NHMI NEWS

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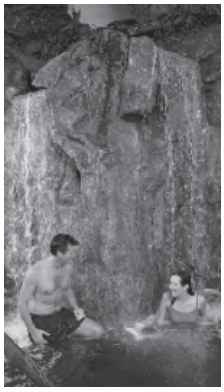
New Hampshire Musculoskeletal Institute

A nonprofit organization established to conduct research and education



Stoweflake Spa a Great Spot for NHMI's Winter Meeting

An incredible new spa including this 15-foot tall therapeutic waterfall only made our experience at Stoweflake Mountain Resort and Spa that much better than last year! We held our Annual Winter Meeting at Stoweflake March 19 and 20th this year. An eclectic mix of speakers and topics kept the meeting interesting and dynamic while Mother Nature provided excellent spring skiing for the off hours. This year's speakers were:

Joe Abate, MD, University of Vermont
Richard Iorio, MD, Lahey Clinic
Tom Kleeman, NH Spine Institute
Mark Lemos, MD, Lahey Clinic
Michael Miranda, MD, Hartford, CT
John Richmond, MD, NE Baptist Hospital
Glen Shapiro, MD, North Conway, NH
Ray Sinatra, MD, Yale
James Vailas, MD, NHMI

Among the exciting topics was Tom Kleeman's discussion of his research using bone morphogenetic protein in spinal fusion, including his unique approach designed to avoid neurologic complications. Dr. Iorio contributed food for thought with his description of his use of objective preoperative activity measures to determine demand and implant selection in total hip and total knee arthroplasty. The shoulder was the subject of three talks: arthroscopic shoulder stabilization, arthroscopic versus open rotator cuff repair, and treatment of Grade III AC joint injuries. Rounding out the schedule were lectures about winter sports injuries and surgical management of fractures, meniscal tears and unicompartmental arthritis of the knee.

As always, we are indebted to our vendors for their invaluable support of the Institute and this meeting. Without their participation, the cost to attend this meeting would literally be twice the reasonable fee charged this year.

Save March 18 and 19th, 2005 for next year's meeting.

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Research Update - '04 Abstracts

Gender Comparison of Vertical Jump Landing Knee Angles Normalized by Kinetic Energy

(Supported by NATAREF Grant #90166P008.)
Laura C. Decoster, Erik E. Swartz, Pamela J. Russell, Ronald V. Croce:
American College of Sports Medicine, Indianapolis, June 5

Landing from a jump is implicated in 50% of non-contact ACL injuries. Observation of filmed injuries suggests ACL failure is often associated with knee extension, tibial valgus and external rotation. If women land in this position excessively, their injury risk may increase. However, research conclusions regarding gender and landing knee angle have varied. In general, drop landing studies show women land with more extension, while functional landing studies show no differences in knee angle. An important issue in landing from a functional jump is that subjects achieve different absolute jump heights. This may affect the amount of impact-absorbing flexion used in a given landing. **PURPOSE:** The purpose of this study was to identify differences in knee flexion angle, adjusted for jump height, between men and women landing from a vertical jump (VJ). **METHODS:** Twenty-eight subjects provided informed consent and participated in this study (14 women, age=24.22+2.27; 14 men, age=23.57+3.23). Twenty-three reflective markers applied to each subject created an 8-segment linked model for 3D analysis. For each of four trials, subjects jumped for a ball set at 50% of their maximum VJ height, then landed on two feet, facing forward, with only their dominant foot on the force plate. Knee flexion angles at initial contact (IC), at peak vertical ground reaction force (Fz) and peak knee flexion (PKF) were normalized to kinetic energy (KE). Center of mass velocity in the frame before IC represented touchdown velocity. Data were analyzed using a paired T-test (a =0.05). **RESULTS:** Gender comparison of knee angles in degrees revealed no differences. At IC women experienced 0.08+0.04 º/KE and men experienced 0.05+0.02°/KE (p =0.02). At Fz women experienced 0.54+0.11°/KE and men experienced 0.30 +0.08°/KE (p=0.00). For PKF, women experienced 0.26 +0.08°/KE and men experienced 0.14 +0.07°/KE (p=0.00). **CONCLUSIONS:** When scaled by the kinetic energy generated during descent, women demonstrated more knee flexion than men. KE simultaneously considers mass and descent velocity, both of which may affect impact forces and the amount of flexion used to accommodate them. In attempting to determine the relative amount of flexion used in functional tasks, it may be necessary to account for differences in mass and landing force to insure appropriate comparisons.

Loading Rate in Self-Initiated Vertical Jump Landings: Developmental and Gender Comparisons

(Supported by NATAREF Grant #90166P008.)
Pamela J. Russell, Erik, E. Swartz, Ron V. Croce, Laura C. Decoster:
International Society of Biomechanics in Sports, Ottawa, August 9

INTRODUCTION: Research surrounding the disproportionately higher incidence of non-contact anterior cruciate ligament (ACL) injuries in females has led to numerous investigations of the biomechanics and neuromuscular aspects of landing (e.g., Lephart, *et al.*, 2002). Among initial findings females had less knee flexion upon landing (McClay, *et al*., 2001), but current findings are mixed regarding gender differences in landing mechanics (e.g., knee flexion angle) (Fagenbaum, *et al.*, 2003). Few studies have explored when, during development, gender differences may become apparent. This study examined landings across gender and explored when differences might emerge, that is through assessment of gender and developmental (i.e., pre- and post-pubescent) qualities of landing from a self-initiated vertical jump. Although there is no direct causal relationship between magnitude of load and injury, the rate at which vertical load is modulated may be a risk factor for injury. Loading rate information during landing tasks could contribute to the ACL injury puzzle solution (McClay, *et al.*, 2001). Thus, the purpose of this study was to compare gender and developmental differences in vertical loading rate upon landing from a self-initiated vertical jump. **METHODS:** Fifty-eight subjects (grouped by age and gender) signed an approved consent to participate. All subjects were recreational participants in jumping and landing activities and demonstrated a mature vertical jump. Motion analysis, force plate, and surface electromyographic data were collected. Fourteen retro-reflective markers provided a 4-segment model for the dominant leg. Each subject jumped to reach a target (i.e., medium sized ball suspended on a retractable cord) then landed in a balanced position with only the dominant foot on the force plate. Loading rate was determined as the maximum vertical ground reaction force (MGRFz) normalized to total body kinetic energy (KE) at initial contact (IC), divided by the time from IC to MGRFz. Data were averaged across 3-4 trials/subject before group means were calculated. A 2 x 2 (gender x development) ANOVA was used to determine significant differences. Significance was set at $p < .05$. **RESULTS AND DISCUSSION:** Results showed significant developmental differences, but no significant gender differences. Pre-pubescent subjects demonstrated greater loading rates (262.7 + 27.8) than post-pubescent subjects (131.9 + 28.3) did, that is, with loading rate normalized to KE at IC to account for differences in body mass and jump height.

Standing and Supine Hamstring Stretches are Equally Effective

Decoster LC, Scanlon RL, Horn KD, Cleland J:
National Athletic Trainers Association, Baltimore, June 17

The purpose of this study was to evaluate the relative effectiveness of standing and supine hamstring stretching in increasing hamstring flexibility as measured by increasing knee range of motion. A convenience sample of 29 healthy subjects (22 females, 7 males, age 25.9+6.13) with tight hamstrings (> 25° from full knee extension with the hip in 90° flexion) volunteered to participate in this study. Supine active knee extension was used to assess knee range of motion. All subjects performed one stretching method on each leg three days per week for three weeks (3 x 30 seconds per leg per session). The stretch performed on each leg was randomly assigned using a computer-generated number table. The supine stretch involved placing the stretching leg on a wall with the opposite leg and trunk flat on the floor. The standing stretch involved placing the heel on a plinth with the pelvis tilted anteriorly and the spine held erect. Stretching sessions were supervised; no warm-up activities preceded any measurement or stretching session. Measurements were taken before and following the three-week stretching phase by the same investigator, who was blind to leg assignment. A two-way mixed design ANOVA and Tukey's HSD post hoc tests were used to analyze data. The leg stretched in the supine position improved from 139.45° (+9.68°) to 147.52° (+8.25°). The leg stretched in standing improved from 138.31° (+10.68°) to 147.66° (+10.28°). The mean change score for the supine stretching legs was 8.1° (+ 8.4°, 95% confidence interval 4.7-11.4°) and for the standing stretching legs was 9.4° (+ 9.7, 95% confidence interval 6-12.8°). Analysis revealed a significant main effect for the within group factor, time ($df=1$, $F= 53.5$, $p<0.025$) but not between groups ($df=1$, $F= .030$, $p = .585$). Post hoc analysis revealed a significant difference ($p<0.05$) from pre- to post-test measurements for both stretching methods, but no significant difference ($p>0.05$) between the supine and standing group measurements. A different group participated in two measurement sessions to assess intratester reliability (ICC (3,1) =.899). This study suggests that standing and supine hamstring stretches are comparably effective. There was no significant difference in change score between the standing and supine hamstring stretches. With proper instruction and supervision, both stretches can be effective and may be used interchangeably. However because the supine stretch does not require specific pelvic positioning, and therefore requires less instruction and supervision, it may be more effective for independent programs.

Various Types of Football Helmets, Face Masks, and Face Mask Loop Straps, and Their Effects on the Efficiency of Face Mask Removal (Funded by NOCSAE.)

Swartz EE, Norkus SA, Cappaert TA, Decoster LC:
National Athletic Trainers Association, Baltimore, June 19

The purpose of this study was to analyze the effect of varied helmets, face masks, and loop straps on face mask removal. Fifteen certified athletic trainers reported for two data collection sessions and used a cordless screwdriver (SD) and FM Extractor (FM). Subjects signed an informed consent and were trained in unscrewing or cutting the face mask for all conditions. Conditions included combinations of 3 helmets (Riddell VSR-4 (R4), Riddell Revolution (RV), and Schutt Air Advantage (ST)) 3 face masks (Riddell thin wire, Schutt Armourguard Elite, Riddell Revolution) and 5 loop straps (Riddell standard (RS), Schutt Armourguard (SA), Maxpro Shockblocker (SB), Stabilizer II (SII), Revolution (Rev)). Each subject then removed the face mask two times for all conditions. Trial order was counterbalanced, and data were analyzed for average time (T) in seconds (s) and a rating of perceived exertion (RPE) to indicate the level of difficulty for each condition. Data were analyzed using a MANOVA (alpha = .05) with Bonferonni adjustments and follow-up comparisons when appropriate. When using a SD, a significant effect was detected for T (P=.007). Pairwise comparisons revealed subjects took longer to remove a face mask from an R4 helmet when it was attached using the SII (55.83 ±13.12 s) compared to when it was attached using a SB on both the R4 (43.05±5.54) (P= .023) and ST (40.36±6.52s) (P= .008). There were no differences between conditions in RPE for subjects when using the SD. When subjects used the FM, a significant effect was detected for T (P=.000). Pairwise comparisons revealed subjects took longer to remove the face mask from a RV when attached with Rev (165.67±29.40s) compared to when attached using SB on both R4 (63.08±14.78s) and ST (103.57± 25.86s) (P= .001, P=.047, respectively). Face mask removal took significantly longer using SA (203.33±25.86s) compared to RS (95.00±7.07s) (P=.004), SB when attached to R4 (P=.000), and SB when attached to ST (P=.001). A significant effect was detected for RPE (P=.026) when using the FM, yet follow up tests did not identify differences between specific conditions. Subjects reported the highest RPE when removing the face mask from the RV (6.833±1.02) and lowest RPE when removing the face mask from the R4 when attached with the SB (2.67±.72) These results demonstrate that regardless of type of tool used, football helmet components affect the efficiency of face mask removal. Further research should compare effects on head movement.

Comments from the President

Spring is a busy time of year for NHMI. Planning is well under way for the fall Symposium, and preliminary plans for the 2005 Winter Meeting are also in the works. Interviewing for next year's Athletic Training Fellows is in mid-stride. As you may have read, the recent Winter Meeting was a success and the venue, Stoweflake in Stowe, Vermont was wonderful for our group. I encourage you folks to attend either the winter or fall conference, whichever suits your needs. The programs have been quite educational, the facilities have been exceptional, and the value of the continue education credits has been a bargain. I am proud to state that NHMI has developed enough experience with the symposia that the overall quality of the programs is consistent. Also, I cannot credit or mention enough, our gratitude to the corporate sponsors who have supported our programs, especially during a time when corporate sponsors are being highly scrutinized for "buying" physician support. In addition to our education pursuits, the Institute's research arm continues to grow with five abstracts accepted for 2004 (see preceding page). Much credit is due to Laura for taking on the load and making things happen. Again, I am quite pleased and comforted by being able to say that the "state of affairs" within the Institute is strong and favorable. We appreciate your time and interest, and especially your support of the Institute and its Mission.

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Mission Statement:

The New Hampshire Musculoskeletal Institute is a nonprofit organization established to promote, conduct, coordinate and disseminate musculoskeletal research and education and to ultimately improve musculoskeletal health care.

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