

The IADMS Bulletin for Teachers

Volume 1, Number 1, 2009

Editors-in-Chief

Gayanne Grossman, P.T., Ed.M., and Marliese Kimmerle, Ph.D.

Associate Editors

Ruth Solomon and John Solomon

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IADMS Bulletin for Teachers

From the Editors

Dear Dance Educators:

Welcome to the introductory issue of the *International Association for Dance Medicine and Science (IADMS) Bulletin for Teachers*. The purpose of the Bulletin is to apply dance medicine/science theory and research to practical problems in dance education, dance training and dance performance. It will address issues of concern to teachers of amateur, pre-professional or professional dancers across the age span. The articles will identify practical teaching problems and present scientific knowledge that may enlighten teaching practices.

Although a number of journals for dance teachers exist, we anticipate that this one will serve a particular need, namely to provide access to the wealth of medical and science research that has blossomed in the last ten years. Many researchers in motor learning, control and development, biomechanics, exercise physiology, sport psychology, anatomy, kinesiology, and medicine have found dance a challenging study topic. Their research, however, is typically published and presented in the journals and conferences of their own disciplines, and does not necessarily reach the practical world of the dance educator. The authors for the Bulletin have been asked to fill that gap. Additionally, a selection of current research will be reviewed in each issue.

We hope to encourage a dialogue with the teaching profession via a "Letters to the Editor" column. Practical problems sent in by dance educators will be answered by the IADMS Education Committee. Please focus your questions on teaching methodology, physical training, or locating resources in the form of literary references or personnel. The *IADMS Bulletin for Teachers* is not a medical forum, and IADMS would direct those questions elsewhere.

We sincerely hope you find this publication to be helpful.

Editors:

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Greetings from the Chair of the IADMS Education Committee

Rachel Rist, Director, Arts Educational School, Tring Park, Hertfordshire, UK

The Role of the IADMS Education Committee

The Education Committee is dedicated to reaching out to dance teachers all over the world to give access to information and resources. Well-informed dance teachers can enable dancers to dance longer and stronger. We know that it is in the studio that future generations of dancers are born, either for the professional theater or for recreational pleasure. By keeping dance teachers up to date with the best information we have, those dancers will have greater longevity and the life-enhancing joy of dancing.

Committee Projects

Resource Papers

This Education Committee project is part of a strategy to provide resource material appropriate for dance teachers. Resource Papers aim to present possible applications of current research to dance teaching, thus forming a bridge between scientific knowledge and the day-to-day needs and terminology of dancers and dance teachers. There are currently six Resource Papers on the IADMS website (www.iadms.org), addressing issues concerning the adolescent dancer, nutrition, screening, proprioception, bone health, and pointe readiness. Two additional Resource Papers are in progress: *breathing* and *dancers' response to career-threatening injuries*.

Teacher Liaison

This is a new sub-committee, co-chaired by Jan Dunn and Elsa Posey, with additional members drawn from the IADMS member base. The primary purpose of the group is to increase the number of dance teachers worldwide who know about IADMS, want to learn more and come to the conferences and events, and who will feel that the

organization really works for them. We will be building an international data base to help distribute information such as the IADMS Bulletin for Teachers, the Safe Dance Project, and articles relating to dance science and medicine. Another project under discussion is for IADMS members to connect with their local dance communities and offer workshops of interest to individual teachers and studio owners. The Education Committee has been discussing ways to better facilitate dissemination of information to the dance education community, in addition to the annual Day for Teachers. We believe the Teacher Liaison sub-committee is an exciting and necessary step in that direction.

The IADMS Bulletin for Teachers

You are reading the first issue resulting from this project. We are aware that much of the dance research reported only appears in lengthy research format in academic journals. We want to promote accessibility to this material for dance educators by encouraging researchers to submit short, more readable versions of their studies.

A Day for Teachers: IADMS 18th and 19th Annual Meetings

At each IADMS Annual Meeting one day is set aside for special interest groups. "A Day for Teachers" this past year was in Cleveland, Ohio, USA, on October 26, 2008. It was titled *Dancing Mind, Body and Soul*. The next "A Day for Teachers" will be held in The Hague, The Netherlands on November 1, 2009.

Safe Dance Practice Qualification

During the 2008 IADMS Annual Meeting in Cleveland the new Safe Dance Practice Qualification was launched. It will be examined worldwide by Trinity International Examina-

tions, and has been constructed as a pioneering link with IADMS to provide a practical and useful way for a wide variety of dance practitioners to demonstrate knowledge and understanding of safe dance practices.

Education Committee members

Michael Kelly Bruce	USA
Arlene Chertoff	Israel
Jan Dunn	USA

Pamela Geber	USA
Gayanne Grossman	USA
Janet Karin	Australia
Marliese Kimmerle	Canada
Elsa Posey	USA
Sonia Rafferty	UK
Rachel Rist	UK
Margot Rijven	Netherlands
Bonnie Robson	Canada

Conditioning for Greater Leg Extension

Mary Virginia Wilmerding, Ph.D., University of New Mexico, Albuquerque, New Mexico, USA

There are a number of attributes that dance teachers work diligently to develop in their students. One of the most impressive and sought-after skills is a high “extension”. This, of course, refers to the height of the gesture leg, either to the front or side, and is practiced both at barre and in center with adagio music and *développé* exercises. A standard ballet class will have at least one exercise at barre (thus a repetition to the right and another to the left) and one other exercise in center (again, with a

repetition to the right and left side) to train the extension that defines the *développé*.

It is beyond the scope of a dance class to expect to develop the necessary components of strength, flexibility, and neuromuscular coordination required of the performing artist. To this end, many teachers and researchers recommend outside conditioning. Conditioning outside of the dance class has shown good results for back strengthening and arabesque height in a 10-week training program docu-



Figure 1. Passive Range of Motion



Figure 2. Active Range of Motion



Figure 3. Therapeutic exercise for increased ‘extension’

mented by Welsh and colleagues.¹ Increases in measured strength have also been documented by Koutedakis for leg strength,² and Stanforth for abdominal strength.³ It seemed clear to us that the same expectations could be held for gaining greater height in dancers’ extensions.

We engaged 16 healthy university level dancers and tested them initially for active and passive ranges of hip motion, simulating a *développé à la seconde*. (Those combined actions are known as flexion, abduction, and outward rotation of the hip.) Research had suggested that ballet dancers have a measurably greater passive range of motion than the normal population of females.⁴ Our goal was to see if we could get the active range of motion to be closer to the passive range of motion. We placed the dancers near a wall, in front of a measuring tape. They were given hand support to simulate a barre. They held their gesture heel with the same side hand and lifted it to the side (passive range of motion). A photograph was taken in this position (see Figure 1). The dancers then let go of the heel and tried to maintain the same leg height (active range of motion). A second photograph was taken (see Figure 2). Coaching was provided to maintain proper alignment and body position. We measured the difference in leg height between the first and second photograph.

We then divided the students approximately in half and

told one group to simply continue with their dance classes. The second group was taught a five-minute therapeutic exercise and asked to perform it in three sets of ten repetitions, on both legs, three days a week for six weeks. The exercise was a modified leg raise: in a long sit position the dancers leaned back on their hands and the leg to be exercised was turned out and the knee flexed, like a front attitude (see Figure 3). The aim was to engage the quadriceps as little as possible and focus the work on the hip flexors; the dancers were coached to achieve this aim. In six weeks we brought everyone back and re-measured their active and passive ranges of motion. Again, we measured the difference in the two photographs. All the dancers who did the therapeutic exercise saw an increase in their *développé à la seconde*. The average height increase was 6.5". The dancers that did no extra training showed no change in the six-week period.

It should be noted that the dancers who saw the gains from the extra exercise were asked to execute this training on their own. Most chose to take a bit of time after class to complete their “assignment”. It was not labor-intensive, and it should be stated that the dancers clearly understood the purpose of our study. They were quite pleased with the results.

The hip flexor muscles are used in a high percentage of dance steps. In class, however, they are not isolated for strength training. Dancers may have adequate to above normal range of motion in their hips, but may lack the physical strength or motor control required to lift their legs to the end point of range of motion. Our small endeavor showed that specialized training may help the dancer achieve a higher *développé à la seconde*. Likewise, other studies that have focused on a single part of the body have shown that gains can be made through outside conditioning that may improve important dance skills.

Acknowledgment

This information article was generated from: Grossman G, Wilmerding MV. The effect of conditioning on the height of dancer’s extension in *à la seconde*. *J Dance Med Sci.* 2000;4(4):117-21.

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IADMS Education Committee

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Recommendations for supplemental exercise targeting increased “extension”:

1. Condition 3-5 times a week.
2. Aim to isolate the hip flexor muscle group. Use the quadriceps as little as possible. Lean back on your hands, turnout the front leg and bend the knee (a small attitude position). Then bend the other knee and place the foot on the floor to help support your back.
3. Execute up to 10 repetitions of the exercise in sets of three.
4. Expect to see changes in strength in about 4-6 weeks.
5. Then you can combine increased function with resistance (elastic bands, etc). This is optional. You may not need it.
6. Combine increased function with standing balance training. Be sure to incorporate other required muscle groups such as abdominals, back, and standing leg support.
7. Proceed SLOWLY to avoid tendon irritation in the front of the hip joint. It may take a couple weeks before you can achieve three sets of 10. Stretch after strengthening.



Teaching to the Whole Dancer

Synthesizing Pedagogy, Anatomy, and Psychology

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The approach to technique training in both dance and music reflects the educational models of previous centuries in which the teacher was an experienced professional and the student an apprentice, learning at the feet of the master. Traditionally, dance has been taught from this hierarchical, teacher-centered perspective.¹ In this traditional model, the teacher is perceived as the primary source of knowledge; students learn through imitation and adherence to external instructions. Physical mastery is achieved through repetition, with minimal conceptual foundation. Technical goals are defined in terms of ideal physical accomplishments (e.g., 180 degrees of turnout). This approach relies heavily on innate natural talent and physical facility relative to the demands being placed on the body, with few accommodations made for individual limitations.

While there is no doubt that many exquisite dancers have emerged from this training system, it contains some serious drawbacks. The teacher-centered environment encourages students to equate learning with the acquisition of skills, placed within a right/wrong dance context that focuses on external product and results. Students trained in this model are generally motivated by their desire for external approval; they often become passive learners who excel at following instructions but lack internal awareness and motivation. Cognitively, they lack a conceptual foundation (anatomical, mechanical, somatic, etc.) to support their technical development.

There is often a physical toll associated with this approach to training. By ignoring individual physical limitations, a Darwinian system of professional preparation has evolved in which those with bodies well-suited to the field's demands thrive. Those with less than ideal physical instruments or whose bodies cannot tolerate the physical stress of improper mechanics may drop out of the field prematurely.

An artistic toll is taken as well. Mature artistry requires self-awareness and the capacity for creative collaboration. The emphasis on obedience, imitation, and submission to

external authority, in combination with the early age of entry into the profession, have led to fragile self-esteem, stunted emotional development, and a culture of infantilization of professional artists.² Lacking tools for self-empowerment and self-direction, many dancers do not fulfill their artistic potential.

Dance Technique Education for the 21st Century

The traditional dance training model was widely accepted in previous eras when the professional environment preferred dancers who aspired to become obedient tools. However, as the dance field evolves, we have seen an increase in the desire for thoughtful dancers: artists who can bring the depth of themselves and their training into the studio and onto the stage. To prepare dancers for current professional expectations and support their technical, artistic, and personal growth, we must invite the whole person into the dance studio. In doing so we must move from training, which emphasizes skill acquisition, to education, which addresses development of the whole person.

Whole person education provides students with diverse tools for growth. As dance educators, we can give dancers four important tools to develop artistry and physical mastery: conceptual understanding of anatomically sound dance technique; refined perceptual awareness; knowledge and understanding of how to work with one's own body; and a strong sense of self.

A conceptual understanding of anatomically sound dance technique enables dancers to base their technical form, goals, and process on the body's anatomical structure, with respect for individual variations and limitations. Working in an anatomically-sound manner reduces the risk of injury while enhancing performance, thus increasing the probability of a long and fulfilling life in dance.

To develop anatomically sound dance technique, dancers also need refined perceptual awareness that enables them to discern and differentiate subtle movement sensations. This kinesthetic sensitivity enables dancers to respond in a nuanced manner to both internal feedback

from their bodies and external feedback from teachers. It facilitates fine motor control, which enhances movement efficiency and expressive qualitative range.³ The two tools are complimentary: anatomical knowledge can serve as a scaffolding or framework for sensory experiences.

Both cognitive understanding and perceptual awareness empower students to explore their full potential by expanding their understanding of personal structural limitations and physical idiosyncrasies. Rather than teaching students to conform to an external ideal, we should teach them to find the optimal individual way to reach the desired aesthetic goal with the least amount of stress on their bodies. They should be encouraged to ask “How can I best achieve this result with *my* body?” This personalized approach to healthy dancing can be supported by tools for self-care, including knowledge of the principles of adjunct conditioning for strength, flexibility and endurance.

Conceptual knowledge, deep perceptual awareness, and understanding of individual solutions are facilitated by a learner-centered pedagogical approach that encourages students to become thinking dancers who assume responsibility for their own growth and progress. Learner-centered education shifts the class focus from what the teacher knows to what the student understands, valuing the student’s personal awareness and discoveries. It encourages active learning supported by self-reflection, accompanied by the self-cueing and self-direction essential to technical progress.⁴

By teaching dancers to value and trust their own perceptions and experiences, a learner-centered education also cultivates a strong sense of self, inner direction and self-esteem. These qualities enable artists to become creative collaborators who can participate fully in the choreographic process and access their own creative voices as both interpretative and generative artists.

Example: Teaching Postural Alignment and Core Support

An example of a learner-centered pedagogical approach that draws on both cognitive and perceptual tools to teach postural alignment and core support is presented below. This approach can be used to address any technical goal.

As a technique teacher, one can try to give students a conceptual framework, explaining the anatomical foundation of technical goals. To teach postural alignment and core support, begin on a skeletal level, explaining the desired relationship of skeletal reference points to one another and to the plumb line of gravity. Explain the desired pattern of core muscle activation and its relationship to breathing and use of the diaphragm.

Provide movement experiences that allow the students to explore these concepts physically, integrating cognitive knowledge with sensory experiences. These types of movement explorations can be integrated into technique classes or addressed in separate classes intended as laboratories for technique analysis. For this topic, movement explorations will include engaging the core muscles individually

and in combination, integrating core muscular support with breath and experimenting with postural alignment patterns. As part of this process, help students to identify their personal postural patterns and develop constructive approaches to working with their individual challenges.

It is essential that students learn to apply conceptual and perceptual knowledge to the specifics of dance technique. Assist them in this process by asking them to use their knowledge first in the simplest building blocks of dance technique and then in progressively more complex movements. In dance vocabulary, we begin with stationary movements such as standing on two legs with and without turnout, progressing to standing on one leg and doing gestural movements with the arms and legs, and on through changing levels and locomotive movement through space. The goal in this process is to help students understand the need for, and find a system of, body organization and postural support that they can use consistently throughout their dancing.

Although some dance scientists caution against what they term “micromanagement” of the body, finding and isolating desired muscle activation patterns and joint movements provides an enlightening specificity for the dancer that is highly useful when followed by integration into a global coordination and organization of the entire body. Having built a foundation of desired motor patterns and physical sensations as reference points, the dancer must integrate these isolated and specific movement experiences into the act of dancing. The final step, therefore, is to apply and utilize these isolated sensations during an actual technique class so that they become an automatic component of motor planning.

Learner-centered pedagogical strategies can help students to integrate and apply their anatomical knowledge and sensory experiences to dancing. These strategies include replacing instructions (“use your stomach”) with cues for awareness that encourage students to notice and make choices based on their perceptions (“notice if you are using your core support”). Awareness then becomes a tool for change.⁵ Instructions can also be framed as questions that facilitate discussion, such as “Do you notice any changes to your sense of balance when you use your core support?” Teachers can make the transferability of dance knowledge explicit by pointing out the way in which motor patterns in simple level changes such as pliés and relevés may be present in more complex level changes such as jumps, and by drawing students’ attention to these technical themes as a class progresses.⁶

In providing feedback, teachers can enhance student self-trust and confidence by acknowledging effort, change, and improvement (“I can see you working on your pelvic alignment”), and by encouraging the student to focus on and value his/her personal experience (“What does that feel like to you?” and “Can you feel the difference between...”).⁷ A common pedagogical strategy is the “compliment sandwich,” in which the teacher acknowledges progress and success before and after providing critical

feedback. Finally, it is important to provide opportunities for reflection and assimilation. Journals and essays that guide students to think critically about their experiences can help them identify and see the significance of their new sensations and realizations.

Summary

In summary, our goal as a field must be to educate dancers who can explore and discover the most effective ways that *their* bodies can dance, fulfilling desired aesthetic goals with the least amount of physical damage. We must change the intent of our dance education from producing obedient tools adept at following external commands to empowering self-directed, knowledgeable artists capable of artistic depth and creative collaboration. These goals are served by learner-centered, whole-person education that provides dancers with conceptual, perceptual, and personal tools for continued growth.

Acknowledgments

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Improving Pelvic Alignment

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The dance community places a high level of importance on proper alignment, which provides a basic building block for achieving the aesthetic line and form required for success in the field. Teachers and researchers alike recognize pelvic alignment as the cornerstone of overall skeletal alignment. Proper or neutral pelvic alignment allows for efficient execution of movements—such as external rotation from the hip joint—and effective muscle recruitment.^{1,2,8} Numerous studies have been conducted exploring ways to identify and improve pelvic alignment in dancers.³⁻⁷

Neutral alignment can be defined simply as balancing the pelvis on the heads of the femurs.¹ However, this concept can be vague at best when teaching dancers with varying body types. The research indicates that neutral pelvic alignment is different for each dancer, and is highly variable from day to day.^{3,7} Despite this, defining and aligning specific bony landmarks on the pelvis can be a useful tool for dancers and teachers. Two generally accepted alignments include:

- On the vertical plane, aligning the two front hip bones (anterior superior iliac spines) with the pubic bone.⁹
- On the horizontal plane, with the lumbar spine in

neutral, aligning the anterior superior iliac spines within a few degrees of the posterior superior iliac spines (best identified by the two “dimples” located on either side of the sacrum).²

Because bony landmarks also vary from dancer to dancer, these should serve as a starting point from which to begin investigation into finding the neutral alignment that best serves each individual dancer.

Deviations from a neutral pelvis can be defined as anterior tilt (allowing the tail bone to flare backward) and posterior tilt (tucking the tail bone under).^{2,3,5,7,9} Though both deviations are common among dancers, anterior pelvic tilt has become a common and often accepted technique fault among ballet dancers. The traditional approach of addressing the misalignment in technique class does not always serve to decrease it.^{3,7} Furthermore, miscuing dancers to squeeze their gluteal muscles as per classical ballet convention may only lead to overdeveloped gluteal muscles. Dancers with anterior pelvic tilt may also suffer from tight hip flexors and lower back pain. The answer to how best to decrease anterior pelvic tilt and effectively recruit muscles is multifaceted and individualized to each dancer. Several studies have found success with the use of Pilates-based

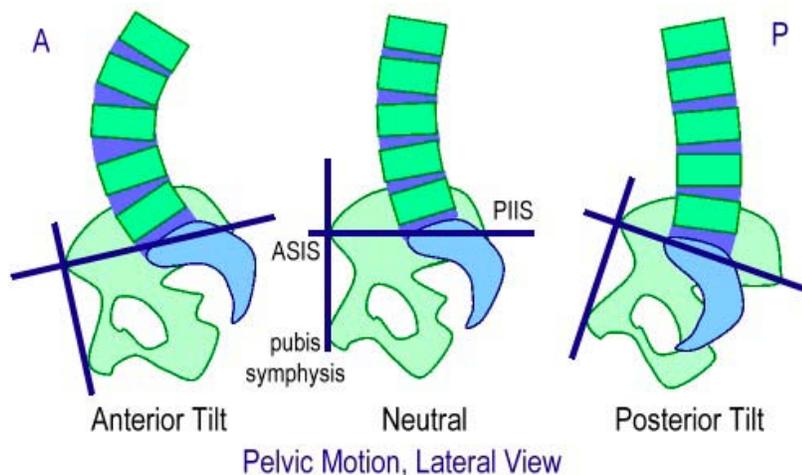


Figure 1. Alignment Diagram

and Somatics-based exercises.^{3-5,7}

The major focus of our research was identifying and decreasing anterior pelvic tilt in three university ballet majors through individual tutoring sessions. Each dancer received six hours of tutoring over a three-week period.⁷ The dancers were female, between 17 and 19 years of age, and displayed a high level of anterior pelvic tilt. They had been consciously struggling with it, but did not know how to fix the problem.

During the six tutoring sessions the dancers were:

- Provided with a short anatomy lesson using a pelvic model as a visual aide to explain neutral alignment;
- Taught a series of Pilates and pre-Pilates exercises, which focused on the abdominal and lower back muscles, hip flexors, quadriceps, and deep hip rotators;
- Coached through simple ballet exercises, emphasizing neutral alignment and proper muscle recruitment, focusing specifically on using the deep rotators and inner thigh muscles while engaging the abdominal muscles to bring the pelvis toward neutral;
- Taught several relaxation exercises to reduce muscle tension;
- Encouraged to use this information in their daily technique class and to ask questions.

The major focus of the tutoring sessions was increasing awareness and motor control, and developing good alignment habits to promote lasting improvements. The results of the study indicate that following intervention each of the dancers decreased their degree of anterior pelvic tilt by an average of 3.5 degrees. Through a simple tutoring program these dancers were able to improve their pelvic alignment and gain a greater understanding of what was necessary for maintaining this alignment.

Research based conclusions regarding pelvic alignment:

- Technique class alone does not always improve pelvic alignment.
- The addition of Pilates-based and Somatics-based exercises leads to improvement in some individuals.
- Pelvic alignment is highly variable and changes from day to day for each dancer.
- Neutral pelvic alignment is different for each dancer.
- Improvements in pelvic alignment can occur in a very short period of time as a result of improved awareness, muscle recruitment, and motor control.

Teacher's guide to improving pelvic alignment:

1. Visually identify dancers needing remediation
 - Screen dancers specifically for pelvic alignment. Barre work often provides the optimal sustained positioning for visual assessment.
 - Once identified, continue observation of dancers during varied exercises and multiple lessons.
2. Provide identified dancers with feedback on proper pelvic positioning and "problem movements" specific to each. Include discussion of underlying anatomy, with skeleton demonstration if available. The key is to make this an individualized discussion,

encourage questions, and take a hands-on approach to helping the student find a neutral pelvic alignment.

3. Continue to observe targeted dancers for improvement following basic feedback. If dancers are still in need of improvement, integrate the following exercises into the dancer's daily routine:
 - Increase abdominal strength; strong abdominals provide support for finding and maintaining a neutral pelvis.
 - Stretch hip flexors, if they have become excessively tight from years of anterior pelvic tilt. Stretching them on a daily basis will allow the pelvis to settle into a more neutral position.
 - "Pelvic clock" provides a first step toward improvement by increasing awareness of pelvic alignment: Lying on your back with knees bent and feet on the floor, tip the pelvis through full range of motion, starting at 12 o'clock with the navel and lower back pressed to the floor and moving through to 6 o'clock as the waist rises off the floor and the tailbone is the only part of the spine contacting the floor. Make certain not to miss any point of the clock, and repeat in a counterclockwise circle. This exercise forces you to explore the full range of motion available in the pelvis and find a neutral pelvic alignment.

Acknowledgment

This article is excerpted from Deckert JL, Barry SM, Welsh TM. Analysis of pelvic alignment in university ballet majors. *J Dance Med Sci.* 2007;11(4):110-7.

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Abstracts from the Current Literature

Edited by Gayanne Grossman, P.T., Ed.M., and Marliese Kimmerle, Ph.D.

Brown AC, Wells TJ, Schade ML, Smith DL, Fehling PC. Effects of plyometric training versus traditional weight training on strength, power and aesthetic jumping ability in female collegiate dancers. J Dance Med Sci. 2007;11(2):38-44.

Two of the articles in this issue of the IADMS Bulletin for Teachers report on the effectiveness of outside-of-class training programs on pelvic alignment and on leg extension. This study examines the benefits of two different types of 6-week strength training programs on the jumping ability of ballet dancers. One of the contributions that the movement sciences have made as they have gone beyond sport to explore dance training is that we have learned more about the physical demands and athleticism of dance.

There is increasing recognition that supplementary training outside of the technique class is needed for maximum performance. While the benefits of strength training for athletes is well known, very little is known about its effects on dancers. This study compared a traditional approach to strength training, via four lower body isotonic leg exercises with gradually increasing weights, to a plyometric program of active one- and two-legged jumping exercises of increasing height and intensity. Both training methods were effective in increasing laboratory leg strength and power measurement, including the height of vertical jumps.

A question of interest in the study, however, was how these improvements in physical fitness might affect the aesthetics of the jumps. Dance faculty evaluated ballon, aesthetic jump height, ability to point the feet in the air, and overall jumping ability during a petite allegro. Improvements were seen in perceived jump height and ability to point the feet, but there was no change in any group for ballon or overall jumping ability. The authors suggest that the supplemental training was effective in developing higher jumps but the improvements did not necessarily translate into aesthetically more pleasing jumps, which are best mastered through technical training. Of note, however, is that the control group demonstrated no changes in any measure of jumping ability from the 6 weeks of dance classes. One

of the benefits of supplemental training to improve physical fitness may be that it allows the dancer to focus on the artistry of the movement in class instead of the physical demands.

Gamboa JM, Roberts LA, Maring J, Fregus A. Injury patterns in elite preprofessional ballet dancers and the utility of screening programs to identify risk characteristics. J Orthop Sports Phys Ther. 2008 Mar;38(3):126-36.

Within the dance science and medicine community a tremendous amount of effort has been spent investigating screening protocols, standardization of screening methods, and injury reporting. One of the lines of thought is that with the information collected through screening, dancers and those who train and care for them will be better equipped to identify risk factors for injury and possibly promote more efficient injury prevention programs. This team of researchers conducted a five-year retrospective review of data collected through yearly screenings and physical therapy treatments at an elite pre-professional ballet boarding school. One of their purposes was to see if screening data could be used to distinguish between injured and non-injured dancers. They defined as injured any dancer who sought at least one physical therapy treatment. They looked at demographics, past medical history, posture, strength, flexibility, various orthopedic tests, and dance function. Another purpose was to look at types of injuries and when injuries occur throughout the season.

Their conclusion was that some, but not all, of the information collected was consistent with risk factors for injury in dancers. Interestingly, they found no significant difference between injured and non-injured dancers in: age, onset of menses, regularity of menses, hip popping (with and without pain), upper extremity strength (shoulder and arm), core stability, flexibility, hip rotation (turning in or out) and knee over second toe alignment during grand plié. However, there was a significant difference between the injured and non-injured dancers when they measured: history of injury, history of low back pain, lower extremity

strength (hip and leg), pronation (rolling in) of the foot - (although this was true only for the right foot) and lack of plantar flexion (pointing the foot; true also only for the right foot).

They also concluded that most injuries are caused by overuse, and the number of injuries spike with sudden increases in training schedules and rehearsal time. Other researchers have found similar patterns. They feel that fatigue and stress may play a role. Finally, they suggest that a possible benefit to screening is for dancers to understand “their own personal musculoskeletal profiles.”

Sanders S. Dancing through pregnancy: activity guidelines for professional and recreational dancers. *J Dance Med Sci.* 2008;12(1):17-22.

This review article tackles a subject that is hardly ever addressed in the literature-- professional or recreational dancers continuing to dance while pregnant. Since dance does not fit neatly under the category of “familiar” exercise such as walking or running, and can contain a very broad range of movements depending on the dance forms, there is little guidance to be found from the medical profession specifically directed at dance activities. The guidelines that seem most applicable are those for exercise in general during pregnancy.

The author has compiled an impressive review of existing guidelines that deal with such topics as hormone-related changes in the musculoskeletal system, such as ligamentous laxity and bone changes, the impact of pregnancy on the abdominal muscles, back pain, changes in the hip and pubic symphysis, temperature control and blood flow, and considerations for duration and intensity of exercise. What is helpful is that she not only describes the effects of pregnancy on a woman’s body, but also illustrates how this impacts dancing, what movements to avoid, and signs that suggest it’s time to stop dancing.

Her conclusion is positive in terms of supporting dance as

beneficial exercise during pregnancy. “Aside from a few minor adjustments, dancers can maintain their current level of activity as long as no warning signs are experienced.” For any pregnant dancer, or a teacher who receives a request for information, this is a good source for understanding what body adjustments to expect and how to continue to dance safely.

Wilson M, Ryu JH, Kwon YH. Contributions of the pelvis to gesture leg range of motion in a complex ballet movement. *J Dance Med Sci.* 2007;11(4):118-23.

How do dancers accomplish the specific aesthetic elements and the correct mechanics of a grand rond de jambe en l’air en dehors? The focus of this study examines the complex interaction of the gesture leg, the supporting leg, and, specifically, the role that pelvic movement plays. In an earlier study Wilson and colleagues demonstrated that skilled ballet dancers show more pelvic motion than unskilled dancers when performing this movement. In this 3-dimensional motion analysis study of the hip joint they wanted to see how hip motion changed as height of the gesture leg increased from 90 to 105 degrees and then to the dancers’ maximal active range of motion. They looked at hip motions going forward (flexion), backward (extension), to the side (abduction), and turned out (external rotation). They measured pelvic motion as it dropped to the front (anterior tilt), to the back (posterior tilt), and to the side (lateral tilt).

The authors found that pelvic motion is integrally tied to leg motion and height. Grand rond de jambe at 90° or more is, in fact, a combined motion that includes contributions from the hip and pelvis. When the leg is raised to the front, backward (posterior) pelvic tilt contributes 4%-16% of leg height. Up to 60% of leg height in arabesque is generated from the pelvis tilting forward (anteriorly). Leg height to the side included a pelvic contribution of 45% to 60%. This exciting information may modify existing training techniques.