

The IADMS Bulletin for Dancers and Teachers

Volume 6, Number 1, 2015

Editor-in-Chief

Gayanne Grossman, P.T., Ed.M.

Introduction

Letter from the Editor

Gayanne Grossman, P.T., Ed.M.

Greetings from the Chair of the IADMS

Education Committee

Margaret Wilson, Ph.D.

Articles

**Functional Criteria for Assessing Pointe
Readiness**

Megan Richardson, M.S., A.T.C., Marijeanne
Liederbach, Ph.D., P.T., and Emily Sandow,
P.T., D.P.T.

Timing Matters! Ballet Training in Soft Blocks

Alison F. Whitaker, M.Sc., B.Sc.(Hons)

**Insights into the Position of the Ankle and Foot in
Female Ballet Dancers En Pointe**

Jeffrey A. Russell, Ph.D., A.T.

Departments

Abstracts from the Current Literature

Marliese Kimmerle, Ph.D.

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Copy Editor

Jane Baas, M.F.A., M.A.

Introduction

- 3 Letter from the Editor**
Gayanne Grossman, P.T., Ed.M.
 - 4 Greetings from the Chair of the IADMS Education Committee**
Margaret Wilson, Ph.D.
-

Articles

- 6 Functional Criteria for Assessing Pointe Readiness**
Megan Richardson, M.S., A.T.C., Marijeanne Liederbach, Ph.D., P.T., and Emily Sandow, P.T., D.P.T.
 - 8 Timing Matters! Ballet Training in Soft Blocks**
Alison F. Whitaker, M.Sc., B.Sc.(Hons)
 - 10 Insights into the Position of the Ankle and Foot in Female Ballet Dancers En Pointe**
Jeffrey A. Russell, Ph.D., A.T.
-

Departments

- 13 Abstracts from the Current Literature** — *edited by Marliese Kimmerle, Ph.D.*



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Letter from the Editor

Dear Dancers and Teachers,

The *IADMS Bulletin for Dancers and Teachers* is about to begin its fifth year of publication. We extend a big and grateful thank you to you, our readers. IADMS is very pleased that you continue to download our bulletin and hope it is helpful for employing scientific principles to enhance or validate your approach to teaching and dancing. We value your opinions. Please write to Bulletin@iadms.org if you have any comments or wish the Bulletin team to address any specific questions or topics.

The Bulletin team, the Education Committee, and the IADMS Board of Directors and Staff appreciate Ken Endelman and Balanced Body for ongoing support of the *IADMS Bulletin for Dancers and Teachers*.

We are very pleased to offer articles in this issue of the *Bulletin* that focus on the foot. Included are articles on criteria for assessing pointe readiness, ballet training in soft blocks, and addressing the alignment of the foot en pointe using MRI. Combined, these articles will help you

understand what the foot is doing anatomically and how to train for improved function while dancing en pointe.

The abstract review portion was compiled and written by Marliese Kimmerle, Ph.D. It includes summaries on the cardio-respiratory profile of professional ballet dancers, with a related summary on oxygen consumption and heart rate during various ballet exercises. There is an article on postural control, and another with exciting new information on closed-eye balance training.

The 2015 IADMS “A Day for Teachers” will be in held in Pittsburgh, Pennsylvania, USA on Thursday, October 8, 2015. Please join us! If you are interested in more IADMS programming, we are holding a Regional Meeting for dancers and teachers at DeSales University in Center Valley, Pennsylvania on April 26, 2015. DeSales University is located one hour from Philadelphia, Pennsylvania and one and a half hours from New York City, New York by car. Look for detailed information soon!

Editor:
Gayanne Grossman, P.T., Ed.M.

Greetings from the Chair of the IADMS Education Committee

The IADMS Education Committee is comprised of individuals who research, mentor, study and teach dance all around the world. From New Zealand to Hong Kong, Canada, the UK, and US, this committee is one of the most active in the IADMS organization. As the chair of this ambitious committee, I have the honor of relating the good work that the individuals on this committee have undertaken, efforts designed to enhance teaching and an understanding of dance science at all levels. We accomplish this in many ways from “A Day for Teachers” during the Annual IADMS Meeting, to resource papers and posters, to the Dance Educator Network, and the *Bulletin* for Dancers and Teachers. Currently all of these resources can be accessed on the IADMS website, and our goal is to reach teachers and students both inside and outside of the IADMS organization.

Our most recent “Day for Teachers” took place during the Basel, Switzerland IADMS Annual Meeting. With presentations ranging from “Motivation” to “Alignment” to “Nutrition,” participants gained new insights during the lecture and the interactive discussions. One comment was clearly voiced during this session – teachers want more workshops! We are currently planning a workshop to be held in Vancouver, Canada in March and at DeSales University near Allentown, Pennsylvania in April. Other workshops are in the planning stages, but if you would like to request a workshop in your area, please contact us at

education@iadms.org. And please consider attending the 25th IADMS Annual Meeting in Pittsburgh, Pennsylvania October 8-11, 2015 with “A Day for Teachers” on Thursday, October 8.

Two new papers are on the IADMS Resource Paper tab of the IADMS website: “Perfectionism,” written by Sanna Nordin Bates, and “Technique Options for the Injured Dancer” by Kitty Daniels. Please look at the IADMS Website under Resources for Teachers to find these and many other valuable resources.

The Dance Education Network continues to grow, and this committee publishes four newsletters per year. If you are not a member of this network, please send an email to education@iadms.org, so you can start receiving the newsletter and other information on IADMS initiatives. Finally, look for IADMS on Facebook and in a new blog. As you can see, the Education Committee is committed to outreach and education. Please enjoy the *Bulletin* for Dancers and Teachers, and please share this information – as well as information about IADMS with your colleagues and students.

Regards,
Margaret Wilson, Ph.D.
Education Committee Chair
IADMS Board of Directors

DANCE MEDICINE & SCIENCE POSTERS FOR SALE



The posters draw from research and knowledge outlined in the IADMS Resource Papers (available online) and are aimed at teachers, students, and health care specialists.

Series 1 topics are Pointe Readiness, Proprioception, and Adolescent Growth Spurt.

Series 2 topics are First Aid, Somatics, and Fueling the Dancer.

Series 3 topics are Turnout for Dancers: Hip Anatomy, Turnout For Dancers: Supplemental Training, and Dance Fitness.

Series 4 topics are Motor Learning, Bone Health & Female Dancers, and Stretching For Dancers

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Functional Criteria for Assessing Pointe Readiness

Megan Richardson, M.S., A.T.C.; Marijeanne Liederbach, Ph.D., P.T.; Emily Sandow, P.T., D.P.T., Harkness Center for Dance Injuries, New York University Hospital for Joint Diseases, New York, New York, USA

“**W**hen should a dancer begin training en pointe?” is frequently asked of ballet instructors and dance medicine professionals. Three factors have been traditional criteria for pointe readiness: chronological age, years of dance training, and ankle plantar flexion range of motion. We propose that lower extremity strength, neuromuscular control, and skill acquisition are additional factors that are also important to consider.

Pointe work traditionally begins just prior to or during the onset of the adolescent growth spurt at approximately 9 to 15 years of age. Ballet dancers typically mature at the later end of this age spectrum; therefore, chronological age alone seems an unreliable method for determining skeletal maturation, not to mention the physical and cognitive skills needed for pointe work. Nevertheless, in a survey of dance institutions across the United States, 96% of respondents cited age as the primary prerequisite for pointe training, with 39% citing age 12.¹

During maturation, growth and bone turn over are at their peak, and significant adaptations in strength, flexibility, and proprioception occur, influencing both motor control and psychological state.² Importantly, due to rapid growth changes, there is a decrease in motor ability and dynamic balance during adolescence, and as a result, dancers are unable to rely on formerly learned motor patterns.³ Instead, a period of reacquisition of skills, both cognitive and physical, occurs due to these growth-related changes.

The purpose of the present study was to determine if objective functional tests that assessed muscular strength, neuromuscular control, and dance skill could aid in determining a student's readiness for pointe training. Additionally, the students' dance teachers, who were blinded to the test outcomes, were asked to subjectively grade each student according to their perception of the student's technical skill and readiness to dance en pointe.

Three tests, which measure trunk control and dynamic lower extremity alignment, were found to be significantly predictive of dance teacher classification for pointe readi-

ness: Topples test, Airplane test, and Single-leg Sauté test. These tests assess the dancer's ability to maintain neutral alignment and center of mass over the base of support while doing complex movement. Although single screening tests are never foolproof determinants of success or risk, they may provide general benchmarks in determining a dancer's readiness to participate in pointe training.

Test Descriptions

Topples Test⁴

The modified Topples test was a single pirouette en de hors from 4th position with the gesture leg in full retiré and the support leg fully extended while maintaining a vertical trunk and demonstrating a controlled decelerated landing. The Topples test was closely associated with the teachers' assessments of pointe-readiness, a finding that supports the prior work of Lopez-Ortiz⁴ who found skilled dancers possessed a greater ability than their lesser skilled counterparts to control the “toppling effect” of a turn by exhibiting greater acceleration, less head movement and body sway, and longer landing phases.

Airplane Test⁵

The Airplane test requires the trunk to be pitched forward and the non-support leg extended to the back keeping the pelvis square to the ground (Figure 1). The subject performs five controlled pliés while horizontally bringing the arms together in order to touch the fingertips to the ground. Pass criteria were defined as at least 4 out of 5 pliés maintaining neutral lower extremity alignment which includes: knee tracking over the center of foot; maintaining a level pelvis with the foot, back and head in one line; and no foot pronation.

The Airplane test was the most sensitive for distinguishing between dancers identified by teachers as ready or not ready for pointe work. The Airplane test's horizontal positioning of the trunk and visual field demands significant control not only of the tri-planar motion during the plié but also of the long lever arm of the trunk and leg in the

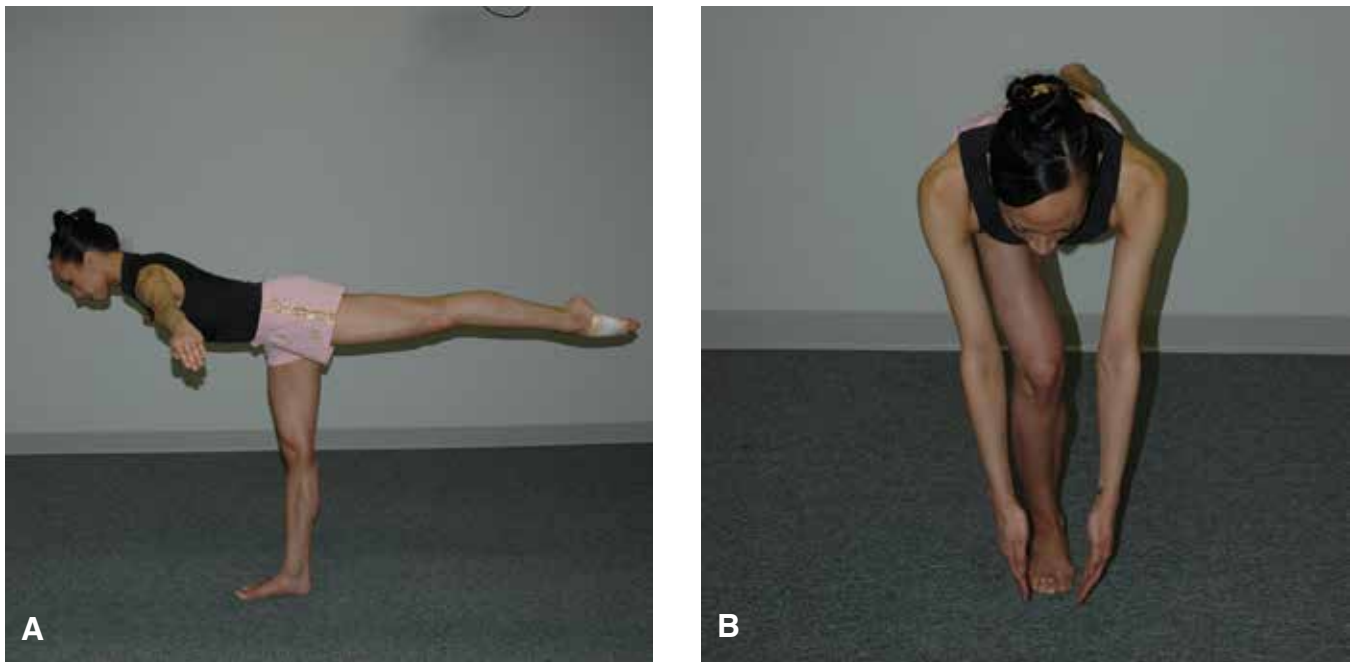


Figure 1 A, Airplane Test, starting position side view. B, Airplane Test, finishing position front view.

sagittal plane – a fundamental, dance-specific technique demand.

Single-leg Sauté Test

The Sauté test consists of 16 consecutive single-leg sauté jumps. The dancer was graded on the ability to maintain a neutral pelvic position, upright and stable trunk, neutral lower extremity alignment, toe-heel landing, and fully extended knee and pointed foot while in the air. Pass criterion was defined as at least 8 out of 16 properly executed jumps. The Sauté test proved to be the strongest predictor of pointe-readiness classification overall. While younger and less experienced dancers did not have the strength and control needed to perform the Airplane test, the more experienced dancers could complete more sautés while maintaining proper trunk control and lower extremity

alignment and were most often classified by teachers as ready to successfully perform pointe work.

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Timing Matters!

Ballet Training in Soft Blocks

Alison F. Whitaker, M.Sc., B.Sc.(Hons), London Metropolitan University, London, UK

A female adolescent dancer's body is often placed under varied physical demands in preparation for a professional career in ballet during her vocational training.¹ It is of great interest to those involved in her ballet training that improvements in her performance and skill are sustainable as the technical demands increase. In order to do so, the growing adolescent body requires gradual changes to physical achievement, training hours, or training focus in order to adapt effectively.² If this gradual approach is not adopted, fatigue will ensue resulting in poorer control of the dancing body, increasing risk of injury and impairing performance.³

A key milestone for all aspiring young female dancers is starting pointe work.¹ It is well known that pointe shoes place an increased demand on the joints of the feet.^{4,6} The body must be gradually prepared to control the foot during pointe work if it is to accept this demand and therefore allow the dancer to improve her technique en pointe.

The purpose of this study was to investigate how the different ballet shoes that young dancers use contribute to a gradually adaptive training environment as they prepare for and develop their pointe work. In order to obtain a fuller picture, the study was carried out in two parts: 1) measuring underfoot pressures of the different ballet shoes; and 2) collecting information on ballet shoe use, training, and injuries among female adolescent dancers in vocational training.

Part 1.

The objective in this instance was to measure underfoot pressures in three types of ballet shoe: split sole soft shoes (Sansha tutu split), soft blocks (Grishko 2007), and pointe shoes (Grishko 2007). Eight female dancers from an undergraduate dance degree program with experience in pointe work performed a trial consisting of a controlled, timed, demi-plié through to a rise on demi-pointe on a pressure mat. Pressures were recorded for each trial. Each trial was carried out in soft shoes, soft blocks, pointe shoes and in bare feet for comparison. Pointe shoes were fitted new a

week before the trials and were permitted to be broken in by the dancer so that she could find her demi-pointe in the pointe shoe. The data were then analysed for differences in pressure. Pressures recorded during the pointe shoe trials were significantly higher than those during the soft shoe trials. However, no significant differences in pressure were measured between soft blocks and soft shoes, nor soft blocks and pointe shoes, indicating overall that the soft blocks provide a transitional stage in pressure between soft shoes and pointe shoes. Progression can be observed from soft shoes to soft blocks to pointe shoes, the latter having significantly higher pressure values.

Part 2.

Sixty-five female dancers currently training at UK vocational schools of dance completed a questionnaire with details including their training, shoe use, and injury. All dancers were training en pointe, their main dance discipline was ballet, with an average age of 13.5 years plus or minus 1.5 years. Injury data were sorted so that only relevant injuries were considered in this study. These were any lumbar spine or lower limb musculoskeletal injuries that occurred or were first noticed during ballet practice (ballet injury), or any musculoskeletal injury located below the knee occurring during any dance-related activity (lower leg, ankle, and foot injury). Relationships were then explored between training frequency, pointe experience, current shoe use, shoe use before starting pointe, and relevant injuries sustained throughout training.

Young dancers train using one of three shoe progression scenarios:

1. Wearing soft shoes only before starting pointe work, then continuing to practice in soft shoes only when not in pointe shoes;
2. Wearing soft shoes, then soft blocks for a period prior to starting pointe work;
3. Wearing soft shoes only prior to the start of pointe work and then, having started pointe work thereafter train in soft blocks.

A dancer was found to be more likely to sustain a relevant injury if she had not worn soft blocks prior to starting pointe work (progressions 1 and 3). In contrast, dancers who wore soft blocks before starting pointe work were more likely to report their first relevant injury at an older age than those who did not wear them beforehand (progression 2). The reason for this may be that progression 2 allows for a more gradual adaptation to the demands of pointe work, specifically adapting to the pressures experienced when dancing in the different shoes.

Having started pointe work, injury rates were higher among dancers who currently wore soft blocks during class. Dancers who wore their soft shoes or a combination of soft shoes and soft blocks during class outside of their regular pointe work reported fewer relevant injuries.

In conclusion, this study supports the practice of wearing soft blocks in the months leading up to a young dancer starting pointe work so as to prepare the feet for the increased demands on her joints. This practice, combined with a suitable controlled strengthening and technical development exercise program,⁷ is considered optimal preparation for pointe work preparation.

Once a dancer is working in pointe shoes, an effective way of reducing underfoot pressures is to encourage her to wear a variety of shoes in her daily class, i.e. soft shoes and soft blocks. For practical purposes, soft shoes could be worn for some classes and soft blocks for others. This plays a role in promoting and sustaining musculoskeletal health in young dancers in their early years of training en pointe.

Acknowledgment

This article is adapted from: Pearson, SJ, Whitaker, AF. Footwear in classical ballet: a study of pressure distribution and related foot injury in the adolescent dancer. *J Dance Med Sci.* 2012;16(2):51-6.

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Insights into the Position of the Ankle and Foot in Female Ballet Dancers En Pointe

Jeffrey A. Russell, Ph.D., A.T., Ohio University, Athens, Ohio, USA

Ballet en pointe requires an extreme amount of motion in the ankle when a female dancer points her foot to stand in maximum plantar flexion. (Plantar flexion is the motion of pointing one's foot.) The anatomy of these regions and the demands of the pointe position must be clearly understood by those who work with dancers in this genre. Magnetic resonance imaging (MRI) and x-rays are two techniques that offer a look inside the body and help us understand the positioning of the structures in the foot and ankle. Using images from these tools to illustrate, this article presents an anatomical overview of the ankle and foot en pointe.

The ankle and foot comprise an incredibly important area as it marks the connection between a dancer's body and the floor. The ankle is a modified hinge joint that provides motion between the leg (and, therefore, the rest of the body) and the foot. The foot's structure, with its many bones intricately fitting together, provides a dynamic platform on which to support the body. The foot's adaptability to the floor or ground, regardless of whether or not it is encased in a shoe, is what starts the process of pushing off the floor, absorbing shock when landing from a jump, changing direction in turns, and providing a surface on which to spin, to name a few of the foot's functions important to dance. Knowing the demands that are placed on the structures of the ankle and foot is very important for the dancer and dance educator.

No ankle and foot position in dance is more extreme than that required to stand en pointe.¹ There are a number of crucial considerations about this position that dancers and dance teachers should understand. Just the ability to bear weight en pointe should be a marvel in itself because of what we know from research such as that done with MRI.^{2,3} The magnetic resonance images in Figure 1 give an overview of the ankle and foot in both typical standing and the en pointe positions. Note the relative positioning of the bones of the ankle and foot compared to the tibia (shin bone) in order to gain an appreciation for how remarkable it is that bal-

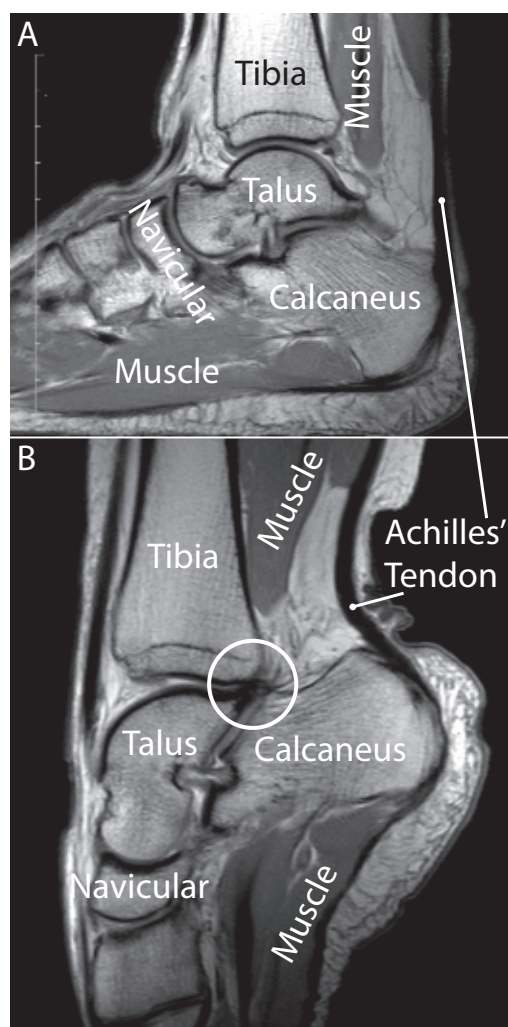


Figure 1 Magnetic resonance images of a ballet dancer in [A] a neutral standing position and [B] en pointe. Important anatomical structures are marked for an appreciation of how these structures are positioned when a dancer stands en pointe. Note the circled area in 'B' where the tibia (shin bone), talus (top bone in the foot), and calcaneus (heel bone) come together, thus forming a weightbearing situation that should be recognized in dancers.

let dancers can achieve this and succeed in their pointe choreography.

In a study designed to explore the ankle en pointe while dancers were standing in this position,³ several bony and soft tissue contours were noted across all or most of the participants. These included the convergence of the tibia, talus, and calcaneus (seen in the circled area of Figure 1B), a position of the bones that helps with stability of the ankle in the pointe position because the three bones are “locked,” i.e., firmly compressed together, when they contact one another.⁴⁻⁵

The anatomy of the foot and the positioning of its array of bones is important to the motion required to stand en pointe because the mobility of these bones helps provide movement that is not possible purely from the ankle joint. In order for that much pointing of the foot (plantar flexion) to occur, there also must be some motion of the foot bones. This was evaluated in ballet dancers using x-rays;⁶ the study suggested that more than 25% of the foot’s ability to point occurred between three pair of foot bones. Figure 2 shows this principle pictorially, with angle θ representing the motion that must come from somewhere other than the ankle joint. That is, to stand on full pointe the foot bones must move downward into more plantar flexion along with the ankle.

When dancers are en pointe, proper alignment in the sagittal plane is essential. This plane divides the body into right and left portions. There must be enough plantar flexion to situate the metatarsals of the foot (the five bones found in the middle part of the foot to which the toes are attached) underneath the shaft of the tibia (shin bone) for proper support. However, there should not be so much plantar flexion that “going over” occurs, a position that can over-lengthen the ligaments and tendons of the feet. Again looking at Figure 2, if the dancer did not have enough strength or muscular control to limit “going over,” one can easily imagine that the joints indicated by black arrowheads would open farther and thus create a position of the foot that is less stable because the muscles, tendons, and ligaments have to work extra hard to control it. Also, a pointe dancer’s technical ability is improved when the leg, ankle, and foot are lined up properly. Improving one’s ability to correctly hold the ankle and foot en pointe is why strengthening of both the extrinsic muscles (located in the leg with tendons extending into the foot and creating movement there) and intrinsic muscles (muscles and tendons located completely in the foot) is essential in pointe dancers.

Alignment in the frontal plane is also important in pointe dancing. This plane divides the body into front and back, or anterior and posterior portions. Faulty foot posture in this plane is often called sickling if the forefoot (the forward portion of the foot from approximately the instep, including the toes) is positioned inward, or medially, so the outer, or lateral, portion of the shoe’s platform is where the dancer bears most of the weight. Winging is the term used if the forefoot is directed toward the outside (laterally) and the majority of weight is borne on the inner, or medial,

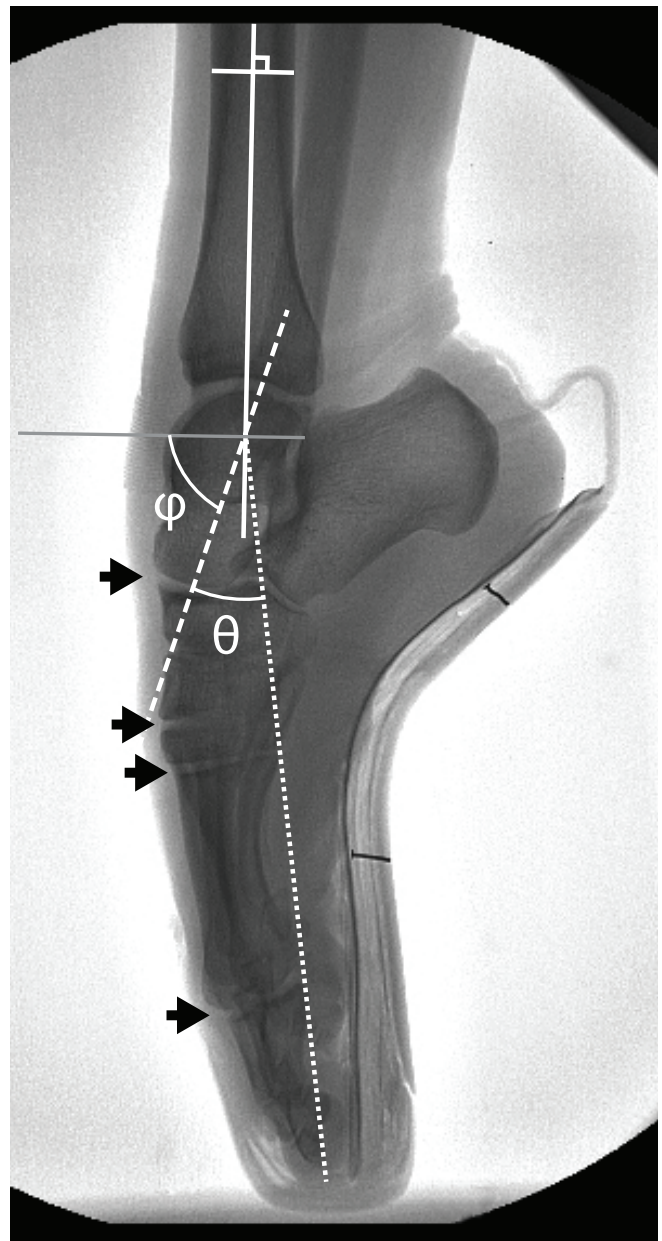


Figure 2 An x-ray of a dancer standing en pointe used to demonstrate that both ankle and foot motion are required to achieve this position. The solid line represents the shaft of the tibia (shin bone), and the gray line, perpendicular to it, is used as a line of reference. The dashed line is the long axis of the talus (bone at the top of the foot); thus, angle ϕ represents motion of the ankle joint. The dotted line is the amount of total plantar flexion (pointing the foot) that appears to occur. Angle θ , then, shows that motion occurs among the foot bones in addition to the motion based in the ankle joint. This comes from the joints marked by the black arrowheads. Note that this is a conceptual visualization in a single dancer, rather than an exact measurement of her plantar flexion.

edge of the platform. Once again, sufficient foot strength and proper technical training are necessary to counteract a dancer’s tendency toward one of these alignment issues.

A Special Note About Young Dancers

Observing the architecture of the bones comprising the ankle should especially inform the initial stages of en pointe training for young ballet dancers. Most notably, placing adolescent ankles and feet in this position should be done only after careful assessment of a dancer's readiness to assume its demands. Excellent resources are available to help ensure a healthy transition to pointe work.⁷⁻⁹ While a child's foray into the world of pointe comes with much anticipation and excitement, teachers and parents must become familiar with the principles of pointe readiness in order to allow young dancers to have an enjoyable, safe, and productive experience.

Chronological age alone is not a satisfactory criterion for advancing to pointe dancing.^{8,9} All in all, an effective process of a pointe teacher carefully guiding dancers through learning the skills and developing the strength necessary to dance en pointe is essential. Important factors to success in beginning pointe work are:

- Strong lower extremities (legs, ankles, and feet) to help develop the mechanical function needed to stand en pointe
- Sufficient, but not too much, flexibility and motion in the ankles and feet
- Strong "core" muscles (trunk and hips) to provide support to the body
- Good balance and alignment of the legs and torso
- Adequate preparatory ballet work (at least two sessions per week is suggested).⁹

Conclusions and Applications

In summary, dancing en pointe is a remarkable, beautiful part of ballet. This position places great demands on the ankle and foot as their joints plantar flex to move into the pointe position. Dancers and dance teachers should be familiar with the anatomy of the ankle and foot as it per-

tains to working en pointe so they can appreciate how good technique and the mechanics of anatomical function lead to success. This will also help them work together toward a positive experience for dancers. In addition, strengthening of the musculature of the foot, ankle, leg, thigh, hips, and trunk is important for ensuring that ballet dancers can participate en pointe effectively.

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Abstracts from the Current Literature

Marliese Kimmerle, Ph.D.

Bronner S, Ojofeitimi S, Lora JB, Southwick H, Kulak MC, Gamboa J, Rooney M, Gilman G, Gibbs R. A preseason cardiorespiratory profile of dancers in nine professional ballet and modern companies. J Dance Med Sci. 2014;18(2):74-85.

In recent years, there has been an increasing interest in evaluating the cardiovascular demands of dance performance in the different styles of dance, measuring the physiological capacities of dancers both in the lab and the studio as part of screening, and the development of supplementary and dance-appropriate fitness training to prepare the dancers for these demands. This study compared the cardiovascular fitness of professional modern and ballet dancers by measuring the difference in peak and recovery heart rate. They also looked at a number of company and work variables that could affect cardiorespiratory profiles. The demands of modern dance are quite different from ballet in terms of overall length of a typical piece of choreography, the amount of long continuous or high intensity short movements, and the amount of rest. Two hundred and eleven dancers from two modern and seven ballet companies were evaluated on a three minute step test as part of a more comprehensive post-hire health screen. This test was chosen as a convenient practical assessment of cardiorespiratory fitness given the time and space constraints of testing large numbers of professional dancers. The results showed that a higher percentage of modern dancers were “fit,” as demonstrated by lower blood pressure, lower resting heart rate and heart rate recovery. There were also differences in fitness levels between the different companies. The authors discuss a number of factors that may affect the cardiorespiratory fitness levels such as the repertory, rehearsal and performance seasons, size of the company and amount of actual time dancing, and individual off-season or cross training. Reviewing a number of studies that report technique classes are generally not physiologically challenging enough to prepare for performance, the authors support

the need for supplementary training and suggest that the step test is a simple tool to include in screening to identify dancers who could benefit from additional aerobic conditioning.

Rodrigues-Krause J, Cunha GDS, Alberton CL, Follmer B, Krause M, Reischak-Oliveira A. Oxygen consumption and heart rate responses to isolated ballet exercise sets. J Dance Med Sci. 2014;18(3):99-10.

In order to prescribe supplementary training for dancers, it is important to evaluate their individual cardiovascular capabilities as well as evaluate the demands of the dance movements they typically perform. Maximum heart rate and oxygen consumption were measured on twelve female ballet dancers during an incremental treadmill test. In order to determine the aerobic intensity at which ballet dancers work in class, the authors also evaluated their heart rate and oxygen consumption during isolated sets of ballet movements (pliés, tendus, jetés, rond de jamps, fondus, grand adagio, grand battements, temps levés and sautés). The sets consisted of repetition of one movement at the required speed, lasting approximately one to three minutes with rest periods in between. Results showed that workloads varied between low and moderate aerobic intensity, pliés and tendus being the lowest, and sautés, levés and grand battements being the highest. However these latter center-floor exercises that require higher oxygen consumption take up only a relatively small percentage of class time with long rest periods. The intermittent nature of class means that typically dancers do not reach the moderate to high aerobic intensities found in rehearsals and performances. Volume of training, intensity and rest periods however can be manipulated to increase cardiorespiratory demands both in class and in choreography. The authors suggest that isolated ballet sets adapted to the dancer’s role as corps de ballet or soloist could be supplementary to their normal routine to enhance their aerobic fitness.

Hopper DM, Grisbrook TL, Newnham RJ, Edwards DJ. The effects of vestibular stimulation and fatigue on postural control in classical ballet dancers. *J Dance Med Sci.* 2014;18(2):67-73.

Classical ballet demands excellent postural control in achieving, maintaining, and restoring balance. One of many challenges to balance in dance is acceleration, e.g. spinning movements such as pirouettes that challenge the vestibular system. Balance is controlled by visual and somatosensory systems, and previous research suggests that dance training shifts feedback use from the former to the latter. It has also been shown that fatigue alters postural control and balance. This study explored whether dance experience affects the ability to control static posture in response to vestibular stimulation and fatigue. Twenty-three classical ballet dancers, classified as professional, pre-professional, and recreational dancers had their baseline static balance assessed using measures of postural sway while standing on one leg on a force platform. They then performed the vestibular stimulation task, five continuous pirouettes, and were reassessed in the one leg static stance. They then performed the fatigue-inducing task, 30 seconds of unilateral ballet jumps (*temps levés*) and retested on the force platform. An interesting result was that there were no differences between the groups in baseline static balance. However, the professional dancers had significantly smaller sway than the other two groups following the turning task; that is, they adapted better to the vestibular stimulation. The authors attribute this to their hours of task-specific motor training and their spotting ability. There was no significant effect of the fatigue task in any group but there was a different pattern of recovery. While the amount of sway was similar at the 60-second recovery measure, the pre-professionals and recreational dancers had significantly greater sway immediately and at 30 seconds of recovery. The explanation given for both results suggests that the professional dancers developed adaptive strategies to cope with both vestibular and fatigue challenges due to more extensive hours of dance specific training. They suggest that training for amateur dancers should include more vestibular-stimulating and fatigue-inducing tasks to help to develop balance recovery abilities.

Hutt K, Redding E. The effect of an eyes-closed dance-specific training program on dynamic balance in elite pre-professional ballet dancers: a randomized controlled pilot study. *J Dance Med Sci.* 2014;18(1):3-11.

This study explores visual and proprioceptive control of balance in a dynamic balance task. The background for this study is that in brightly lit ballet studios filled with mirrors, dancers receive a lot of visual feedback to guide their movements, while during performance on stage under unpredictable lighting, that feedback is not available. The dancer has to rely much more on proprioceptive feedback to adapt to the many balance challenges in a piece of choreography. This raises the question of whether specific training can bring about a shift from the use of visual to proprioceptive feedback. That is the focus of this intervention study where vision was removed during the learning of dance sequences. Five variations of the Star Excursion Balance Test (SEBT) were used as a pre and post indirect measure of dynamic balance. This required the dancer to stand on one leg, while the gesturing leg reached in eight directions on the floor or in the air. Distance reached and time to complete the pattern were measured. Nineteen female pre-professional ballet dancers were divided into a control and an experimental group for a training intervention. An important component was that the “training” was incorporated into the dancers’ daily ballet classes. The researcher and ballet teacher together developed dance specific sequences at center that progressed over the four week training period from stationary to travelling and turning sequences, double leg to single leg stance exercises, and working with the leg on the ground or in the air. The control group practiced these sequences normally while the experimental group practiced them with eyes closed. Both groups made some improvements in distance and time, but the eyes-closed group made greater improvements, and these were significantly better than their pre-test scores in four of the five tasks. The authors suggest that eyes-closed training can improve dynamic balance abilities, and that this training can stimulate a shift from visual to proprioceptive dependence for balance control. Further research may encourage dance educators to consider incorporating eyes-closed training into their dance classes.