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PAPER NO. 36

Normative DASH Scores in Intercollegiate Athletes Differ from Values in the General Population

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The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire has been validated as an effective upper extremity specific outcome measure. Normative scores have not been established for the young, athletic population. The purpose of this study is to establish normative DASH scores for intercollegiate athletes. We hypothesize that DASH scores in intercollegiate athletes differ from published values obtained from the general population. The DASH questionnaire was administered to 321 athletes cleared for full participation in intercollegiate sports. Scores from this cohort were compared to normative values in the general population and two other age-matched cohorts. Intercollegiate athletes had a significantly better upper extremity function when compared to the general population (1.37±2.96 vs. 10.10±14.68, $p<0.001$) and an age-matched cohort of employed adults (1.37±2.96 vs. 5.40±7.57, $p<0.0001$). The majority (65.1%) of athletes had a DASH of 0. Within this cohort, male athletes reported better upper extremity function compared to women (0.98 vs. 1.82, $p=0.010$). Athletes participating in overhead sports reported worse upper extremity function when compared to non-overhead athletes (1.81 vs. 0.98, $p=0.042$). Intercollegiate athletes report significantly greater upper extremity function than the general population. The utility of using these results as a benchmark for measuring return to baseline function and differences seen between groups of athletes are limited by a substantial ceiling effect in this population of competitive athletes. Various upper extremity outcome measures may be similarly limited by a ceiling effect and should be examined for appropriateness prior to use.

PAPER NO. 239

The Increased Financial Burden of Further Proposed Orthopaedic Resident Work Hour Reductions

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Increased residency funding was not made available during the implementation of the 80-hour work week. Many hospitals responded by hiring physician extenders to maintain continuity of care. Recent proposals include a further decrease to 56 hours. The goal of this study was to determine the cost of further reduction in orthopaedic resident hours. A survey was sent out to 152 residency programs to determine the number of full time equivalent (FTE) physician extenders hired after the 80-hour restrictions. Nine programs responded (5 university-based and 4 community-based), encompassing 173 residents. Previous published data were used to determine the change in work hours before and after 80-hour restrictions. A ratio between change in FTE per resident and number of reduced hours was used to determine the cost of the proposed further decrease. After the 80-hour restriction, the average reduction in work hours was approximately 5. 13 physician extenders were hired to meet compliance, at a frequency weighted average cost of $83,571 per FTE. A further reduction to 56 hours would increase cost by $30,085 per resident. With 3259 orthopaedic residents nationwide, the increased cost would be $98,047,015 per fiscal year. For each hourly decrease in weekly work hours, the cost is $4,085,293 over the course of the fiscal year. Mandated reductions in resident work hours are a costly proposition, without a clear decrease in adverse events. The federal government should consider this data prior to initiating unfunded work hour mandates, as further reductions in resident work hours may make resident education financially unsustainable.

PAPER NO. 277

High Cholesterol Adversely Affects Biceps Tendon Mechanical Properties in a Porcine Model

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The link between elevated low-density lipoprotein and cardiovascular disorders is well-documented; however there is a lack of data related to its potential effect on the musculoskeletal system. Our clinical work has also uncovered a link between rotator cuff tears and high cholesterol in shoulder patients. Therefore, the objective of the present study was to investigate potential relationships between high cholesterol and shoulder tendon mechanics in an existing porcine model. We hypothesized that biceps tendons from hypercholesterolemic pigs would have reduced mechanical properties when compared to those of normal controls. A total of seven male Yorkshire pigs (103 kg average) were used in this IACUC-approved study. At 3-4 months of age, a control group (n=3) continued to receive a normal diet while a high cholesterol group (n=4) received a diet of 0.5% cholesterol, 10% lard, and 1.5% sodium cholate for a period of five months. At the end of the five month treatment, all animals were sacrificed. Biceps tendons were dissected free from the muscle insertion, while leaving the bony insertion intact. Tendon cross-

sectional area was measured using a custom laser-based device. Specimens were submerged in a 37∫C PBS bath and tensile tested as follows: preload, preconditioning, and ramp to failure at 0.1%/s. Data between groups were evaluated using a one-tailed unpaired t-test with significance set at $p<0.05$. Mean cholesterol levels at the time of sacrifice were 290 mg/dL for the hypercholesterolemic (HC) group and under 100 mg/dL for the control (CTL) group (no quantitative measure below 100 was recorded). No differences were noted in tendon size as measured by cross-sectional area. Biomechanical testing revealed significantly reduced stiffness ($p<0.002$) and Youngs modulus ($p<0.0001$) in the HC group compared to CTL tendons. This finding was present for both tendon midsubstance and insertion site properties. Testing demonstrated that tendon mechanics of hypercholesterolemic animals were severely compromised compared to those of control animals, in support of our hypothesis.This is the first study reporting effects of hypercholesterolemia on native tendon mechanical properties. The present finding of substantially reduced mechanics supports our clinical observations relating high cholesterol and the incidence of tendon tears.

PAPER NO. 295

Publication Rates of Presentations at an American Academy of Orthopaedic Surgeons Annual Meeting

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The purpose of this paper is to quantify the publication rates in peer reviewed journals of papers presented at an American Academy of Orthopaedic Surgeons (AAOS) Annual meeting. Using the proceedings from the 2001 68th Annual AAOS meeting, a comprehensive literature search of Medline and PubMed was performed. The search included all the names of the authors listed in the proceedings for a given paper and the abstract was compared to the yielded results in order to ensure the accuracy and similarity of the papers. The rate of publication in peer reviewed journals was recorded at regular intervals (1, 2, 3, and 5 years) and the results were subdivided according to podium or poster presentations and subspecialty. Overall, the publication rate of all presentations was 49% at 5 years. Poster and podium presentations were published at a rate of 47% and 52% respectively. After 1, 2, and 5 years, the overall publication rates were 15%, 30%, and 49% respectively. After 1, 2 and 5 years, the overall poster presentation publication rate was 14%, 29%, and 47% respectively while the overall podium presentation publication rate was 18%, 33%, and 52% respectively. Subspecialty publication rates at 5 years are as follows: Adult Hip Reconstruction 37%, Adult Knee Reconstruction 46%, Basic Science 48%, Foot and Ankle 44%, Hand and Wrist 28%, Pediatrics 51%, Tumor and Metabolic Disease 55%, Health Policy and Management 55%, Rehabilitation Medicine 21%, Shoulder and Elbow 53%, Sports Medicine and Arthroscopy 58%, Spine 57%, Trauma 56%, and Miscellaneous 50% .There was a statistically greater likelihood of being published compared to the 1996 Annual AAOS meeting presentations (OR 1.816, $p<0.0001$). Compared to previous studies, the overall publication rates for all AAOS presentations have improved. However, it is important to be aware that not all studies presented at AAOS annual meetings will be subject to the scrutiny of peer review publications.

PAPER NO. 405

Femur Fractures in Children: Abuse or Accidental Trauma?

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Femur fractures are both common in young children and frequently caused by child abuse. We hypothesize that femur fractures caused by abusive trauma can be readily recognized by history, physical exam, and radiographic characteristics, and that a prediction model can be generated to determine the probability of a potential abusive etiology. This study is a retrospective review of prospectively collected information from an urban level I pediatric trauma center. Seventy consecutive children with femur fractures stemming from child abuse (ages birth to 48 months) were identified by membership in our institution's Suspected Child Abuse and Neglect (SCAN) database between 1998 to 2007, and compared against 139 control patients of the same age group with femur fractures stemming from accidental trauma presenting between 2000 to 2003. A multiple logistic regression model identified three criteria of significant risk that helped predict the likelihood of a femur fracture stemming from abuse based on the number of risk factors observed for each patient.The three significant risk factors identified were: 1) age less than 18 months, 2) physical and/or radiographic evidence of prior trauma, and 3) history suspicious for abuse Patients without risk factors had a 4.2% chance of having a femur fracture stemming from child abuse, patients with one risk factor had a 24.1% chance, those with two had an 87.2 % chance, and children with three had a 92.3% chance for an abusive etiology. Prediction based on the multiple logistic regression model can help determine the etiology of pediatric patients presenting with a fractured femur. Clinicians need only determine the number of risk factors and then apply the prediction rule. We believe that this method will help all clinicians determine whether or not child abuse has occurred and thus improve their approach to management.

PAPER NO. 416

Volume Change Following Neoadjuvant Chemotherapy as a Predictor of Survival in Soft Tissue Sarcomas

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Histologic tumor necrosis following neoadjuvant chemotherapy is an established prognostic factor for bone sarcomas, but its predictive value for soft tissue sarcomas (STS) remains

uncertain. This study investigates change in tumor volume post-chemotherapy to determine its prognostic value. Our STS database was searched for patients treated with neoadjuvant chemotherapy and surgery. Inclusion criteria were 3-dimensional tumor measurements reported by the radiologist (pre- and post-chemotherapy, pre-radiation therapy) and minimum 12-month follow-up. Tumor growth e10% was defined as progression. Shrinkage of e10% was defined as response. Change of <10% was defined as stablilty. Kaplan-Meier and Cox regression analyses were performed. Forty-one of 92 patients met inclusion criteria. Mean follow-up was 36 months (range 12-113). Response was seen in 22 patients, progression in 15, and stability in 4. Mean volume change was +134 cm^3 (−2217 to +4255cm^3. Mean percent volume change was +20% (-97% to +931%). One patient developed local recurrence 2 months post-operatively. Seven patients developed metastasis at a mean of 12.8 months. Seven patients died. Patients with progression were more likely to have a shorter overall survival than those with response or stability (p=0.005 [Kaplan-Meier], p=0.02 [Cox Regression]). However, disease-free survival was similar for these groups (p=0.448, p=0.496). Neither overall survival nor disease-free survival was significantly different based on histologic necrosis (<90 vs. e90%) (p=0.239 and p=0.469, respectively [Kaplan-Meier], p=0.202 and p=0.518, respectively [Cox Regression]). Tumor percent volume change after chemotherapy, measured on MRI, may be a more useful predictor of overall survival than histologic necrosis for STS. Neither volume change nor necrosis appears to reliably predict disease-free survival for STS.

PAPER NO. 639

Rectus Femoris to Gracilis Transfer with Vasti Lengthening for Treating Adult Stiff Knee Gait

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Stiff knee gait, which may be seen in patients with upper motor neuron injury, describes a gait pattern with relative loss of sagittal knee motion. It interferes with foot clearance during swing, often leading to inefficient compensatory mechanisms and ambulatory dysfunction. At our institution, we have been performing distal rectus femoris transfers and fractional lengthening of the vasti muscles in adult patients with great clinical results. The purpose of this study was to describe our unique surgical technique and report our initial outcomes. Adults with stiff knee gait due to stroke or traumatic brain injury who underwent distal rectus femoris transfer with fractional lengthening of the vasti muscles were included. Lower extremity examinations, clinical gait analyses, and satisfaction levels were recorded pre- and post-operatively. There were 19 males and 18 females, with an average age of 51 years at the time of surgery. At a mean follow-up of ten months, 36 of 37 patients (97%) were satisfied with their clinical and functional results. We have found distal rectus femoris transfer and fractional lengthening of the vasti muscles to be an effective treatment for adults with stiff-knee gait caused by stroke or traumatic brain injury.

PAPER NO. 649

Surgical Treatment for Avulsion Fractures Involving the Anterior Talofibular Ligament in Children

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Some children have persistent pain and instability following inversion injuries of the ankle. Radiographs may reveal a small bony fragment distal to the lateral malleolus, suggesting an avulsion injury to the anterior talofibular ligament and/or the calcaneofibular ligament (ATFL/CFL). This may cause ligamentous laxity and chronic pain from non-union. This must be differentiated from asymptomatic os subfibulare, which is a normal anatomic variant in 1% of children. Twenty-three patients presented with chronic ankle pain and instability, tenderness anterior and distal to the lateral malleolus, and imaging (stress radiographs) suspicious for avulsion injury of the ATFL/CFL. After failed non-operative treatment, all patients underwent excision of the bony fragments, anatomic reconstruction of the ATFL by using drill holes through the lateral malleolus, and a modified Brostrom procedure. The mean age was 10.4 years (range, 8 to 13 years) at the time of injury and 13.6 years (range, 11 to 20 years) at the time of surgery, which represents an average delay in diagnosis and treatment of 3.2 years. At mean follow-up of 4.5 years (range, 2.1 to 13.2 years), the mean Foot and Ankle Outcome Score was 91.4 out of 100 (range, 87 to 98) with all but one patient returning to pre-injury recreational levels. There were no long term complications from the procedure. Surgical excision of chronic avulsion fracture fragments combined with ATFL reconstruction and a modified Brostrom procedure is effective in restoring ankle stability, eliminating pain, and returning children to pre-injury functional levels.

PAPER NO. 701

Hip Arthroscopy for Labral Pathology: Review of Outcomes with 5-Year Average Follow-up

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Hip arthroscopy is a relatively new diagnostic and therapeutic option for labral pathology. More data is needed to identify any patient related factors which might predict functional outcome. This retrospective study with prospective followup examined 52 consecutive patients. Outcomes included clinical course, the modified Harris Hip Score, and preoperative activity level according to the UCLA Activity Scale. Average age was 42 years; follow-up was 2-8 years. 21 patients (40.4%) had a traumatic etiology of their tears. 8 patients (15.4%) had possible secondary gain. Fifteen patients (28.8%) had pre-existing osteoarthritis. 40.4% of patients had no chondromalacia at time of arthroscopy; 32.7 % had grade I or II changes; 26.9% had grade III or IV changes. Four (7.7%) patients suffered transient nerve palsies. Three patients (5.8%)

went on to total hip arthroplasty. On multivariate analysis, higher pre-op activity level and duration of symptoms >18 months were found to be predictors of good or excellent outcomes. Smoking and secondary gain issues were significant negative predictors of good or excellent outcomes. Only prior level of activity was a significant positive predictor of return to activity following surgery. A traumatic etiology of the labral tear was a significant negative predictor of return to activity. Chondromalacia and osteoarthritis were not significant predictors of negative outcome. This series supports the hypothesis that hip arthroscopy provides safe and reliable relief of labral symptomatology. Pre-operative activity level should guide both patient and physician expectations of postoperative results.

PAPER NO. 707

Isolated Gastrocnemius-Soleus Tightness in the Athletic Population

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Contracture of the gastrocnemius-soleus complex has been described in the general population and implicated in the development of foot and ankle pathology. The athletic population has not been evaluated with respect to the existence of isolated gastrocnemius contracture and its relationship to preceeding pathology. Ankle dorsiflexion measurements were performed on 166 intercollegiate athletes. Goniometer measurements were obtained controlling midfoot and subtalar motion in two positions: knee fully extended and knee flexed 90 degrees. Demographic data including gender, sport, and history of foot/ankle pathology were recorded. Ankle dorsiflexion measurements were compared to published data. Factors were assessed statistically for association with ankle equinous contracture defined as dorsiflexion less than 10 degrees. Mean ankle dorsiflexion was similar to published data with the knee both flexed and extended. However, ankle flexion contracture was more commonly noted on the left (21%) than the right (11%) in athletes with mean dorsiflexion being greater with the knee flexed ($p<0.001$) and extended ($p<0.001$) on the right side. Increased athlete weight was associated with decreased mean ankle dorsiflexion ($p=0.02$), presence of equinous contracture ($p=0.02$) and isolated gastrocnemius tightness ($p<0.05$). A self-reported history of any foot/ankle pathology was reported by 34% of athletes. Positive history was associated with decreased mean ankle extension ($p<0.05$) and an increase in gastrocnemius tightness ($p<0.05$), but was not different between sides. Mean ankle dorsiflexion in the athletic population differs from the general population as there is significantly asymmetric ankle motion. Increased gastrocnemius tightness was associated with increased athlete weight and prior history of injury.

POSTER NO. P103

Incidence of Modern Alumina Ceramic Bearing Failures in 3 Million Hip Implants

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Ceramic fractures in total hip arthropasty (THA) are a rare but catastrophic complication. Because of improvements in ceramic materials, manufacturing, and implant design, the incidence of ceramic failures has decreased over time. The purpose of this study is to report the incidence of modern alumina bearing failures from a single major ceramic manufacturer in 3 million hip implants and to identify trends in the modes of failure of these implants. Between 2000-2008, CeramTec AG (Plochingen, Germany), a major supplier of alumina THA bearings to orthopaedic implant manufacturers, began a comprehensive program for reporting and gathering failure data on its products. Over this period, approximately 3 million Biolox forte ceramic implants have been implanted worldwide. The failures were analyzed with respects to time to failure, head size, implant design, and other factors that may have contributed to breakdown. The incidence of Biolox forte THA bearing failures between 2000-2008 was 1 in 5000 (0.021%). The majority of implant failure occurred within 36 months following surgery ($p<0.01$). Fractures were usually associated with specific events such as trauma, mismatched components, autoclaving and cooling, and dislocations (poor implant position). Large diameter heads were associated with lower fracture risk compared to smaller diameter femoral heads (0.0052% for 36 mm heads vs. 0.030% for 28mm heads, $p<0.01$). Taper size and design also had some effect on the risk of failure; medium sized tapers were associated with lower fracture rate compared to small and large tapers (0.005% vs. 0.018%). Improvements in materials, manufacturing, implant design and surgical techniques have continued to decrease the incidence of fracture in ceramic THA.

POSTER NO. P244

The Utility of Posterior Sloping Angle in Predicting Contralateral Slipped Capital Femoral Epiphysis

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Prophylactic pinning of the uninvolved side after unilateral slipped capital femoral epiphysis (SCFE) is controversial. The posterior sloping angle (PSA) has been previously proposed to predict contralateral slip. The purpose of this study was to determine whether the PSA can predict subsequent slip after unilateral SCFE, and if so, whether a gender difference exists. A retrospective case-control study was performed comparing 51 patients who initially presented with unilateral SCFE and 51 patients who had unilateral SCFE only (Unilateral). Data collected include age, sex, ethnicity, and PSA. The patients in the Bilateral group had significantly higher PSA

(14.5± 6.1 vs. 10.6 ±5.3, P= 0.001) and were younger (11.3 ± 1.5 vs.12.3 ± 1.2, P <0.001) than the patients in the Unilateral group. A receiver operating characteristic (ROC) curve demonstrated that the threshold for pinning contralateral hip with PSA > 12.66 yields an area under the curve (AUC) of 67%. When the analysis was repeated with respect to gender, girls in the Bilateral group had significantly higher PSA (15.9 ± 6.3 vs. 10.1 ±6.0, P= 0.002) and were younger (10.7 ± 1.1 vs.11.9 ± 1.0, P <0.001) than the girls in the Unilateral group. However, among boys, these associations were not significant. An ROC curve demonstrated that the threshold for pinning contralateral hip with PSA > 13.19 in girls yields an AUC of 76%. PSA is predictive of contralateral slip in patients presenting with unilateral SCFE. However, it is more predictive in girls, and we recommend prophylactic pinning in girls with PSA > 13.

POSTER NO. P300

Luggage Tag Technique of Anatomic Fixation of Displaced AC Joint Separations

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The purpose of this study was to evaluate the clinical results of a novel approach to anatomic fixation of acromioclavicular joint injuries, we hypothesize that this method will result in a low rate of redisplacement, and patient centered outcomes indistinguishable from normal adults. Acromioclavicular (AC) joint dislocations are common injuries in active individuals. Type I-III injuries are often treated non-operatively. Many techniques have been described for the surgical treatment of severely displaced AC separations. Recent biomechanical studies favor anatomic reconstruction of the conoid and trapezoid ligaments and the AC joint capsule as opposed to the traditional modified Weaver Dunn technique. This paper presents a modification of the anatomic fixation technique using a 'luggage tag' method which places a graft under the base of the coracoid. Twenty one patients with acute, subacute or chronic grade IV, V or VI patients were followed for an average of 53 months post op. Routine radiographs and physical examinations were performed during this time period. Final post operative DASH and SST were administered by phone interview. At an average of 53 months follow up, the median DASH score was 4.3, the median SST score was 12. There was only one radiographic displacement (4.6%), this was initially a type V dislocation that displaced less than 100% at final follow up. One patient had a non displaced clavicle fracture through a drill hole placed in the clavicle that healed with non-operative treatment. Only two patients continued to complain of pain at final follow up. One of these patients had symptomatic rotator cuff arthropathy that went on to necessitate reverse total shoulder replacement, this patient remained asymptomatic at the acromioclavicular joint. This procedure, in our early experience, has been associated with very low redisplacement of the distal clavicle and minimal post-operative morbidity. We have found that the luggage tag technique provides excellent anatomic fixation of the distal clavicle and restoration of coronal and sagittal plane stability to the injured AC joint. In addition, this procedure eliminates the possibility of coracoid fracture and decreases the risk of hardware complications associated with some AC joint reconstruction techniques.

POSTER NO. P444

Arthroscopic Remplissage for the Treatment of Glenohumeral Instability with Hill Sachs Defects

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The treatment of recurrent anterior glenohumeral instability is complicated when there are bony defects present on either the humeral or glenoid side. Several studies have documented poor outcomes with arthroscopic Bankart repair when sizable defects are encountered at arthroscopy. The following investigation seeks to determine whether arthroscopic Remplissage with Bankart repair is an effective treatment strategy for patients with Bankart lesions and large Hill Sachs defects. Between January 2007 and December 2008, twenty patients underwent Arthroscopic Bankart Repair with Remplissage for the treatment of recurrent anterior glenohumeral instability and large Hill Sachs defects. Preoperative imaging in all patients identified avulsion of the anterior inferior glenohumeral ligament with an associated Hill Sachs defect that involved greater than 25% of the humeral head. Patients were followed post-operatively with the Western Ontario Shoulder Instability Score (WOSI), the American Shoulder and Elbow Society Score, and the PENN Shoulder Score. Recurrent subluxation or dislocation was documented. Of 20 patients, 15 were male and 5 were female. The average age of the patients was 26.7 years. The average length of follow-up in this series was 24.6 months (range 18.2 to 32.7 months). At final follow-up, three patients reported recurrence of instability, all of which were spontaneously reduced. The average ASES score was 92.5 (Pain 47.3; Function 45.3). The average PENN score was 90.0/100 (Pain 27.3/30; Satisfaction 8.5/10; Function 54.3/60). The average total WOSI score was 72.74% (physical symptom score average: 77.10%, sports and recreation average: 70.25%, lifestyle score average: 75.00%, emotions score average: 58.50%). Arthroscopic Remplissage with Bankart Repair was successful at restoring stability in the majority of patients with recurrent glenohumeral instability with large Hill Sachs lesions. In this patient population with complex pathology, an all arthroscopic technique was able to restore function, diminish pain, and satisfy almost all patients in our series at early to intermediate term follow-up.