PASIG PERFORMING ARTS SPECIAL INTEREST GROUP

ORTHOPAEDIC SECTION AMERICAN PHYSICAL THERAPY ASSOCIATION

APTA American Physical Therapy Association *The Science of Healing. The Art of Caring.*

PASIG MONTHLY CITATION BLAST: No. 104 **May 2015**

Dear Performing Arts SIG members:

The 3rd Annual Orthopaedic Section Meeting will be held this week at the Arizona Grand Resort & Spa in Phoenix, Arizona (May 14-16, 2015). During this 2-day meeting, sessions will explore the multidisciplinary advances in rehabilitation through the episode of care of various lower extremity dysfunctions, treatment of osteoarthritis from presurgical to postsurgical, and the physical therapist's role in advances in regenerative medicine. Experts in the field will gather together for lecture presentations and small group, hands-on lab sessions. We would love to hear feedback from all who are attending!

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:
Platelet Rich Plasma Injections
Back Pain in Dancers
Hallux Valgus in Dancers
Posterior ankle impingement
TMD in Musicians
Concussions
Bone Mineral Density in Dancers
Serratus Anterior Strengthening for Dancers
Focal Dystonia

Gymnastics: Update on Injuries and Movement Strategies
Dancers: Jumps, Landings, and Associated Injuries

These blasts are fairly simple to prepare. We love having contributions from our members regarding topics of great interest. If you are interested in contributing by writing a citation blast, contact me, Brooke Winder: BrookeRwinder@gmail.com

Best regards,

Brooke
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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
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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)

Dynamic Warm-Up and Stretching Strategies

As the profession of physical therapy progresses, we find ourselves reaching out more and more to performing artists in the realm of injury prevention, wellness, and performance optimization--not just rehabilitation of existing injuries. I myself often lecture to dance studios, companies and workshops on injury prevention, and am always looking for ways to help dancers learn proper warm-up strategies. This month's blast offers a collection of recent research focused primarily on dynamic warm-up strategies, including dynamic and static stretching, and their acute physiological and biomechanical effects. I hope you find this list of abstracts useful in educating your patients on this topic.

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Aguilar, Alain J., et al. "A dynamic warm-up model increases quadriceps strength and hamstring flexibility." ***The Journal of Strength & Conditioning Research*** **26.4 (2012): 1130-1141.**
Research suggests that static stretching can negatively influence muscle strength and power and may result in decreased functional performance. The dynamic warm-up (DWU) is a common alternative to static stretching before physical activity, but there is limited research investigating the effects of a DWU. The purpose of this study was to compare the acute effects of a DWU and static stretching warm-up (SWU) on muscle flexibility, strength, and vertical jump using a

randomized controlled trial design. Forty-five volunteers were randomly assigned into a control (CON), SWU, or DWU group. All participants rode a stationary bicycle for 5 minutes and completed a 10-minute warm-up protocol. During this protocol, the DWU group performed dynamic stretching and running, the SWU group performed static stretching, and the CON group rested. Dependent variables were measured immediately before and after the warm-up protocol. A digital inclinometer measured flexibility (degrees) for the hamstrings, quadriceps, and hip flexor muscles. An isokinetic dynamometer measured concentric and eccentric peak torque (N·m/kg) for the hamstrings and quadriceps. A force plate was used to measure vertical jump height (meters) and power (watts). In the DWU group, there was a significant increase in hamstring flexibility (pretest: 26.4 ± 13.5°, posttest: 16.9 ± 9.4°; $p < .0001$) and eccentric quadriceps peak torque (pretest: 2.49 ± 0.83 N·m/kg, posttest: 2.78 ± 0.69 N·m/kg; $p = 0.04$). The CON and SWU did not significantly affect any flexibility, strength, or vertical jump measures ($p > 0.05$). The DWU significantly improved eccentric quadriceps strength and hamstrings flexibility, whereas the SWU did not facilitate any positive or negative changes in muscle flexibility, strength, power, or vertical jump. Therefore, the DWU may be a better preactivity warm-up choice than an SWU.

Avloniti, Alexandra, et al. "The Acute Effects of Static Stretching on Speed and Agility Performance Depend on Stretch Duration and Conditioning Level."*Journal of strength and conditioning research/National Strength & Conditioning Association* (2014).

Although static stretching (SS) is an integral part of physical preparation before training and competition, its usefullnes in regards to power performance improvement has been questioned. The aim of this study was to investigate the effect of six static stretching (SS) durations on speed and agility performance. According to a cross-over design, 34 trained males (age 20.5+/-1.4 years, height 1.81+/-0.2 m, weight 77.2+/-2.6 kg, body fat 8.2+/-2.6%) participated in a control session (no stretch) and six experimental conditions (10, 15, 20, 30, 40, 60 sec) performed in randomized order. Performance in speed (10 and 20 m) and agility (T-test) was measured after the control and experimental conditions. SS, consisting of stretches for hip extensors, hip adductors, knee extensors, knee flexors and ankle sole flexors, was performed after light cardiovascular exercise (8 min). A one-way repeated measures ANOVA showed that speed was improved only by SS of short duration (15/20 sec) whereas agility remained unaffected by all SS trials. When participants' speed and agility level was taken into account, it was revealed that only those of moderate performance demonstrated an improved speed (in 15- and 20-sec trials) and agility (in 10- and 15-sec trials) performance. These results suggest that short duration SS protocols induce an acute improvement of speed and agility performance whereas longer duration has neither positive nor negative effect. Furthermore, it appears that individuals of lower speed and agility performance level are more likely to benefit by a short duration SS protocol.

Ayala, Francisco, et al. "Acute effects of static and dynamic stretching on hamstrings' response times." ***Journal of sports sciences*** **32.9 (2014): 817-825.**
The main purposes of this study were to (a) investigate acute effects of static and dynamic lower limb stretching routines on total response time, pre-motor time and motor time of the medial and lateral hamstrings during maximal eccentric isokinetic knee flexion; and (b) determine whether static and dynamic routines elicit similar responses. A total of 38 active adults completed the following intervention protocols in a randomised order on separate days: (a) non-stretching (control condition), (b) static stretching and (c) dynamic stretching. After the stretching or control intervention, total response time, pre-motor time and motor time of the medial and lateral hamstrings were assessed during eccentric knee flexion movements with participants prone. Measures were compared via a mixed-design factorial ANOVA. There were no main effects for total response time, pre-motor time and motor time. The results suggest that dynamic and static stretching has no influence on hamstrings response times (total response time, pre-motor time and motor time) and hence neither form of stretching reduces this primary risk factor for anterior cruciate ligament injury.

Chatzopoulos, Dimitris, et al. "Acute effects of static and dynamic stretching on balance, agility, reaction time and movement time." ***Journal of sports science & medicine*** **13.2 (2014): 403.**
The purpose of this study was to compare the acute effects of three different stretching protocols on balance, agility, reaction time and movement time of the upper limbs. Participants were thirty one female high school athletes (age = 17.3 ± 0.5 yr.). All participants performed one of the following protocols on different days: (a) 3 min jogging followed by 7 min static stretching (SS), (b) 3 min jogging followed by 7 min dynamic stretching (DS), and (c) 3 min jogging followed by 7 min of rest (NS). After the protocols participants performed the following tests: dynamic balance, 505 agility test, reaction time (time between a sound stimulus and release of a button) and movement time (movement of the upper extremity over a 0.5 m distance). The order of stretching protocols and performance tests were counterbalanced to avoid carryover effects. Repeated measures analysis of variance revealed significant main effects for all variables except reaction time. The DS protocol compared to SS performed significantly better in balance, agility and movement time. Additionally, the DS protocol compared to NS performed significantly better in agility. According to the results of the study, a DS protocol is more appropriate than SS for activities that require balance, rapid change of running direction (agility) and movement time of the upper extremities.

Cilli, Murat, et al. "Acute Effects of a Resisted Dynamic Warm-Up Protocol on Jumping Performance." ***Biology of Sport*** **31.4 (2014): 277.**
This study aimed to investigate the kinematic and kinetic changes when resistance is applied in horizontal and vertical directions, produced by using different percentages of body weight, caused by jumping movements during a dynamic warm-up. The group of subjects consisted of 35 voluntary male athletes (19 basketball and 16 volleyball players; age: 23.4 ± 1.4 years, training experience: 9.6 ± 2.7 years; height: 177.2 ± 5.7 cm, body weight: 69.9 ± 6.9 kg) studying Physical Education, who had a jump training background and who were training for 2 hours, on 4 days in a week. A dynamic warm-up protocol containing seven specific resistance movements with specific resistance corresponding to different percentages of body weight (2%, 4%, 6%, 8%, 10%) was applied randomly on non consecutive days. Effects of different warm-up protocols were assessed by pre-/post- exercise changes in jump height in the countermovement jump (CMJ) and the squat jump (SJ) measured using a force platform and changes in hip and knee joint angles at the end of the eccentric phase measured using a video camera. A significant increase in jump height was observed in the dynamic resistance warm-up conducted with different percentages of body weight ($p < 0.05$). On the other hand, no significant difference in different percentages of body weight states was observed ($p > 0.05$). In jump movements before and after the warm-up, while no significant difference between the vertical ground reaction forces applied by athletes was observed ($p > 0.05$), in some cases of resistance, a significant reduction was observed in hip and knee joint angles ($p < 0.05$). The dynamic resistance warm-up method was found to cause changes in the kinematics of jumping movements, as well as an increase in jump height values. As a result, dynamic warm-up exercises could be applicable in cases of resistance corresponding to 6-10% of body weight applied in horizontal and vertical directions in order to increase the jump performance acutely.

Fletcher, Iain M., and Bethan Jones. "The effect of different warm-up stretch protocols on 20 meter sprint performance in trained rugby union players." ***The Journal of Strength & Conditioning Research*** **18.4 (2004): 885-888.**
The purpose of this study was to determine the effect of different static and dynamic stretch protocols on 20-m sprint performance. The 97 male rugby union players were assigned randomly to 4 groups: passive static stretch (PSS; n = 28), active dynamic stretch (ADS; n = 22), active static stretch (ASST; n = 24), and static dynamic stretch (SDS; n = 23). All groups performed a standard 10-minute jog warm-up, followed by two 20-m sprints. The 20-m sprints were then repeated after subjects had performed different stretch protocols. The PSS and ASST groups had a significant increase in sprint time ($p <= 0.05$), while the ADS group had a significant decrease in sprint time ($p <= 0.05$). The decrease in sprint time,

observed in the SDS group, was found to be nonsignificant ($p >= 0.05$). The decrease in performance for the 2 static stretch groups was attributed to an increase in the musculotendinous unit (MTU) compliance, leading to a decrease in the MTU ability to store elastic energy in its eccentric phase. The reason why the ADS group improved performance is less clear, but could be linked to the rehearsal of specific movement patterns, which may help increase coordination of subsequent movement. It was concluded that static stretching as part of a warm-up may decrease short sprint performance, whereas active dynamic stretching seems to increase 20-m sprint performance.

Kim, Kanghoon, et al. "The Effects of Diverse Warm-up Exercises on Balance."*Journal of physical therapy science* 26.10 (2014): 1601.
[Purpose]To examine how stretching, plyometric, and treadmill exercises influence the dynamic balance necessary for sports activities. [Subjects and Methods] Twenty-two healthy subjects participated in this study. The subjects conducted stretching, plyometric exercises, and treadmill walking for set times over a period of three days. The subjects' dynamic balance was then measured. The measurements were taken prior to the intervention, immediately after the intervention, and 20 minutes after the intervention. All the intervention times were set at 16 minutes, excluding resting times. The data were analyzed with using the two-way ANOVA. [Results] There was no interaction between exercises and time. There were no statistical differences among the exercises and no statistical differences in changes over time. [Conclusion] This study found that warm-up exercises such as plyometric exercises, stretching, and treadmill walking have no effect on the dynamic of balance in healthy subjects.

Kirmizigil, B, Ozcaldiran, B, and Colakoglu, M. Effects of three different stretching techniques on vertical jumping performance. *J Strength Cond Res* 28(5): 1263–1271, 2014
The aim of this study was to evaluate 3 different flexibility techniques: (a) ballistic stretching (BS), (b) proprioceptive neuromuscular facilitation stretching (PNF) + BS, and (c) PNF + static stretching (SS) on vertical jump (VJ) performance and to determine the most appropriate stretching method during warm-up period before explosive force disciplines. One hundred voluntary male athletes participated in this study. All subjects performed aerobic warm-up (5-minute jog) followed by BS (5 seconds for each stretching exercise), PNF + BS (PNF performed followed by 5 seconds of BS), and PNF + SS (PNF performed followed by 30 seconds of SS) treatment protocol, respectively in the same day. Each stretching treatment was applied for 4 sets bilaterally. In all stretching treatments, lumbar extensor, gluteus maximus, and hamstring muscles were stretched with a single stretching exercise. After a 2-minute brief rest period, participants performed 3 trials of VJ test followed by one of the treatment protocols. Vertical jump performance was evaluated by

countermovement jump (CMJ). Participants were divided into 3 groups according to their flexibility and prejump performances after warm-up. For each individual group and the whole group, after all treatments, differences in CMJ values were obtained ($p \leq 0.05$). Ballistic stretching increased the VJ performance in the groups with low and average flexibility, poor prejumping performance, and also in the whole group ($p \leq 0.05$). Proprioceptive neuromuscular facilitation stretching + BS affected VJ performance in the group of participants with high flexibility ($p \leq 0.05$). Proprioceptive neuromuscular facilitation + SS decreased VJ performance in groups of participants with high flexibility, moderate, and high prejumping performance and in whole group ($p \leq 0.05$). Ballistic stretching method increased VJ height, therefore seems to be more suitable than PNF + SS and PNF + BS before events that rely on explosive power as a part of warm-up period.

Meerits, Teet, et al. "Acute effect of static and dynamic stretching on tone and elasticity of hamstring muscle and on vertical jump performance in track-and-field athletes." ***Acta Kinesiologiae Universitatis Tartuensis*** **20 (2014): 48-59.**
The aim of the study was to evaluate and compare acute effect of static and dynamic stretching exercise on hamstring muscles tone and jump performance in trained track-and-field athletes. Twelve male track-and-field elite athletes (mean age: 22.0±2.1 years) who trained speed and explosive power (sprint, jumps and decathlon) voluntarily joined in the study. Muscle tone and elasticity characteristics (frequency and logarithmic decrement, respectively) of hamstring muscles (biceps femoris and semitendinosus) were measured by Myoton PROdevice (Myoton Ltd, Estonia). Squat jump height was measured by telemetric system BTS G-studio (BTS S.p.A., Italy). All characteristics were measured before and after stretching exercise. Frequency of hamstring muscles did not differ significantly after static and dynamic stretching. Hamstring muscle's decrement decreased by 2.9% ($p<0.01$) after static stretching. Jump height increase by 7.1% ($p<0.01$) after dynamic stretching and decrease by 5.2% ($p<0.05$) after static stretching was noted. Muscle tone and elasticity characteristics did not correlate with jump height. This study shows that dynamic stretching has a positive effect on explosive power in trained track-and-field athletes and it is preferable to use static stretching after warm-up of these athletes.

Morrin, Niamh, and Emma Redding. "Acute effects of warm-up stretch protocols on balance, vertical jump height, and range of motion in dancers." ***Journal of Dance Medicine & Science*** **17.1 (2013): 34-40.**
The aim of this study was to examine the acute effects of static stretching (SS), dynamic stretching (DS), and a combined (static and dynamic) stretch protocol on vertical jump (VJ) height, balance, and range of motion (ROM) in dancers. A no-stretch (NS) intervention acted as the control condition. It was hypothesized that

the DS and combination stretch protocols would have more positive effects on performance indicators than SS and NS, and SS would have negative effects as compared to the NS condition. Ten trained female dancers (27 ± 5 years of age) were tested on four occasions. Each session began with initial measurements of hamstring ROM on the dominant leg. The participants subsequently carried out a cardiovascular (CV) warm-up, which was followed by one of the four randomly selected stretch conditions. Immediately after the stretch intervention the participants were tested on VJ performance, hamstring ROM, and balance. The data showed that DS ($p < 0.05$) and the combination stretch ($p < .05$) produced significantly greater VJ height scores as compared to SS, and the combination stretch demonstrated significantly enhanced balance performance as compared to SS ($p < 0.05$). With regard to ROM, a one-way ANOVA indicated that SS and the combination stretch displayed significantly greater changes in ROM than DS ($p < 0.05$). From comparison of the stretch protocols used in the current study, it can be concluded that SS does not appear to be detrimental to a dancer's performance, and DS has some benefits but not in all three key area's tested, namely lower body power (VJ height), balance, and range of motion. However, combination stretching showed significantly enhanced balance and vertical jump height scores and significantly improved pre-stretch and post-stretch ROM values. It is therefore suggested that a combined warm-up protocol consisting of SS and DS should be promoted as an effective warm-up for dancers.

Paradisis, GP, Pappas, PT, Theodorou, AS, Zacharogiannis, EG, Skordilis, EK, and Smirniotou, AS. Effects of static and dynamic stretching on sprint and jump performance in boys and girls. *J Strength Cond Res* 28(1): 154–160, 2014

The aim of this study was to investigate the acute effects of static (SS) and dynamic stretching (DS) on explosive power, flexibility, and sprinting ability of adolescent boys and girls and to report possible gender interactions. Forty-seven active adolescent boys and girls were randomly tested after SS and DS of 40 seconds on quadriceps, hamstrings, hip extensors, and plantar flexors; no stretching was performed at the control condition. Pretreatment and posttreatment tests examined the effects of stretching on 20-m sprint run (20 m), countermovement jump (CMJ) height, and sit and reach flexibility test. In terms of performance, SS hindered 20 m and CMJ in boys and girls by 2.5 and 6.3%, respectively. Dynamic stretching had no effect on 20 m in boys and girls but impaired CMJ by 2.2%. In terms of flexibility, both SS and DS improved performance with SS being more beneficial (12.1%) compared with DS (6.5%). No gender interaction was found. It can therefore be concluded that SS significantly negates sprinting performance and explosive power in adolescent boys and girls, whereas DS deteriorates explosive power and has no effect on sprinting performance. This diversity of effects denotes that the mode of stretching used in adolescent boys and girls should be task specific.

Ryan, Eric D., et al. "Acute effects of different volumes of dynamic stretching on vertical jump performance, flexibility and muscular endurance." ***Clinical physiology and functional imaging*** **34.6 (2014): 485-492.**

The purpose of this study was to examine the acute effects of different volumes of a dynamic stretching routine on vertical jump (VJ) performance, flexibility and muscular endurance (ME). Twenty-six males (age 22·2 ± 1·3 years) performed three separate randomized conditions: (i) a control (CON) condition (5-min jog + 12 min of resting), (ii) a 5-min jog + a dynamic stretching routine (DS1; 6·7 ± 1·3 min) and (iii) a 5-min jog + a dynamic stretching routine with twice the volume (DS2; 12·1 ± 1·6 min). The dynamic stretching routine included 11 exercises targeting the hip and thigh musculature. VJ performance (jump height and velocity) and flexibility were measured prior to and following all conditions, while ME was measured following all conditions. The DS1 and DS2 conditions increased VJ height and velocity ($P<0·01$), while the CON condition did not change ($P>0·05$). When compared to the CON condition, the DS1 condition did not improve ME ($P>0·05$), whereas the DS2 condition resulted in a significant (15·6%) decrease in the number of repetitions completed ($P<0·05$). Flexibility increased following all conditions ($P<0·01$), while the DS1 condition was significantly greater ($P<0·01$) than the CON condition at post-testing. These results suggest that dynamic stretching routines lasting approximately 6–12 min performed following a 5-min jog resulted in similar increases in VJ performance and flexibility. However, longer durations of dynamic stretching routines may impair repetitive high-intensity activities.

Santos, Christiano Francisco dos, Auristela Duarte de Lima Moser, and Elisangela Ferretti Manffra. "Acute effects of short and long duration dynamic stretching protocols on muscle strength." ***Fisioterapia em Movimento*** **27.2 (2014): 281-292.**

Objective

Compare the acute effects of dynamic stretching protocols on the isokinetic performance of the quadriceps and hamstring muscles at two velocities in adult males.

Methodology

Included the participation of 14 males (21 ± 2.6 years; 178 ± 0.4 cm; 73.2 ± 20.9 kg) were assessed using an isokinetic dynamometer before and after following a short or long-duration dynamic stretching protocol or a control protocol. The results were assessed by a two-way ANOVA and a Scheffé's *post hoc* test at a 5% significance level.

Results

No difference was found in the variables assessed at 180°/s after LDDS. At 60°/s, LDDS reduced the power of the knee flexors. The control protocol reduced the power of the knee flexors and increased the power of the extensors. At 60°/s, the work of the knee flexors exhibited a reduction after LDDS. The control protocol resulted in a reduction in the work of the flexors. The peak torque angle exhibited a reduction in the extensors and flexors after LDDS and SDDS.

Conclusion

Dynamic stretching did not cause any change in the peak torque, which points to its possible use in activities involving velocity and muscle strength. The executing dynamic stretching before physical activities such as running and high-intensity sports might be beneficial by promoting increases in heart rate and in body temperature.