



PASIG MONTHLY CITATION BLAST: No.87

October 2013

Dear Performing Arts SIG members:

It's time to book your flight, hotel and conference! CSM is around the corner, and this year we are in Las Vegas. The website information for the conference is up, take a look:

<http://www.apta.org/csm/>

CSM 2014 PASIG programming in Las Vegas: Wednesday, February 5th
"A multidisciplinary approach in caring for the acrobatic athlete in the performing arts."

The speakers are:

Kerry Gordon, MS, ATC, CMT, CSCS, PES

Steve McCauley, ATC, CSCS

Chad Hason, MD

Tiffney Touton, PT, DPT, LAT, ATC, CSCS

Frank Perez, ATC

They will present on behind the scenes care of performers, epidemiology of injuries, assessments of hypermobile performers and management of hip and shoulder pathologies.

Remember, the PASIG business meeting follows immediately after the presentations, and all PASIG members, including students, are welcome to join!

I truly hope to see you there! PASIG membership is free to all orthopaedic section members, so please join us!

This month's citation blast is on *Turnout and Injury in the Dancer*, compiled by Kaitlyn Pasquinelli, a Student Physical Therapist who spent her off-days shadowing me at my clinic, while she was interning at another clinic, hours of driving time away. I was impressed by her educational background, her synthesis of information, and her thirst for learning.

Thank you, Kaitlyn, for your quick and good work on this month's topic!

The practice of compiling abstracts has been an easy way for interns and clinicians to provide content for a citation blast as well as prepare for a clinical inservice or case study report. Please consider compiling Performing Arts-related abstracts for a citation blast this year. It's easy to do, and a great way to become involved with PASIG! Just take a look at our Performing Arts Citations and Endnotes, look for what's missing, and email me your contribution or ideas on future citation blasts.

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

Special request:

One of our Performing Arts SIG members requested citation blast content on gyrotonics and performing arts. Would anyone like to follow-up on this?

Best regards,

Annette

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Laura Reising, MS, PT, DPT, lbreising@gmail.com (EndNote Organizer)

Reminder to those interested in participating in the production of a wellness screen for the young, pre-professional dancer:

contact Brooke Winder, PT, DPT, OCS, brookeRwinder@gmail.com



PERFORMING ARTS CONTINUING EDUCATION, CONFERENCES, AND RESOURCES

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/>

The 23rd Annual Meeting of the International Association for Dance Medicine & Science (IADMS) will be held in [Seattle, Washington, USA](#) from October 17 - 19, 2013. Meeting activities and sessions will be held at the [Renaissance Seattle Hotel](#).

On Sunday, October 20, 2013, Special Interest Groups (SIG) Day will be held, with special programs available.

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 me your conference and continuing education information and I will include it in the upcoming blasts.)

Turnout and Injury in the Dancer

Turnout is greatly emphasized in various dancer forms. However, many dancers may not have the body structure capable of producing the excessive turnout desired and therefore refer to compensation methods, which produce greater pain and increased injury risk. Research has been looking into range of motion at various lower extremity joints and how being hypomobile in either certain directions or with specific musculature may be a large risk factor for dancers acquiring lumbar, knee, or ankle pain and reported injury. It has been pointed out that therapists working with dancers should assess all hyper and hypomobile segments that may

contribute to current pain. Dancers should practice correct technique in class and therapy through neuromuscular control training while stressing the importance of alignment over an aesthetic desire for 180 degree turnout that may not be currently available to the body.

I became fascinated with this topic and believe that it is important to understand due to how often poor alignment during dynamic activities contributes to the injuries dancers face, and how frequent they present to therapists working with individuals in the performing arts. I hope these citations provide information that may be helpful to your practice or education and may be used as a reference when needed.

Kaitlyn Pasquinelli

Doctor of Physical Therapy Program, University of Illinois in Chicago

Class of 2014



Brandsma, B. A. and M. R. Kum (2005). Ballet Dancers' Turnout: A Study On Compensation and Self-Reported Injury, Pacific University Library.

Background and Purpose. A lack of information is available about injury in ballet dancers and its relationship to the amount of compensation acquired with excessive movement in the joints of the lower extremities and lumbar spine during external rotation at the hips that is required in ballet. The purpose of this study was to look at the relationship between injury and compensation at the lumbar spine, knee, and ankle when moving from parallel to first position in adolescent dancers.

Methods. Twenty-one adolescent dancers completed a self-reported injury survey and were measured with a rod and plumb line device for rotation at the hip, knees, and ankle, as well as with a flexible curve for lumbar spine movement.

Results. Of the twenty-one subjects, twenty appeared to demonstrate compensation at the lower extremities and eleven appeared to demonstrate an increase in lumbar lordosis. No significant difference between the injured and noninjured groups was found in terms of compensation at the lower extremities or lumbar spine.

Discussion and Conclusion. Although no significance was found, further studies should be conducted to determine if injury and compensation have a relationship.

Cimelli, S. N. and S. A. Curran (2012). "Influence of turnout on foot posture and its relationship to overuse musculoskeletal injury in professional contemporary dancers: a preliminary investigation." *J Am Podiatr Med Assoc* **102**(1): 25-33.

BACKGROUND: The angle of turnout is thought to predispose professional dancers to overuse musculoskeletal injuries of the lower limb; yet, the influence of angle of turnout on foot posture is currently unknown.

METHODS: Twelve professional contemporary dancers (five women and seven men; mean age, 26.8 years) were recruited. The angle of gait and angle of turnout were measured using a quasi-static clinical tracing method. Foot posture was assessed in the base of gait and angle of turnout using the Foot Posture Index. Each dancer completed a dance history and injury questionnaire.

RESULTS: The results show a tendency toward a pronated foot posture (mean, 9 degrees) in the angle of turnout position. A significant relationship was noted between the Foot Posture Index and angle of turnout ($\rho = 0.933-0.968$, $P < .01$) and between the number of reported injuries and change in foot posture in the angle of turnout ($\rho = 0.789$, $P < .01$) (right foot only). Twenty-eight injuries were reported; male dancers experienced a mean of 2.8 injuries and females a mean of 1.6 injuries. An inverse relationship was noted between age at training initiation and total reported injuries ($r = -0.867$, $P < .01$). All of the dancers reported a history of injury to the spine or lower limb, and 9 of the 12 reported an injury within the previous 12 months.

CONCLUSIONS: Turnout is one of the most fundamental aspects of dance technique. This study suggests a trend toward pronation in angle of turnout and a link to lower-limb musculoskeletal injury.

Coplan, J. A. (2002). "Ballet dancer's turnout and its relationship to self-reported injury." *J Orthop Sports Phys Ther* **32**(11): 579-584.

STUDY DESIGN: Retrospective cohort study. **OBJECTIVES:** To compare the relationship between the degrees of turnout, passive hip external rotation range of motion, and self-reported history of low back and lower extremity injury in ballet dancers.

BACKGROUND: Ballet dancers are encouraged to externally rotate their lower extremities (turnout) as far as possible. This may cause stress on the dancers' low back and lower extremities, putting them at risk for injury.

METHODS AND MEASURES: Thirty college-level ballet dancers and instructors were evaluated. Each participant completed an injury questionnaire that placed the participant either in a group with a self-reported history of low back and lower extremity injury or in a group without a self-reported history of low back and lower extremity injury. Each dancer's first-position turnout and passive external rotation range of motion for both hips were measured. The comparison between each dancer's first-position turnout and the measured hip external rotation range of motion was called "compensated turnout." A 2-sample test was used to determine if the average compensated turnout was significantly different in the injured and noninjured groups.

RESULTS: The mean (\pm SD) compensated turnout values for the injured and noninjured groups were 25.40 degrees (\pm 21.3 degrees) and 4.7 degrees (\pm 16.3 degrees), respectively. This difference was significant at $P = 0.006$.

CONCLUSION: Based on a self-reported history of low back and lower extremity injuries, ballet dancers have a greater risk of injury if they reach a turnout position that is greater than their available

bilateral passive hip external rotation range of motion.

Kolo, F. C., C. Charbonnier, et al. (2013). "Extreme hip motion in professional ballet dancers: dynamic and morphological evaluation based on magnetic resonance imaging." *Skeletal Radiol* **42**(5): 689-698.

OBJECTIVE: To determine the prevalence of femoroacetabular impingement (FAI) of the cam or pincer type based on magnetic resonance imaging (MRI) in a group of adult female professional ballet dancers, and to quantify, in vivo, the range of motion (ROM) and congruence of the hip joint in the splits position. **MATERIALS AND METHODS:** Institutional review board approval and informed consent from each volunteer were obtained. Thirty symptomatic or asymptomatic adult female professional ballet dancers (59 hips) and 14 asymptomatic non-dancer adult women (28 hips, control group) were included in the present study. All subjects underwent MRI in the supine position, while, for the dancers, additional images were acquired in the splits position. Labral abnormalities, cartilage lesions, and osseous abnormalities of the acetabular rim were assessed at six positions around the acetabulum. A morphological analysis, consisting of the measurement of the alpha angle, acetabular depth, and acetabular version, was performed. For the dancers, ROM and congruency of the hip joint in the splits position were measured. **RESULTS:** Acetabular cartilage lesions greater than 5 mm were significantly more frequent in dancer's hips than in control hips (28.8 vs 7.1%, $p = 0.026$), and were mostly present at the superior position in dancers. Distribution of labral lesions between the dancers and the control group showed substantially more pronounced labral lesions at the superior, posterosuperior, and anterosuperior positions in dancers (54 lesions in 28 dancer's hips vs 10 lesions in 8 control hips). Herniation pits were found significantly more often ($p = 0.002$) in dancer's hips ($n = 31$, 52.5%), 25 of them being located in a superior position. A cam-type morphology was found for one dancer and a retroverted hip was noted for one control. Femoroacetabular subluxations were observed in the splits position (mean: 2.05 mm). **CONCLUSION:** The prevalence of typical FAI of the cam or pincer type was low in this selected population of professional ballet dancers. The lesions' distribution, mostly superior, could be explained by a "pincer-like" mechanism of impingement with subluxation in relation to extreme movements performed by the dancers during their daily activities.

Lee, H. H., C. W. Lin, et al. (2012). "Changes in biomechanics and muscle activation in injured ballet dancers during a jump-land task with turnout (Sissonne Fermee)." *J Sports Sci* **30**(7): 689-697.

Large impact loading with abnormal muscle activity and motion patterns may contribute to lower extremity injuries in ballet dancers. Yet, few studies investigated the influence of injury on the ballet movement. The purpose of this study was to find the neuromuscular and biomechanical characteristics in dancers with and without ankle injury during a jump-landing Sissonne Fermee task. Twenty-two ballet dancers were recruited and divided into the injured group ($n = 11$) and the

uninjured group (n = 11). They performed a ballet movement called "Sissonne Fermee" with reflective markers and electrodes attached to their lower extremities. Ground reaction force, joint kinematics, and muscle activity were measured. The injured dancers had greater peak ankle eversion but smaller hindfoot-to-tibial eversion angles. Also, the injured dancers had greater activity of the hamstring of the dominant leg and tibialis anterior of the non-dominant leg during the pre-landing phase. The injured dancers had greater tibialis anterior activity of the dominant leg but less muscle activity in the medial gastrocnemius of the non-dominant leg during the post-landing phase. The injured dancers had a greater co-contraction index in the non-dominant ankle and a lower loading rate. The higher co-contraction indices showed that the injured dancers required more muscle effort to control ankle stability. Furthermore, the injured dancers used a "load avoidance strategy" to protect themselves from re-injury. Neuromuscular control training of the ankle joint for ballet dancers to prevent injury is necessary.

Negus, V., D. Hopper, et al. (2005). "Associations between turnout and lower extremity injuries in classical ballet dancers." *J Orthop Sports Phys Ther* **35**(5): 307-318.

STUDY DESIGN: Descriptive correlational study. **OBJECTIVES:** To determine relationships between aspects of turnout and injury history in preprofessional classical ballet dancers, and to determine the clinical utility of various methods used to assess turnout. **BACKGROUND:** In Australia 50% of professional dancers currently have persistent or recurrent injuries, with 36% of these injuries commencing before 18 years of age (preprofessional level). Overuse or nontraumatic dance injuries are often attributed to faults in technique, with poor turnout and inappropriate compensatory strategies consistently cited as the main cause. **METHODS AND MEASURES:** Twenty-nine dancers (24 female), aged 15 to 22 years, were recruited from a preprofessional classical ballet program. Measurements were taken of passive and active hip external rotation (ER) range of motion (ROM) in supine, and functional turnout angles in standing. Three turnout variables were derived: active ER lag, compensated turnout, and static-dynamic turnout difference. Injury history over the previous 2 years was ascertained by interview. Pearson product moment and Spearman rank correlation coefficients were used to determine associations between turnout variables and injury history. **RESULTS:** All dancers reported a history of injury, with 93.1% reporting a history of nontraumatic injuries and 41.4% reporting a history of traumatic injuries. Number and severity of nontraumatic injuries were associated with reduced functional turnout (r or $\rho > 0.38$; $P < .04$), but not with hip ER ROM. Number and severity of traumatic injuries were not associated with turnout. No correlation was found between hip ER ROM and functional turnout. **CONCLUSIONS:** Functional measures of turnout are more relevant than hip ER ROM to prevalence of nontraumatic dance injuries. Control of turnout in classical ballet dancers should be assessed dynamically and in functional positions.

Reid, D. C., R. S. Burnham, et al. (1987). "Lower extremity flexibility patterns in classical ballet dancers and their correlation to lateral hip and knee injuries." Am J Sports Med **15**(4): 347-352.

Knee and hip problems account for up to 40% of injuries in classical ballet. Despite apparent flexibility, many dancers appeared to have tight iliotibial bands that contributed to lower limb problems. Thirty senior female ballet dancers were contrasted with thirty age-matched active volunteers for hip and knee range of motion, and the information derived was correlated with their orthopaedic medical histories. Dancers spent a reasonable period of time warming up, but it was usually with an unbalanced routine that emphasized hip abduction and external rotation to the exclusion of adduction work. This was reflected in the significantly lower range of passive hip adduction and internal rotation compared to the controls. Furthermore, the older and more experienced the dancer, the more this trend was exaggerated. This unbalanced flexibility may play a role in the production of lateral knee pain (30% of the dancers) and anterior hip pain (33% of the dancers). It is suggested that more attention should be given to a balanced stretching regimen as part of the dancers' warmup in an effort to reduce the frequency of some of the chronic hip and knee complaints.

Steinberg, N., I. Hershkovitz, et al. (2006). "Range of joint movement in female dancers and nondancers aged 8 to 16 years: anatomical and clinical implications." Am J Sports Med **34**(5): 814-823.

BACKGROUND: Little data are available on changes that occur with age in joint range of motion in dancers and nondancers. HYPOTHESIS: In dancers, joint range of motion will increase with age, whereas it will decrease in nondancers, independent of the joint studied. STUDY DESIGN: Cross-sectional study; Level of evidence, 3. METHODS: The study population included 1320 female dancers, aged 8 to 16 years, who participated in different types of dancing classes (classical ballet, modern dance, jazz, etc) and 226 nondancers of similar age. Range of motion was measured for the hip, knee, ankle, foot, and spinal joints. RESULTS: The pattern of differences in range of motion with age varied in different joints and types of movement. (1) For combined ankle and foot plantar flexion (pointe), ankle plantar flexion, and hip external rotation, there was no change in range of motion in dancers, whereas range of motion diminished with age in the nondancers. (2) For ankle dorsiflexion, neither group showed any change with age, and range of motion was significantly greater in the nondancer group. (3) For knee flexion, hip flexion, and hip internal rotation, range of motion decreased with age in both groups. (4) For hip abduction, range of motion decreased with age in dancers and remained constant in the nondancers. (5) For hip extension, range of motion increased in both groups. (6) For lower back and hamstrings, range of motion increased among dancers with age and remained constant among nondancers. CONCLUSION: Dancers and teachers should realize that passive joint range of motion is unlikely to improve with age. Therefore, the major goal of a dancing program should focus on

exercises that retain the natural flexibility of the dancers' joints rather than trying to improve them.

Steinberg, N., I. Siev-Ner, et al. (2012). "Extrinsic and intrinsic risk factors associated with injuries in young dancers aged 8-16 years." *J Sports Sci* 30(5): 485-495.

In the present study, we tried to determine the association between joint ranges of motion, anatomical anomalies, body structure, dance discipline, and injuries in young female recreational dancers. A group of 1336 non-professional female dancers (age 8-16 years), were screened. The risk factors considered for injuries were: range of motion, body structure, anatomical anomalies, dance technique, and dance discipline. Sixty-one different types of injuries and symptoms were identified and later classified into four major categories: knee injuries, foot or ankle tendinopathy, back injuries, and non-categorized injuries. We found that 569 (42.6%) out of the 1336 screened dancers, were injured. The following factors were found to be associated with injuries ($P < 0.05$): (a) range of motion (e.g. dancers with hyper hip abduction are more prone to foot or ankle tendinopathies than dancers with hypo range of motion); (b) anatomical anomalies (scoliotic dancers manifested a higher rate of injuries than non-scoliotic dancers); (c) dance technique (dancers with incorrect technique of rolling-in were found to have more injuries than dancers with correct technique); (d) dance discipline (an association between time of practice en pointe and injury was observed); and (e) early age of onset of menarche decreased risk for an injury. No association between body structure and injury was found. Injuries among recreational dancers should not be overlooked, and therefore precautionary steps should be taken to reduce the risk of injury, such as screening for joint range of motion and anatomical anomalies. Certain dance positions (e.g. en pointe) should be practised only when the dancer has already acquired certain physical skills, and these practices should be time controlled.


Van Dillen, L. R., N. J. Bloom, et al. (2008). "Hip rotation range of motion in people with and without low back pain who participate in rotation-related sports." *Phys Ther Sport* 9(2): 72-81.

OBJECTIVE: To examine whether passive hip rotation motion was different between people with and without low back pain (LBP) who regularly participate in sports that require repeated rotation of the trunk and hips. We hypothesized that people with LBP would have less total hip rotation motion and more asymmetry of motion between sides than people without LBP.
DESIGN: Two group, case-control. **SETTING:** University-based musculoskeletal analysis laboratory. **PARTICIPANTS:** Forty-eight subjects (35 males, 13 females; mean age: 26.56+/-7.44 years) who reported regular participation in a rotation-related sport participated. Two groups were compared; people with LBP (N=24) and people without LBP (N=24; NoLBP). **MAIN OUTCOME MEASURES:** Data were collected on participant-related, LBP-related, sport-related and activity-related variables. Measures of passive hip rotation range of motion were obtained. The differences between the LBP

and NoLBP groups were examined. RESULTS: People with and without a history of LBP were the same with regard to all participant-related, sport-related and activity-related variables. The LBP group had significantly less total rotation ($P=.035$) and more asymmetry of total rotation, right hip versus left hip, ($P=.022$) than the NoLBP group. Left total hip rotation was more limited than right total hip rotation in the LBP group ($P=.004$). There were no significant differences in left and right total hip rotation for the NoLBP group ($P=.323$). CONCLUSIONS: Among people who participate in rotation-related sports, those with LBP had less overall passive hip rotation motion and more asymmetry of rotation between sides than people without LBP. These findings suggest that the specific directional demands imposed on the hip and trunk during regularly performed activities may be an important consideration in deciding which impairments may be most relevant to test and to consider in prevention and intervention strategies.

Winslow, J. and E. Yoder (1995). "Patellofemoral pain in female ballet dancers: correlation with iliotibial band tightness and tibial external rotation." J Orthop Sports Phys Ther **22**(1): 18-21.

Review of the literature reveals that ballet dancers have a high incidence of idiopathic patellofemoral pain. Twenty-four female ballet dancers were subjects in a study of the relationship between: 1) iliotibial band (ITB) tightness and patellofemoral pain, and 2) ITB tightness and degrees of tibial external rotation used in the dance demi-plie. Dancers were initially assessed by questionnaire to determine if any had knee pain. Twelve subjects met the study criteria for patellofemoral pain, and 12 dancers without knee pain served as controls for the study. Iliotibial band tightness was measured (Ober test), and degrees of tibial external rotation used during knee flexion (demi-plie) in standing were measured in both legs of all 24 subjects (48 legs). Chi-square analysis of the collected data revealed that there was an association between ITB tightness and patellofemoral pain in the dancers. Data analysis using the Wilcoxon Rank Sum test revealed that the degree of tibial external rotation used by dancers with iliotibial band tightness was significantly greater than those without ITB tightness. This study confirms the assumption that ITB tightness in dancers may be a contributing factor to patellofemoral pain. Follow-up study is indicated to determine if the preservation or restoration of functional ITB length is effective in the prevention and/or treatment of patellofemoral pain in ballet dancers.



Please remember to update your orthopaedic section profile, thank you!
https://www.orthopt.org/surveys/membership_directory.php