



PASIG PERFORMING ARTS
SPECIAL INTEREST GROUP



ORTHOPAEDIC SECTION
AMERICAN PHYSICAL THERAPY ASSOCIATION



PASIG MONTHLY CITATION BLAST: No. 126

May 2017

Dear Performing Arts SIG members:

Upcoming conferences! The next Combined Sections Meeting will be held February 21-24, 2018 in New Orleans, Louisiana. The deadline is June 16th for poster and platform presentation abstracts.

Call for Performing Arts Clinical Rotation Sites! We are currently updating the list of clinical rotation sites on our website. Please e-mail Rosie Canizares (rcc4@duke.edu) if you take students and would like your information included on this list.

Dancer Screening Update! We had a very successful "Young Dancer Screening" meeting at CSM in February. Notes and individual screening tools have been sent out to those in attendance and others who requested to be informed. Please contact Mandy Blackmon at mandydancePT@gmail.com if you have questions or would like to be involved in this group.

Fellowship Taskforce Update! The practice analysis re-validation project team is working on final revisions for the upcoming publication of the Description of Fellowship Practice (DFP) for Performing Arts Physical Therapy. The Description of Advanced Specialized Practice (DASP) in Performing Arts Physical Therapy was approved by the ABPTRFE in January 2016. The DFP is currently being reviewed by ABPTRFE. This is the final phase for laying the groundwork for providing current practice guidelines in the sub-specialty area as well as curriculum requirements for Performing Arts PT fellowships.

Interested in a Performing Arts Fellowship? The American Board of Physical Therapy Residency and Fellowship Education (ABPTFRE) has approved the PASIG Description of Specialist Practice (DSP) for the Performing arts as an area of study. We are now working with the ABPTFRE to turn the DSP into a Description of Fellowship Practice (DFP). We anticipate the DFP will be available online by June 2016. This means that sites can begin forming fellowships in dance medicine, music medicine, theater medicine, etc. The PASIG will provide the fellowship criteria for accreditation. Please contact Mariah Nierman Mariah.Nierman@osumc.edu or Laurel Abbruzzese La110@cumc.columbia.edu if interested.

Room for new committee members! There is room for new committee members, and students are welcome to participate. Please refer to the list below for contact information.

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Membership: Current PASIG members, please remember to update your membership:
https://www.orthopt.org/login.php?forward_url=/surveys/membership_directory.php

Social Media: For fun PT info and related performing artists info...
 1) Facebook page: (closed) If you would like to be a part of the group, email Dawn (Doran) Muci: Dawnd76@hotmail.com
 2) follow PASIG on Twitter: @PT4PERFORMERS

Call for case reports: If you have a brief, clinically-focused case report on a performing arts PT patient, or a clinical commentary, please contact Annette Karim to submit your writing for the next Orthopaedic Physical Therapy Practice Magazine: neoluvsonlyme@aol.com

WE NEED MORE CONTRIBUTORS TO OUR MONTHLY CITATION BLASTS!!!!

Past Monthly citation blasts are available, with citations and EndNote file, listed on the website: <http://www.orthopt.org/content/special-interest-groups/performing-arts/citations-endnotes>

TOPICS THAT HAVE BEEN COVERED RECENTLY INCLUDE:

Irish Dancing (Current)

Flexor Hallucis Longus Dysfunction

Sacroiliac and Pelvic Dysfunction Screening

Gyrotonics ® and Gyrokinesis ® for the Performing Artist

Medial Tibial Stress Syndrome

2nd Tarsometatarsal Joint Injuries in Dancers

Screening Tools for the Young Dancer

Thoracic Outlet Syndrome and Nerve Entrapment in Instrumental Musicians

Plyometric Training in Dancers

HVLAT for Lower Extremity Conditions

Inguinal Disruption

Femoroacetabular Impingement

Hand and Wrist Conditions in Gymnasts

Factors in Optimal Turnout

Achilles Tendinopathy

Biomechanics and Posture in Musicians

Pilates

ACL Injuries in Dancers

Patellofemoral Pain and Dance

Neural Entrapments Found Among Musicians

Stress Fractures of the Foot and Ankle

If you are interested in contributing by writing a citation blast or joining the research committee, contact me at lbreising@gmail.com.

Sincerely,

Laura

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PERFORMING ARTS CONTINUING EDUCATION, CONFERENCES, AND RESOURCES

Musician Health Series, Janice Ying, PT, DPT, OCS

Glendale Adventist Therapy and Wellness Center, Los Angeles area (Eagle Rock), CA

<http://www.musicianshealthcorner.com/>

Healthy Musician Series - Overuse

Orthopaedic Section Independent Study Course. *20.3 Physical Therapy for the Performing Artist.*

Monographs are available for:

- Figure Skating (J. Flug, J. Schneider, E. Greenberg),

- Artistic Gymnastics (A. Hunter-Giordano, Pongetti-Angeletti, S. Voelker, TJ Manal),

and

- Instrumentalist Musicians (J. Dommerholt, B. Collier).

Contact: Orthopaedic Section at: www.orthopt.org

Orthopaedic Section-American Physical Therapy Association,

Performing Arts SIG

http://www.orthopt.org/content/special_interest_groups/performing_arts

Performing Arts Citations and Endnotes

http://www.orthopt.org/content/special_interest_groups/performing_arts/citations_endnotes

ADAM Center

<http://www.adamcenter.net/>

Publications:

<http://www.adamcenter.net/#!vstc0=publications>

Conference abstracts:

<http://www.adamcenter.net/#!vstc0=conferences>

Dance USA

<http://www.danceusa.org/>

Research resources:

<http://www.danceusa.org/researchresources>

Professional Dancer Annual Post-Hire Health Screen:

<http://www.danceusa.org/dancerhealth>

Dancer Wellness Project

<http://www.dancerwellnessproject.com/>

Becoming an affiliate:

<http://www.dancerwellnessproject.com/Information/BecomeAffiliate.aspx>

Harkness Center for Dance Injuries, Hospital for Joint Diseases

<http://hjd.med.nyu.edu/harkness/>

Continuing education:

<http://hjd.med.nyu.edu/harkness/education/healthcare-professionals/continuing-education-courses-cme-and-ceu>

Resource papers:

<http://hjd.med.nyu.edu/harkness/dance-medicine-resources/resource-papers-and-forms>

Links:

<http://hjd.med.nyu.edu/harkness/dance-medicine-resources/links>

Informative list of common dance injuries:

<http://hjd.med.nyu.edu/harkness/patients/common-dance-injuries>

Research publications:

<http://hjd.med.nyu.edu/harkness/research/research-publications>

International Association for Dance Medicine and Science (IADMS)

<http://www.iadms.org/>

Resource papers:

<http://www.iadms.org/displaycommon.cfm?an=1&subarticlenbr=186>

Links:

<http://www.iadms.org/displaycommon.cfm?an=5>

Medicine, arts medicine, and arts education organization links:

<http://www.iadms.org/displaycommon.cfm?an=1&subarticlenbr=5>

Publications:

<http://www.iadms.org/displaycommon.cfm?an=3>

Performing Arts Medicine Association (PAMA)

<http://www.artsmed.org/>

<http://www.artsmed.org/symposium.html>

Interactive bibliography site:

<http://www.artsmed.org/bibliography.html>

Related links:

<http://www.artsmed.org/relatedlinks.html>

Member publications:

<http://artsmed.org/publications.html>

(Educators, researchers, and clinicians, please continue to email your conference and continuing education information to include in future blasts.



Irish Dancing

Irish Dancing took the international community by storm during the Eurovision Song Contest in Dublin on April 30, 1994. Since then, Irish Dancing has become an incredibly popular past time and sport shared by children and adults of all cultures, genders, creeds, and ethnicities. Many children start between the ages of three and six, and must compete through six levels to develop their skills. In North America, these levels are termed Beginner (soft shoe only), Advanced Beginner (begin hard shoes), Novice (more challenging hard shoes), Open Prizewinner, Preliminary Championship (format of competition changes), and Open Championship. As dancers gain experience, they may qualify for regional, national, and international competitions, with the top prize being the title of World Champion in their age group. To achieve this, dancers must qualify for the World Championship competition, which can host upwards of 2,000-3,000 dancers from six continents. This top 1-2% of the globe's Irish Dancers competes for the title in their respective division.

To preserve the tradition and culture of Irish dancing, teachers and adjudicators must also go through rigorous testing process. This process serves to determine their knowledge, and their ability to transfer that knowledge to pupils, or apply the knowledge when adjudicating competitions, respectively. After the inception of Riverdance, the ability to continue dancing as a professional after competition became a viable career option for decorated Irish Dancers in addition to teaching or adjudicating. Today, many shows continue to tour, including Riverdance, Lord of the Dance, Feet of Flames, Celtic Tiger, Hammerstep, Taptronic, Trinity Irish Dance Company, and Rhythm in the Night, to name a few.

As Irish dance has grown in popularity, the difficulty and technicality demand has also grown, leading to a growing incidence of injury. The increase in injuries in this predominantly pediatric population has sparked an interest in the medical community. The unique technical demands of a steady upper body, combined with precise, energetic lower body movements, places demands on the body that are only beginning to be understood. As such, the vast majority of the research on this art form is in its infancy, and this is shown in the type and quality of the current research available. Much of the information we have gained at this time focuses on general incidence and prevalence of injuries, as well as forces encountered in particular dancing movements. We have very little research that assesses this information by age or by dancing level, which is necessary to determine risk factors in the population. Additionally, we have no information regarding the validity, reliability, or effectiveness of tests, measures, and treatment strategies in Irish Dancers, which would be greatly helpful in polishing the continuum of care for this cohort of dancers. A singular exception to this is the focus of research on the professional Irish Dancer, which has been expanding in its diversity thanks to Dr. Cahalan's efforts. This is, however, a relatively small portion of the population, and results may not be applicable to all Irish Dancers. It is also apparent that appropriate education of healthcare professionals is needed to allow for a deeper understanding of the technique, and culture of Irish dancing. Development of this understanding in healthcare providers and scientists has the

potential to allow for effective and useful recommendations to promote the wellbeing of all types of Irish Dancers, which will be more likely to be adopted by the Irish Dancing community.

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Cahalan R, Purtil H, O'Sullivan P, O'Sullivan K. A cross-sectional study of elite adult Irish Dancers: biopsychosocial traits, pain, and injury. *J Dance Med Sci*. 2015; 19(1): 31-43.

OBJECTIVE: To determine the biopsychosocial characteristics of elite Irish dancers, and the potential for relationships between these characteristics and musculoskeletal pain and injury.

METHODS: One hundred and four adult Irish Dancers, who were either professional, elite competitors, or in higher education full time while studying Irish dance, were assessed. A questionnaire was used to determine dance and activity levels, physical and psychological health, and pain and injury history. Eighty-four of the subjects also participated in a physical screen of lower limb flexibility, balance, and endurance, multiple functional tests, as well as anthropometric, biomechanical, and anatomical assessments. Subjects were divided into Significantly Injured (SI), and Not Significantly Injured (NSI) categories.

RESULTS: It was determined that approximately 32% of the subjects fell into the SI group, while the other 68% were in the NSI group. Classification in the SI group was shown to be more common in females, those with poor warm up habits, and those with more subjective health and psychological complaints, low mood, or increased catastrophizing. Self-reported injuries over the past five years was found to be 1.49 injuries per dancer, and foot and ankle injuries were the most common, followed by calf/shin, knee, hip/thigh, and low back. When compared to other dance populations, Irish Dancers in this study demonstrated similar posteromedial reach on the SEBT, lower Beighton scores, normal navicular drop, higher BMI (esp. in females), and comparable sex disparity in the vertical jump height. Within the vertical jump, however, male Irish dancers demonstrated lower heights than other types of male dancers, while females demonstrated comparable heights.

CONCLUSION: Based on this information, and the similar biopsychosocial predictive indicators noted in other dance populations, the investigators concluded that the Irish Dance community would be well served to participate in biopsychosocial screening, as done in other sports and types of dance.

LEVEL OF EVIDENCE: 3; Prospective, exploratory cohort study

COMMENTS: This inaugural study is a useful addition to the body of literature on Irish Dance, as these areas have not yet been explored in depth. Due to the adult population, the results are not directly applicable to the vast majority of the Irish Dance population, which is typically pediatric and adolescent, and may exhibit different biopsychosocial indicators.

Cahalan R, O'Sullivan K. Job satisfaction of professional Irish Dancers: implications for performer health and well-being. *J Dance Med Sci.* 2013; 17(4): 139-149.

OBJECTIVE: To obtain information regarding job satisfaction in professional Irish dancers.

METHODS: One hundred sixty-five professional and former professional Irish dancers, 18 years and older were assessed via an essay-type online survey, followed by participation in a focus group by two of the dancers, and nine other dancers outside of the survey cohort. Fifty-eight percent of the subjects were retired, and 42% were currently dancing professionally. Participants were asked to respond to the free text questionnaire with whether or not they would recommend a career in Irish dance to young dancers. No limits were given to word count, or reasoning for the subject's suggestions in the survey. The focus group served to determine details regarding age, length of professional career, and years spent working in shows.

RESULTS: Upon analysis, the themes of global travel, making a hobby/passion a career, development of personal life skills, friendships/relationships, physical fitness, financial remuneration, career insecurity, physical strain, psychological strain, and logistical/touring difficulties, were found to occur in both the "recommending" group (94% of respondents), and the "not recommending" group (6%).

CONCLUSION: Many of the themes found in this investigation serve to improve the awareness of dance captains, choreographers, and company managers to facilitate the overall health and wellbeing of the dancers in the company, and alert individuals in authority positions to the job satisfaction, psychological health and overall wellness of the company members.

LEVEL OF EVIDENCE: 3; Prospective, exploratory cohort study

COMMENTS: The data would have had more clarity if it had been divided into the two groups of online and face-to-face focus group responses. This would have allowed for potential differences in reporting between the two modes of communication. The relative anonymity provided by a computer survey,

compared with a focus group where personal communication occurs, may have had an effect on the responses.

Cahalan R, O'Sullivan K. Injury in professional Irish Dancers. *J Dance Med Sci.* 2013; 17(4): 150-158.

OBJECTIVE: To investigate the rate of injury and associated factors among professional Irish Dancers.

METHODS: One hundred seventy eight professional Irish dancers over 18 years of age were assessed via online questionnaire to determine rates and location of injury in this cohort.

RESULTS: Of the dancers surveyed, 77% reported a previous foot injury(68%), or previous ankle (61%) injury. Mean career injury rate per dancer was found to be 2.25. Most were minor in nature, and occurred at the midpoint of the tour. Massage (83%), stretching (70%), and physiotherapy(63%) were the most popular injury management strategies. A moderate level of psychological distress was noted, particularly regarding interpersonal difficulties and tension in relationships with others on tour, and may have contributed to injury risk. Dancers who lost more time due to injury were typically older, and more experienced.

CONCLUSION: No significant relationships between injury risk and, sex, frequency of dancing in pain, warm-up or cool-down habits, and cross training participation were found in this population.

LEVEL OF EVIDENCE: 3; Prospective, exploratory cohort study

COMMENTS: Research regarding the rates of injury in Irish Dancers is helpful in determining the relative risk factors and potential for harm in this population. This information, although useful, is not generalizable to the majority of the population of Irish Dancers, as most are competitive, not professional. In competitive Irish Dance, the steps, the length of the performance, and the physical, mental and emotional traits of the dancers may differ from the professionals in this study.

Cromie S, Greenwood JG, McCullagh JF. Does Irish-dance training influence lower-limb asymmetry?. *Laterality.* 2007; 12(6): 500-506.

OBJECTIVE: To determine if Irish dance training has an impact on the symmetry of use in the lower limbs.

METHODS: One hundred Irish Dancers from a Belfast school, and 100 non-dancers from a local University were selected, irrespective of age, handedness, or sex, and were asked to perform four tasks involving the lower limbs, and one task involving the upper limb. These physical tasks included writing their name on a sheet of paper (UE task), performing a step-up, kicking a ball, hopping up and down on one foot, and beginning walking on command (LE tasks). Participants began each LE task with feet together, and were not informed that handedness or limb dominance was involved in the study.

RESULTS: After analysis, it was determined that handedness did not differ between groups. With the lower limb tasks, Irish dancers demonstrated a significant and clear preference to begin walking (95%), perform a step-up task (99%), and kick a ball (99%) with the right foot. When asked to perform the hopping task, Irish dancers demonstrated a clear and significant preference for hopping on the left foot (98%). This was in contrast to the non-dancer cohort, who demonstrated a preference for starting with the right foot 62% of the time for the step up, 80% of the time for kicking a ball, 47% of the time for hopping, and, 56% of the time when initiating walking.

CONCLUSION: Individuals trained in Irish Dancing exhibit dramatically significant preference in laterality when performing a variety of motor tasks with the lower extremities. This may have a significant effect on lower limb asymmetry involved in motor tasks.

LEVEL OF EVIDENCE: 2; Observational study with dramatic effect

COMMENTS: Despite the significant disparity in having no age matching in the two cohorts, this information is interesting, and has the potential for usefulness if found to be similar to age-matched controls. In the technique of Irish Dancing, students are taught to begin with feet crossed in a manner similar to fifth position in ballet, with the right foot in front. This is the starting and ending position for most of the dancing that an individual will do in competition. Additionally, when beginning to dance, the majority of steps will begin using the left leg (back leg) as the supporting leg, and the right leg (front leg) as the working leg. The potential connection between the technique restrictions of Irish dance and habits of movement in tasks of daily living may have implications for movement dysfunction or muscle imbalances found in this population, and can potentially be utilized when assessing dysfunction, and determining a rehabilitation or injury prevention plan.

Martin D, Dowling J, Rowan F, Casey M, O'Grady, P. Superficial peroneal nerve palsy in a dancer caused by a midfoot ganglion. *J Dance Med Sci.* 2015; 19(2): 77-79.

OBJECTIVE: To report a case of superficial peroneal nerve palsy caused by a midfoot ganglion, and its resolution in an Irish Dancer.

BACKGROUND: A case report regarding a 10-year-old Irish dancer, complaining of midfoot pain, paresthesias in the lower leg and foot, and a growth on the dorsolateral left foot that had been progressively enlarging over the past few months was reported. This issue was causing a significant increase in the volume of her foot, making it difficult to wear shoes, especially those necessary for Irish Dancing participation. She could dance for approximately 20 minutes prior to the onset of pain when she was seen by the author of this study. The foot had previously been aspirated, which allowed improvement for a few days, before the foot volume again began to increase.

RESULTS: After imaging, and weighing pros and cons, it was determined to surgically excise the mass, which was determined to be a benign ganglion cyst. The cyst had been sitting adjacent to the superficial peroneal nerve, causing paresthesias and pain. The dancer tolerated surgery well, with no damage to the superficial peroneal nerve, and demonstrated complete resolution of symptoms. She remained symptom-free at her one-year follow-up.

CONCLUSION: Surgical excision of a ganglion cyst in an Irish Dancer of this age and activity level is a viable option for treatment, and the procedure can be tolerated well, with appropriate return to dance participation.

LEVEL OF EVIDENCE: 5; Case report

COMMENTS: Although most likely a rare condition, and that paresis is typically not mentioned as a common injury in the current injury prevalence research on Irish Dance, it is prudent to consider the nerves of the foot, ankle and lower leg when assessing injuries and referring dancers in this population through the health system.

McGuinness D, Doody C. The injuries of competitive Irish Dancers. *J Dance Med Sci.* 2006; 10(1): 35-39.

OBJECTIVE: To determine the incidence and types of injury in competitive Irish Dancers, and establish potential strategies for injury prevention for this population.

METHODS: One hundred fifty nine competitive Irish dancers in attendance at the 2004 North American National Championships were surveyed via a self-administered questionnaire. The questionnaire was aimed to determine the rate and types of injury, and assist in establishing injury prevention possibilities in this population. Information regarding injuries over the past five years, use of warm-up, and cool-down, use of dance sneakers, special shock-absorbing dance shoes, and the types of floor used for class and practice were determined via the questionnaire. One hundred forty two females, and 17 males between 15-27 years old participated. All danced in classes for 1-20 hours per week, practiced at home for 0-16 hours per week, and attended 1-16 competitions each year. Forty-eight percent were from the USA, 21% from Canada, 15% from Ireland, and 16% from England, Australia, and New Zealand combined.

RESULTS: Injuries were reported over the past five years, and 79% of dancers reported having an injury in this time frame. Thirty-two percent were found to be ankle injuries, 25% foot, 14% other (calf strain, hamstring strain, shin splints, Achilles tendinopathy, and upper extremity muscular strains), 12% hip, 10% knee, 2% upper limb. Injury rates were found to be higher than those in ballet, potentially due to the self-report nature of this survey. Ankle and foot were approximately 15% more frequent when compared with ballet. Irish Dancers who participated in a warm up appeared to have a 68% decrease in incidence of ankle injuries, and risk was decreased

by 86% when the dancer also participated in a cool-down. Use of shock absorbent flooring, or shock absorbing pumps or hard shoes did not reduce injury incidence in this study. It appeared that use of a split sole dance sneaker decreased injury risk by approximately 87%, although frequency of use was not reported. Approximately 58% of the injuries were sustained just prior to a major competition.

CONCLUSION: The authors concluded that the use of a warm-up, a cool-down, and split sole dance sneakers in training were good strategies to minimize risk of injury in competitive Irish dancers.

LEVEL OF EVIDENCE: 3; Prospective, exploratory cohort study

COMMENTS: As the field of Irish Dance research is just beginning to expand, this type of injury prevalence data is valuable and necessary. Due to the large age variability (six or seven years old to 25 years or older) in competitors at national and international competitions, it would be useful to have assessed the data in all age groups present, and ensure the ability to account for dance experience, not simply practice time. This limits the data to a partial subset of elite competitive dancers, and it would be useful to broaden the scope of ages, and level of experience assessed for useful applicability of the data.

O'Halloran E, Vioreanu M, Padinjarathala B. "Between the Jigs and the Reels": bilateral metatarsal phalangeal stress fractures in a young Irish Dancer. *Clin J Sport Med.* 2011; 21(5): 454-455.

OBJECTIVE: To report a case of bilateral metatarsophalangeal stress fractures in a young, elite Irish Dancer.

BACKGROUND: An 11-year-old Irish dancer preparing for the All Ireland Championships reported to the clinic of the investigator, complaining of bilateral first metatarsophalangeal joint (MTPJ) pain that worsened with Irish Dancing, and was alleviated by rest. At this time she was dancing a minimum of nine hours each week in preparation. The only significant findings in her examination were focal tenderness with palpation of the MTPJs, and dorsiflexion at these joints was painful, and limited to 30 degrees. Plain films revealed acute bilateral Salter-Harris Type III nondisplaced fractures of the proximal phalanx.

RESULTS: These fractures were initially treated with bilateral below knee walking casts with toe platforms, rest, and elevation for four weeks. This provided clinical and radiological resolution for the right side only. The left required another four weeks of partial weight bearing out of the cast to demonstrate radiological and clinical resolution. This healing was demonstrated again at 12 weeks. It was recommended that this dancer remain absent from dancing for four months in total, and return to progressive practice after that.

CONCLUSION: The investigators concluded that this injury in this young dancer was most likely due to three factors: toe stands in steps that placed significant force across the metatarsal heads, landing jumps on the forefoot,

transmitting 6 times the body weight upon impact, and performance of “a constant tapping movement over the MTPJs combined with dorsiflexion and plantarflexion at the ankle to travel across the stage” in time with the music.
LEVEL OF EVIDENCE: 5; Case report

COMMENTS: Although the investigators make valid points in this report, there are a few flaws in the reasoning behind the assumed mechanism of injury. First, the dancer was 11 years old at the time of the report. This means that she was two years too young to be performing toe stands, and would not have been allowed to perform them in competition. Irish Dancers who compete through An Coimisiun le Rinci Gaelacha are limited to beginning toe stands when they compete in the Girls Under 13 age group, meaning they must be 12 years old as of January 1 of that year. This particular dancer would have been too young, and would have been dancing in either the Girls Under 12 or Girls Under 11 age group at the time of the study. Second, the reasoning that Irish dancers perform a “constant tapping movement over the MTPJs in combination with ankle plantarflexion and dorsiflexion in order to travel across the stage” would not provide the necessary force over time to allow for the development of bilateral Salter-Harris Type III stress fractures. The forces necessary to produce a fracture through the growth plate and the epiphysis would be more likely to be axial loading, as produced when dancers are on their toes in soft shoes. This, in combination with the available research stating that the impact on the foot and ankle in hard shoes is similar to those when wearing dance sneakers, seems to suggest that the more damaging forces occur when dancers are participating in soft shoe steps, invalidating this conclusion. Finally, it is true that the forefoot is subjected to large forces when dancers land from jumps, but the finer point of this the manner in which the dancers are taught to land. Irish dancers are taught to place the majority of the weight on the great toe and therefore, through the first ray, particularly when participating in soft shoe steps. This is for aesthetics, as well as a function to allow for an improved illusion of turnout when dancing. This can lead to significant and potentially damaging axial forces that may have the ability to cause this type of Salter-Harris fracture over time. Unlike the common issues with the second ray in ballet, Irish dancers are also subject to frequent injuries of the first ray, including the stress fractures mentioned in this case report, and with damage to the navicular bones. Generally, the authors make good points in this case study, and it is an interesting report, however, it effectively illustrates the importance of fully understanding the technique and teaching strategies within a type of dance before estimating cause and effect.

Shippen J, May B. Calculation of muscle loading and joint contact forces during the Rock Step in Irish Dance. *J Dance Med Sci.* 2010; 14(1): 11-18.

OBJECTIVE: To determine the extent of the loading forces through the ankle with the Rock Step in Irish Dancers.

METHODS: Five female professional Irish dancers between the ages of 20 and 28 years were assessed performing an Irish Dance skill referred to as a “rock” or “rock step”, using a 12 camera Vicon MX40 three-dimensional passive optical tracking system. Thirty-seven retro-reflective markers were attached to the dancers at appropriate anatomical landmarks to represent whole body movement patterns. Dancers performed this skill on a 4 meter x 4 meter sprung Harlequin floor, which included two mounted AMTI OR6-7 force plates.

RESULTS: Data demonstrated approximately 4005 N of force when performing a rock, in comparison with 500-1430 N of force when walking, and that ankle contact forces during the rock were similar to that of running, at 14 times the body weight. This was comprised of both internally generated forces from the muscles (12.8x body weight), and externally applied loads from weight, accelerations, and reaction forces from the floor (1.2x body weight). Peak ground reaction forces (GRF) of 4.5 times the body weight occurred with the extreme internal and external rotation of the ankle joints during the rock movement. The highest muscular force levels demonstrated were in the gastrocnemius (2510 N), compared to the soleus (1495 N), and indicated that the gastrocnemius was activated at a higher level than its calculated maximal isometric force for a short period of time.

CONCLUSION: Upon discussion of this information, the authors concluded that the excess forces produced when performing the rock step have significant potential for causing injury.

LEVEL OF EVIDENCE: 3; Prospective, exploratory cohort study

COMMENTS: The authors of this study make strong claims based on evidence from an small cohort, and draw unstable conclusions from data demonstrating that the rock step and running generate similar forces. Although the movement called the “rock step” is popular at many levels of competitive Irish Dancing, and must be practiced with the tenacity required to master any high level motor skill, the authors conclusions in this investigation set a catastrophizing tone. This is the one of two studies at this time that has determined the forces accommodated through the lower extremity in any part of Irish Dancing. As such, it would be useful to compare and contrast the forces to other types of dance and athletics. This would be of assistance in determining the relative risk associated with such forces, however, this step was omitted by the authors of this investigation. To the untrained eye, Irish Dancing may appear to cause excessive forces that the lower extremities must sustain, however, the research to support the implication of this in an injury mechanism is not currently available. Although the rock step may look intimidating to an inexperienced dancer or an individual unfamiliar with the art form, the data showing that it is just as potentially damaging as running should lend to a much more balanced view than that which is presented in the paper. A more appropriate conclusion would have been that despite the large forces accommodated through the lower extremity with the rock step, the data demonstrates that these forces

are similar to those sustained by the lower body when running, and may cause a similar level of injury risk. This not only ensures that a catastrophizing tone is not taken regarding one small aspect of this art form/sport, but also paves the way for more objective investigations to determine potential for injury regarding loading over time for different movements, and varying levels of dancers.

Supporting Citations for Comments Regarding Jumping & Running:

Logan S, Hunter I, Hopkins JT, Feland JB, Parcell AC. Ground reaction force differences between running shoes, distance flats, and racing spikes in runners. *J Sports Sci Med.* 2010;9(1):147-153.

Ortega DR, Rodriguez Bies EC, Berral de la Rosa FJ. Analysis of the vertical ground reaction forces and temporal factors in the landing phase of a countermovement jump. *J Sports Sci Med.* 2010;9(2): 282-287.

Stein CJ, Tyson KD, Johnson VM, Popoli DM, d'Hemecourt PA, Micheli, LJ. Injuries in Irish Dance. *J Dance Med Sci.* 2013; 17(4): 159-164.

OBJECTIVE: To determine the types of injuries incurred by Irish Dancers through a retrospective chart review.

METHODS: A retrospective study on 255 competitive Irish Dancers (4-47 years old). Approximately 95% of the dancers were under the age of 19. Data was analyzed from charts located in the records of two large hospital systems on the East Coast of the United States over an 11-year period. Surveys were then sent out to the patients included in the study to determine consent, dance school at time of injury (37 dance schools total), and ability to return to dance.

RESULTS: Investigators determined that the most common sites of injury were the foot (33.2%), ankle (22.7%), knee (19.7%), and hip (14.4%), and that 95.9% of the diagnoses involved the lower extremity. Overuse injuries were four times more common than acute injuries. Sixty-six percent of the injuries could be classified into categories of tendon injuries (13.3%), apophysitis (11.4%), patellar dysfunction (10.8%), stress injury (medial tibial stress syndrome, stress reaction, stress fracture; 10.1%), muscle injury (7.8%), ligament injury, and fracture in order of frequency. Within overuse injuries, no association with laterality was found, although, it was determined that traumatic injuries were more likely to involve the right side across age groups. Treatments commonly suggested included Physical Therapy & Home Exercise (84%), immobilization or non-weightbearing status (53%), orthotics/arch supports (42%), medication (26%), and surgery (9%). Sixty-four percent of dancers reported full return to Irish Dance after injury, 27.1% reported inability to return, and 8.5% reported not returning for unrelated reasons.

CONCLUSIONS: The majority of Irish dance injuries affect the lower

extremity, and most are related to overuse. Weeks to months may pass between onset of symptoms and evaluation in a clinical setting. This information would be helpful in the development of screens, risk assessment and injury prevention.

LEVEL OF EVIDENCE: 3; Retrospective cohort study

COMMENTS: More investigation into the incidence and prevalence of injuries in Irish Dancing would be helpful, particularly across different regions of the United States, different countries, and to investigate a potential for difference in injuries across age demographics and levels of dancing.

Smith BK, Engelbert T, Turnipseed WD. Foot claudication with plantar flexion as a result of dorsalis pedis artery impingement in an Irish dancer. *J Vasc Surg.* 2013; 58: 212-214.

OBJECTIVE: To report a case of foot claudication due to dorsalis pedis artery impingement, and its resolution in a competitive Irish Dancer.

BACKGROUND: A case report of a 17-year-old Irish Dancer was noted in 2011, when she reported to the practice of the primary investigator with symptoms of erythema, paresthesias, a sensation of coolness, effusion, and discomfort in her forefeet. Her symptoms were most pronounced during and for a short period of time after dancing, and had been ongoing for a year at the time of her initial visit.

RESULTS: After ruling out collagen vascular diseases, vasculitis, and Raynaud's phenomenon, the dancer was referred for a vascular surgical consult. At this time, her ankle brachial index (ABI) on the right was 1.16, and 1.05 on the left, with normal digital waveforms. Magnetic resonance angiogram (MRA) of the pelvis and lower extremities revealed three focal stenoses of the right dorsalis pedis artery, and one of the left which occurred in plantarflexion, but were completely resolved with return to neutral foot and ankle positioning. The dancer and her parents consented to surgery, and three fibrotic bands were released on the right, and one on the left. These bands were consistent with the location of the stenoses, and demonstrated severe constriction of the artery upon ankle plantarflexion. No complications were noted, and the one month follow up, only mild, asymptomatic residual compression was noted in the plantarflexed position. It is the hypothesis of the authors that this occurred in the dancer as a result of overuse, snug shoes required for Irish Dancing, and the repetitive end range plantarflexion that is required of Irish Dance technique. Although muscle hypertrophy may also be a cause of this type of issue in this patient demographic, it was not shown to be contributory to symptoms in this dancer.

CONCLUSION: It was concluded that for this type of issue, a minimally invasive surgical approach could be effective after vascular imaging to allow young, active individuals to return to their prior level of function without symptoms.

LEVEL OF EVIDENCE: 5; Case report

COMMENTS: Despite this being an uncommon type of injury in this population, as evidenced by the current injury prevalence research on Irish Dancing, this case study serves to illustrate the importance of differential diagnosis, as well as the importance of considering the neurovascular systems when assessing injuries to ensure appropriate referral and treatment for these individuals.

Tregouet P, Merland F. The Effects of Different Shoes on Plantar Forces in Irish Dance. *J Dance Med Sci.* 2013; 17(1): 41-46.

OBJECTIVE: To determine the presence or absence of differences in plantar loads to the foot when utilizing different types of footwear in traditional Irish Dance.

METHODS: Investigators assessed 12 (11 female, one male) competitive Irish Dancers in the Open Championship level of competition (highest competition level). These dancers were assessed wearing soft shoes, hard shoes, and dance trainers when performing one particular piece of choreography that could be performed in all types of footwear. Maximum force, maximum pressure, and impulse were measured using a Pedar insole pressure system, and the whole foot, forefoot, and rearfoot forces were analyzed separately.

RESULTS: The dance trainer exhibited lower kinetic values overall, and forefoot loading values were highest in soft shoes. The difference in kinetic values between the hard shoes, and the trainers was not statistically significant. Peak force, maximum pressure, and impulse were all highest in soft shoes throughout the forefoot. No statistical significance was found in the kinetic measurements of the whole foot, and all measurements were lowest in the rearfoot, with no statistical significance noted between regions, or kinetic values.

CONCLUSION: These results indicate that due to the lower kinetic values in the dance sneakers, it may be beneficial to have dancers practice daily in the sneakers instead of in hard shoes or soft shoes, as this may lead to decreased injury rates over time.

LEVEL OF EVIDENCE: 3; Prospective, exploratory cohort study

COMMENTS: This investigation is currently one of two studies that assessed the forces accommodated through the lower extremity in Irish Dancing. Although this is important information that should be more thoroughly investigated, the authors make strong claims regarding the practice and footwear of Irish dance based on very little statistically significant data, and what appears to be minimal knowledge of the art form/sport. To illustrate this point, a few explanations are in order. First, a core part of Irish Dance technique is to dance on the toes, and avoid letting the heels hit the ground unless it is part of the choreography/step. This explains the low kinetic values in the rearfoot, as this area most likely had very little contact with the floor at all, leading to low ground reaction forces across all footwear types. Second, it is typically safer to allow initial return to dance in hard shoes

compared to soft shoes. Despite the pounding and noise that may accompany hard shoe choreography, there is very little jumping and leaping across the floor. Dancers are judged much more severely on foot placement, timing, and audibility of their rhythm in hard shoes. This is in comparison to soft shoes, where extremely high leaps and choreography that rivals that of some Olympic gymnastics floor routines is common, and has the potential to cause more excessive impulse, peak force, and maximum pressure. This is different than ballet, where it is imperative to return a dancer to pointe after she is able to dance in her ballet slippers. This concept is supported in this investigation, although the reasoning and clinical applicability did not appear to occur to the investigators. Additionally, although neither hard nor soft shoes have much support or padding, the decreased forces in the hard shoes were found to be very similar to those of the dance sneakers in this investigation. This contradicts the assumption made at the beginning of the study that because rhythm is emphasized in hard shoes, the impact forces would be the highest, and most detrimental. The forces observed in this investigation were also similar to those found in running, reinforcing the idea that the forces sustained in Irish Dancing are potentially no more damaging than participation in track and field events. It may, however, be a worthwhile endeavor to investigate different applications of padding and cushioning in both hard shoes and soft shoes to determine if an effect may be achieved to minimize risk over time. Finally, neither the culture nor structure of Irish Dance, nor the necessity of specific practice to successful motor learning were considered in the conclusions made by the authors. While the authors concluded that hard shoes and soft shoes both applied potentially damaging forces to the foot and ankle structures, their recommendation that practice only take place in dance sneakers is highly unrealistic, and potentially damaging to skill acquisition and precision in technique. It is necessary to practice in hard shoes on a regular basis to ensure that one is “accountable for your beats”. This means that when hard shoe steps are not practiced in hard shoes over a period of time, the dancer regularly demonstrates a loss of technique, rhythm, and the ability to make appropriate beats on the ground when performing steps. When wearing dance sneakers instead of soft shoes, dancers are more likely to suffer from increased friction between the shoe and the floor, causing tripping, and “jamming” toes, as well as additional degradation of technique, including poor ability to point toes, and lift from the floor. This is unacceptable in the Irish Dance community, and therefore, the suggestion to wear only dance sneakers to practice is highly unlikely to be respected, followed, or useful to the community overall. An alternate option is this; it may be beneficial for serious dancers taking classes for multiple hours on multiple days to have one day dedicated to dancing in dance sneakers. This could be the studio’s dedicated “dance sneaker day” for all dancers, and would allow for a relative rest, and more likely compliance when suggested to dance schools. This allows for a reasonable solution, which continues to attempt to decrease excessive force through the foot and

ankle, while allowing for specificity of practice when preparing for competition.

Walls RJ, Brennan SA, Hodnett P, O'Byrne JM, Eustace SJ, Stephens MM. Overuse ankle injuries in professional Irish Dancers. *Foot Ankle Surg.* 2010; 16: 45-49.

OBJECTIVE: To determine the extent of overuse ankle injuries in professional Irish Dancers and correlate subjective symptoms with objective findings on imaging.

METHODS: Eight male and 10 female professional Irish dancers, between the ages of 21-32, in a traveling troupe were assessed to determine the prevalence of overuse injuries in this cohort. The right foot and ankle of each dancer was assessed via magnetic resonance imaging (MRI), and self-report questionnaires from the American Orthopaedic Foot and Ankle Society (AOFAS), and the Foot and Ankle Outcome Score (FAOS) were completed.

RESULTS: Three of the ankles assessed were radiologically normal, two of which reported ankle pain. Eight of the dancers reported no ankle pain (four male, four female), nine reported mild ankle pain, and one reported moderate ankle pain. Four ankles demonstrated one radiological abnormality, and the remaining 11 ankles assessed were shown to have two abnormalities, regardless of self-reported pain. Radiologists blinded to this investigation found evidence on MRI of 14 cases of Achilles tendinopathy, seven of which also had plantar fasciitis, calcaneocuboid joint degeneration associated with impaction bone edema (two dancers), bone edema of the posterior subtalar joint (one dancer), and small effusions in the tibiotalar joints (two dancers). The only imaging result correlated with pain was the degeneration of the calcaneocuboid joint with associated bone edema; this subject was the only one to report moderate pain. The only correlation that was found between the MRI and self-report outcome measures was a moderate inverse relationship between bone edema and the FAOS symptom subscale ($p=0.026$). No other significant associations were found in this group.

CONCLUSION: The investigators concluded that the vast majority of dysfunction in this cohort was subclinical. The authors of this investigation hypothesized that the increased prevalence of Achilles tendinopathy and plantar fasciitis in this troupe was likely to be due to Irish Dancers landing jumps on the forefoot with the knee extended, which can cause impact forces of up to six times the body weight, as well as forced pronation to achieve turnout, and tight lacing in ladies' soft shoes. They suggested regular incorporation of shock absorbing insoles and cushioned heel counters in hard shoes, eccentric exercises for the gastrosoleus complex, as well as mobility interventions for the plantar fascia, and regular stretching of the gastrosoleus complex and hamstrings to minimize these injuries in this population.

LEVEL OF EVIDENCE: 3; Prospective cohort study

COMMENTS: Although this study is interesting, and valuable, the conclusions strayed from the evidence, and extrapolated conclusions beyond the data collected. The treatment suggestions and injury prevention suggestions were sound, and follow current best evidence, however, the most notable result in this investigation was the revelation of the vast amount of abnormalities, damage, and dysfunction found on imaging with no correlation to subjective symptom reporting. This result illustrates two points: One, that similar to evidence regarding spinal imaging, it is likely that anatomical findings on imaging and subjective symptom reporting do not always correlate in this population, and both should be respected and utilized effectively on a case by case basis. Second, there appears to be a large cohort of certain overuse injuries that occur in professional Irish Dancers. It would be worth further investigation to minimize the potential for development of these injuries determine objective findings that may correlate with subclinical dysfunction, and determine the natural history of these overuse injures in relation to professional or competitive Irish Dancing.

Oxford Levels of Evidence were used to determine evidence levels in this citation blast. OCEBM Levels of Evidence Working Group*. "The Oxford 2011 Levels of Evidence". Oxford Centre for Evidence-Based Medicine.

<http://www.cebm.net/index.aspx?o=5653>

