectoralis, trapezius, and scalene tightness. Pain was present on palpation of the right sternoclavicular joint, first rib, and transverse processes of thoracic spine (T1-T6). Neurological signs were negative.

**Treatment:** The main objectives were decreased pain, increased pain free shoulder ROM, increased shoulder strength, increased shoulder, scapular and clavicle stability, increased proprioception, and biomechanical and postural education. Treatments included stretching, soft tissue release techniques, and mobilizations. General strengthening exercises included scapular retractions, rhomboids, middle and lower traps, and serratus anterior. Prior to the re-assessment, improved pain-free ROM, shoulder strength, and scapular stability were seen, but poor clavicle control resulted in shoulder instability. Subclavius strengthening exercises were used to promote an anterior and inferior proximal clavicle enhancing the sterno-clavicular joint. Strengthening this muscle, both isometrically and dynamically, improved sternoclavicular (SC) joint stability.

**Outcome:** Five weeks following the initial assessment, re-evaluation of the patient showed full pain free functional in daily activities, full pain free shoulder ROM and strength, and greater scapular, clavicle, and shoulder stability. Following functional testing, the athlete returned to play.

**Significance:** Treating shoulder dysfunctions and instabilities requires traditional rehabilitation treatments, but examining the entire region is essential. By considering the anatomy, therapists can utilize smaller yet significant structures in the rehabilitation. In this case, SC joint instability was limiting improvements in the rehabilitation. Dynamic stabilization of the clavicle and SC joint was shown to be effective in this treatment. This approach should be part of a comprehensive assessment and rehabilitation of the shoulder to prevent re-injury to the shoulder and aid rapid return to play.

## Calcaneal Bone Cyst in Active Adult Female: A Case Study

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**Background:** Unicameral bone cysts typically occur in the metaphyseal-diaphyseal regions of long bones, within the first 10 years of life. Unicameral bone cysts are considered a benign self-limiting disease that spontaneously heals after skeletal maturity. These cysts are relatively common in the humerus, femur,

and tibia, but they rarely form in the calcaneus. The patient is a 36-year-old female, avid runner (36 to 40 miles per week) with right foot, lateral mid to rear-foot pain that is exacerbated during running. A thorough patient history revealed reoccurring stress fractures of the lateral mid-foot for a period of 7 years. Upon orthopedic examination of her latest stint with pain, the physician diagnosed the injury as a cuboid stress fracture. The patient was immobilized in a MaxTrax Walker (DonJoy, Vista, Calif) for 6 weeks. Following 6 weeks of immobilization, the patient attempted to run and noted the same pain and severity of pain she had prior to immobilization. The physician ordered a diagnostic computed tomography scan, which revealed a stress fracture across the entire right calcaneal body. Subsequent radiographs were performed in attempt to validate the computed tomography scan.

**Differential Diagnosis:** A podiatrist diagnosed a bone cyst with a stress reaction mid-body of the right calcaneus.

**Treatment:** Surgical treatment resulted in an evacuation of the bone cyst with curettage and packing of bone with osteoecel allographic bone material. Following surgery, the patient was non-weight bearing and placed on crutches with a soft splint for 21 days. At 22 days, the patient was weight bearing in the Cam Walker without the assistance of crutches. Forty-two days post-operatively, the patient was released to walk and resume physical activity without restriction. Within 4 weeks of physician's release, the patient completed a 5K run at pre-injury performance level with no pain.

**Uniqueness and Conclusion:** Typically, unicameral bone cysts occur in the long bone of youth and primarily males. This case presents a 36-year-old female who had experienced 7 years of stress reactions as a result of the calcaneal bone cyst. In addition, the patient was able to return to full activity after 20 weeks of immobilization and at week 24 compete at pre-injury levels. Although unicameral bone cysts are rare in adults they do occur. If there is a continual trend of stress issues and the pain is not alleviated after weeks of immobilization, further referral is warranted. ■

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