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Assessing Readiness for En Pointe in Young Ballet Dancers

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Abstract

Children begin ballet lessons as young as age 2 years. The graceful movements of classical ballet require a combination of artistry, flexibility, and strength to perform. During the training and development of a young ballerina, the transition to dancing *en pointe* ("on the toes") represents a significant milestone and traditionally begins around age 11 or 12 years, assuming the proper training background and dance aspirations. However, current dance medicine literature describes factors such as maturity, proper technique, strength, and postural control as the more significant factors in determining pointe readiness. An in-office evaluation of these factors can be performed by the clinician to assist dancers, their family, and their dance instructor(s) determine pointe readiness. **[*Pediatr Ann.* 2016;45(1):e21–e25.]**

You are requested to provide clearance for a very excited 9-year-old girl who has been a ballet dancer for 3 years and has just been told by her instructor that she will begin dancing "*en pointe*" ("on the toes") in the next several weeks. The mother has brought her daughter to your office for a consultation because she has heard that starting *en pointe* too early can lead to injuries, and the instructor has asked for your evaluation, including X-rays, to clear her for starting pointe work. Do X-rays play a part in the evaluation of the readiness of this dancer for starting pointe? Are there other examination room tools and movements that might aid in the evaluation? When is it reasonable for someone to start pointe work?

Introduction

Ballet, with its rich and graceful history as a performing art, remains a popular activity for children in the United States. The number of young dancers is estimated to be more than those participating in Little League baseball or Pop Warner Football,[1] and the number of dance studios and schools listed in the country has grown to over 30,000.[2] Audiences and performers alike are drawn to the poise and athleticism of a ballerina floating across the stage, seeming to defy gravity with each step, in a "lifted" or *relevé* position.

For beginning dancers, *relevé* involves stepping on the balls of the feet, a move known as demi-pointe (**Figure 1**). As the dancer matures in skill, strength, and control, *relevé* can be done standing on the tips of the toes, known as dancing *en pointe* (**Figure 2**). For young dancers, their parents, and their dance instructor(s), the transition to dancing *en pointe* represents a significant achievement in the path toward becoming a professional or elite ballerina.

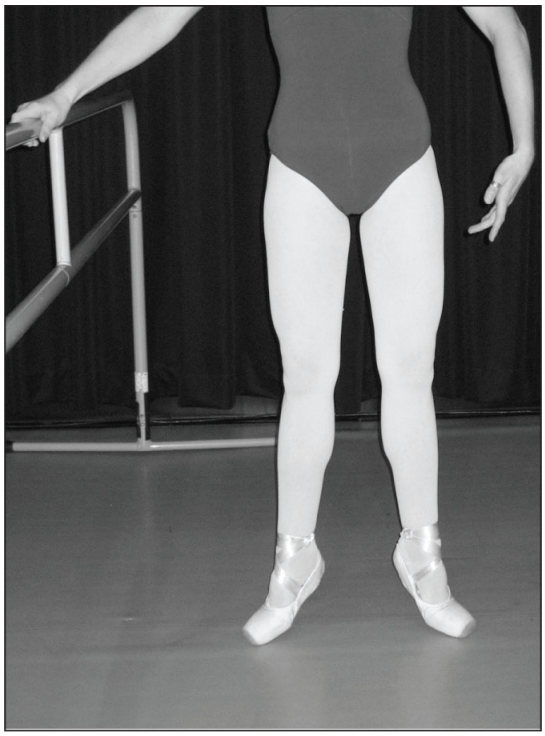

Figure 1.
Dancer demonstrating demi-pointe. Courtesy of Jeffrey A. Russell, PhD, AT, Assistant Professor of Athletic Training, and Director, Science and Health in Artistic Performance (SHAPe), Ohio University.

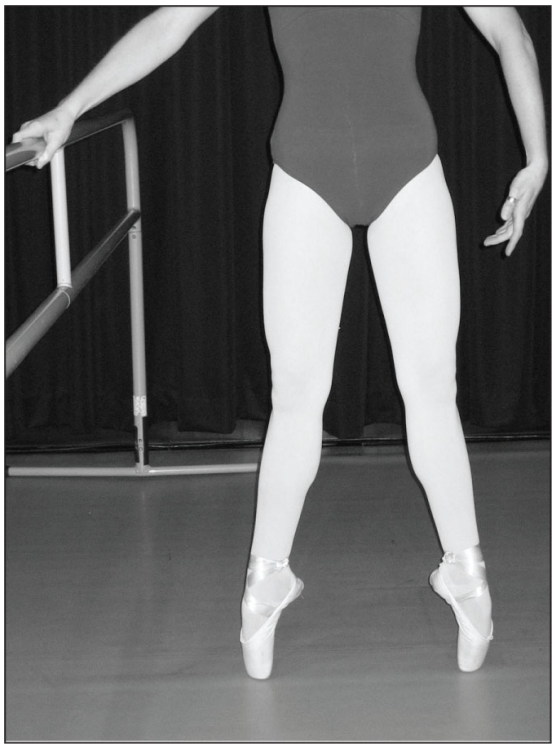

Figure 2.
Dancer demonstrating pointe. Courtesy of Jeffrey A. Russell, PhD, AT, Assistant Professor of Athletic Training, and Director, Science and Health in Artistic Performance (SHAPe), Ohio University.

Dancing *en pointe* requires a combination of ankle flexibility, lower extremity strength, core strength, and proper technique. At the professional level, the injury rate can be high, with Allen et al.[3] recording a mean of 6.8 injuries per dancer during a 1-year prospective study period. Based on numerous studies, the lower extremities represent the region injured most often among professional dancers.[4] Among nonprofessional dancers age 8 to 16 years, Steinberg et al.[5] reported that the back and lower extremity were the most frequently injured regions. To our knowledge, there are no studies that suggest a higher rate of injury after transitioning to dancing *en pointe*; however, as with any endeavor that involves promotion to a more challenging stage, the premature advancement can be associated with physical, psychosocial, and financial setbacks.

Children are enrolled in dance lessons as early as age 2 years. In the beginning stages, the learned rhythms and movements can come from a variety of dance genres, including jazz, tap, modern, as well as ballet. Classical ballet distinguishes itself with formalized movements that have remained largely intact since its origins in Italy during the 15th century. Mastery of the five fundamental positions of the feet involve a distinctive movement called turnout (**Figure 3**), where the hips and lower legs are externally rotated so that the feet are placed ideally at a 180-degree angle with each other. To achieve these positions in *relevé*, the young ballerina starts in demi-pointe position, where all of the body weight is placed on the metatarsal heads. After years of dedicated practice, and

when the ballerina is ready to advance, *relevé* is performed *en pointe*, with all of the body weight on the tips of the toes. The successful promotion to dancing *en pointe* is a precursor for any young dancer who wishes to continue to the elite or professional level.

Figure 3.
Dancer demonstrating turnout. Courtesy of Jeffrey A. Russell, PhD, AT, Assistant Professor of Athletic Training, and Director, Science and Health in Artistic Performance (SHAPe), Ohio University.

The renowned 20th century choreographer and founder of the School of American Ballet, George Balanchine, stated that it took 4 or more years of serious training before pointe work could be initiated. As serious training typically begins at age 7 or 8 years, the prevailing tradition is to start pointe work around age 11 or 12 years. However, without any formalized criteria to assess a safe promotion to pointe readiness, the consensus opinion is that numerous factors, including age, technique, flexibility, strength, training, and career aspirations, should be used.[1,6]

Biomechanical Challenges of Ballet

Classical ballet requires a combination of strength and flexibility, especially in the lower extremities. Dancing *en pointe* shoes is known to increase the force transmitted through the foot by 12 times body weight, as opposed to 4 times body weight, when wearing ballet slippers.[1] To dance in *relevé*, the ankle complex is plantarflexed to a minimum of 90 degrees so that the metatarsal shafts are aligned vertically with the tibia, best seen in a lateral view (**Figure 4**). Pointe work further requires plantarflexion of the great toe so that the thigh, lower leg, foot, and toes all align gracefully for proper aesthetics. One study of professional ballerinas reported a mean ankle plantarflexion of 113 degrees,[7] which is more than twice the standard range of motion of 50 degrees for nondancers.[8]

Figure 4.
X-ray showing bone alignment during pointe. Courtesy of Jeffrey A. Russell, PhD, AT, Assistant Professor of Athletic Training, and Director, Science and Health in Artistic Performance (SHAPe), Ohio University.

Dancers achieve this level of flexibility and strength with the help of specialized pointe shoes, the design of which has not changed significantly over the centuries. The shoes are primarily comprised of soft satin around the foot and a hard toe box that encases and supports the toes. Further support is provided by the insole, outer sole, and shank, which can have varying stiffness and support the arch of the foot. The vamp is the upper portion of the toe box, and can be lengthened or widened to accommodate toes of different sizes. The shoe is held to the foot by a satin ribbon that wraps around the ankles. For the most part, all components of the shoe except the toe box are considered flexible and therefore offer minimal to moderate support.

Even with the support of pointe shoes, the repetitive loading and unloading of the foot and ankle from practices and performances contribute to a number of lower extremity injuries. In particular, weight bearing in ankle plantarflexion brings together three bony structures: the posterior edge of the distal tibia, the posterior aspect of the talus, and the superior surface of the calcaneus.[9] As a result, posterior ankle impingement syndrome occurs when soft tissue or bony structures are pinched between these converging bones. Lateral ankle sprains, common among the general athletic population, are just as prevalent in ballerinas who dance *en pointe*. Ritter and Moore[10] describe the development of chronic ankle instability in ballerinas and the subsequent development of fibularis tendinosis as the muscles act to stabilize the ankle statically in inversion.

Other common overuse tendinopathies in dancers include Achilles tendinosis and flexor hallucis longus tendinosis, also known as dancer's tendinosis. Standing in *relevé* or *en pointe* causes weight-bearing stress to the posterior talus and tibial surfaces, which are not mechanically prepared for repetitive weight bearing. Bony lesions in the posterior talus and posterior tibia, such as osteochondral defects, can occur (**Figure 5**). In the midfoot, complex sprains or fracture dislocations of the Lisfranc ligaments that connect the metatarsal bases to the cuneiform and cuboid bones are often seen in dancers. Toward the forefoot, hallux valgus and hallux rigidis are two common injuries. Plantar fasciopathy is frequent, and stress fractures to the tarsal navicular bone and the metatarsals are also common concerns.[11]

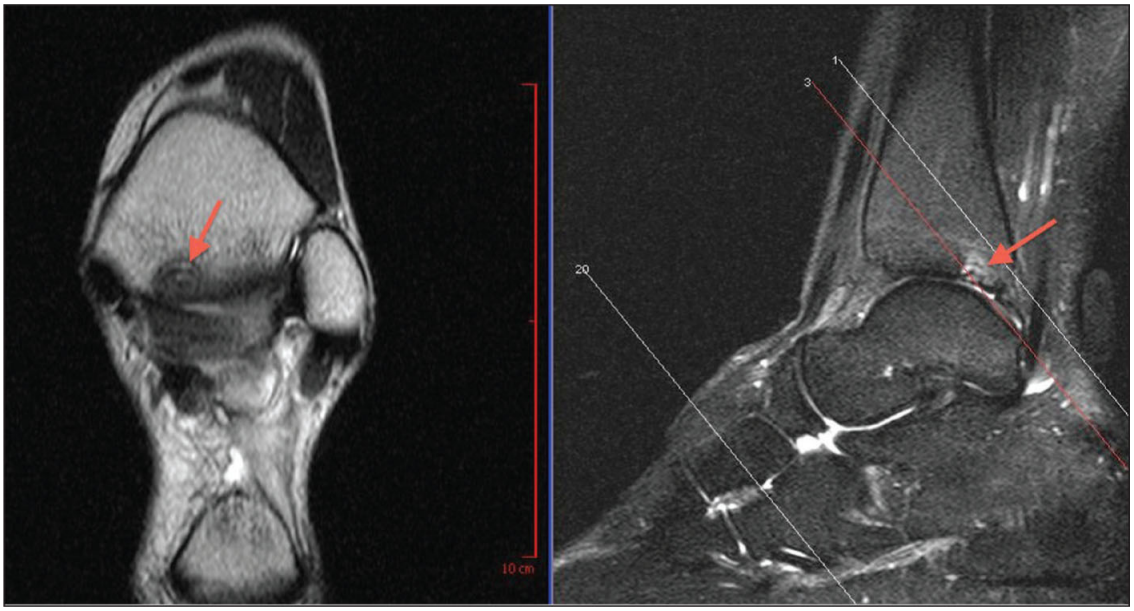

Figure 5.
Magnetic resonance image of posterior tibial osteochondral defect.

Evaluation of Pointe Readiness

As with any medical evaluation, a proper history and physical examination are the first steps in assessing readiness for dancing *en pointe*. Age, years of dance training, and hours per week of training are important details to collect during the history, as are the ballerina's dance aspirations. Prior injuries, especially to the lumbar spine, hips, knees, feet, and ankles, should be recorded. The physical examination focuses on anatomy and flexibility, whereas functional assessments of technique, strength, and postural control (discussed below) also help determine pointe readiness.[6,12]

Age

Traditionally in the United States, pointe training begins at age 11 or 12 years, but this is a topic of debate. In South America, some children begin dancing *en pointe* as young as age 5 or 6 years.[11] The data suggest that age alone is not a reliable indicator of pointe readiness, and that factors such as dance experience and physical strength play a more pivotal role in the transition to pointe.[1]

The primary concern with age involves assumptions about skeletal maturity and the effect that the repeated stress of being *en pointe* can place on the growth plates of the feet. Cartilaginous physeal plates are a region of low strength relative to the surrounding bone and are susceptible to fracture.[13] A dreaded sequelae of physeal injury is growth plate arrest, which can be seen in the sport of gymnastics, where repeated upper extremity weight bearing on an open distal radius growth plate results in radial shortening.[14] However, a similar injury pattern has not been reported in ballet, and there are no reports in the literature of growth plate arrest from dancing *en pointe* while growth plates are open.

Furthermore, complete ossification of the growth plates in the phalanges and the first metatarsal does not occur until approximately age 18 years, and withholding a ballerina from progressing to pointe until then would prevent her from serious consideration as a professional dancer. Thus, radiographs requested to assess the status of growth plates do not contribute to the decision-making algorithm for transitioning to pointe, so they should not be routinely ordered.

Technique

Proper turnout is important in classical ballet, and it involves external rotation of the hips and lower extremities so that the feet point outward, ideally at a 180-degree angle with each other. Ideally, the hips contribute 60% of the movement and the feet contribute the remaining 40%.[1] However, dancers can cheat to achieve the desired turnout by overpronating the feet, increasing lumbar lordosis, or using excess external tibial torsion. Assessment of pointe readiness should include an evaluation of turnout in 1st, 2nd, and 5th position to discover any such compensatory malalignments, and correction of these technical errors should take place before transition to pointe work.

Flexibility

Dancing *en pointe* requires complete plantarflexion of the foot-ankle complex to a minimum of 90 degrees. Plantarflexion occurs from the combined motion of the talocrural, subtalar, midtarsal, and metatarsophalangeal joints, with 70% of the flexibility coming from the talocrural joint.[7] In full

pointe, static stability is provided by a locked subtalar joint, as the posterior lip of the distal tibia rests on the superior calcaneus. In the partial pointe position, the subtalar joint is not locked, and may contribute to increased injury such as inversion ankle sprains. Evaluation of ankle flexibility should be measured with a goniometer in a non–weight-bearing position, using the medial malleolus, fibula, and first metatarsal as landmarks (**Figure 6**).

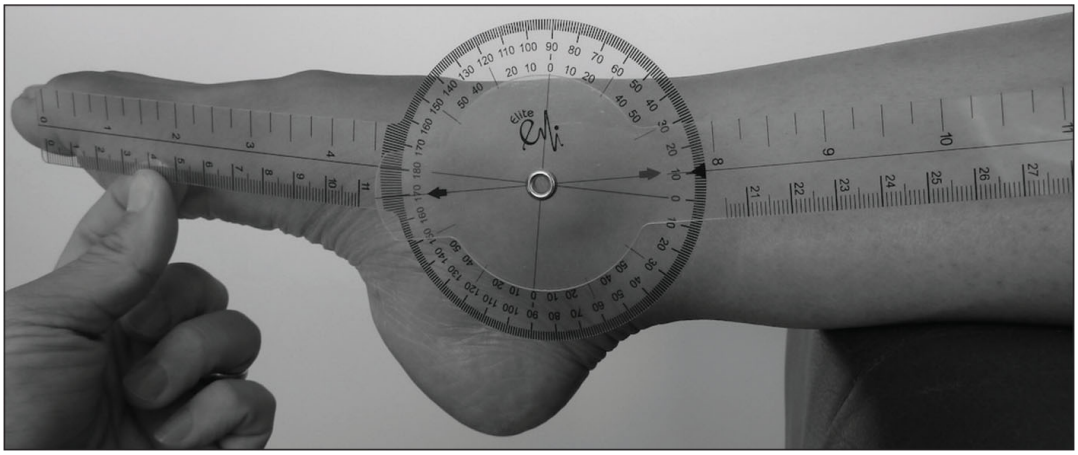

Figure 6. Measurement of ankle plantarflexion using a goniometer. Courtesy of Jeffrey C. Lai.

Anatomy

Forefoot type can affect a dancer's ability to transition to pointe.[1] The “Giselle” or “peasants” foot, where the first three toes are the same length, is the ballerina's ideal forefoot type, because the weight is distributed evenly throughout the toes. The “Grecian” foot and the tapered foot unduly transmit forces across the longer second and first toes, respectively. However, there are no specific requirements for a particular foot type.

Similarly, midfoot arch type can influence the ease at which a dancer can transition. The flat foot is the most challenging type because it hinders the dancer's ability to achieve full ankle plantarflexion, which is a requirement for safely dancing *en pointe*. The cavus foot and its associated high arch is thought to look attractive *en pointe*, but is functionally rigid and stiff, which may affect its shock-absorbing capabilities.[1]

Strength, Proprioception, and Postural Control

Several functional capacity screening tests can be used to assess strength, alignment, proprioception, and postural control in the young ballerina. Richardson et al.[6] identified three tests that were significantly predictive of pointe readiness, as determined by an experienced dance teacher.

The “Airplane” test starts with the dancer standing on one leg, with the trunk pitched forward, arms abducted horizontally, and the non-support leg extended to the back (**Figure 7** and **Figure 8**). The dancer then performs 5 plies (bends) while adducting the arms so that the fingertips touch the ground. A pass is defined as 4 of 5 plies maintaining neutral lower extremity alignment. Inability to pass the “Airplane” test was associated with being deemed not ready for pointe.

Figure 7.
Dancer demonstrating the starting position of the “Airplane” test. Courtesy of Jeffrey C. Lai and Connie Lai (pictured).

Figure 8.
Dancer demonstrating the plié position of the “Airplane” test. Courtesy of Jeffrey C. Lai and Connie Lai (pictured).

The “Saute” test is the strongest positive predictor of pointe readiness. To perform this test, the dancer performs 16 consecutive single-leg Saute jumps. A pass is defined as 8 of 16 properly executed jumps, in which the dancer keeps the pelvis neutral, the trunk upright, the knees extended, and the toes pointed while in the air.

The “Topple” test is also strongly correlated with pointe readiness. The dancer performs a single pirouette with the gesture leg in passe (bent upwards) and the support leg fully extended, while maintaining an upright trunk and demonstrating a controlled, decelerated landing.

Training

There is variability among ballet teachers and schools regarding the prerequisite amount of training needed to transition to pointe work. The typical dance school offers several levels of classes, ranging from once per week to daily. Auditions are required to advance from one level to the next. Accordingly, the young dancer can be assessed for pointe readiness based on her technical ability and not on a certain number of years of training.

Recommendations and Summary

When evaluating a dancer for pointe readiness, it is most important to consider each case individually. There are no absolutes in the clearance of a dancer to participate *en pointe*. It is true that premature participation *en pointe*, when a dancer is truly not ready, can lead to injury, pain, and a premature retirement from ballet. However, if the dancer is appropriately screened and prepared, their transition to pointe can be a successful experience. It is true that recommendations including age limits do exist. However, if the dancer demonstrates appropriate technique, anatomy, stability, and has completed pre-pointe ballet training, a transition to pointe at a younger age can be appropriate. Performing an X-ray as a general screen is no longer recommended for determining pointe readiness. Certainly, if there are any concerning findings during the pointe screening, such as injury history or abnormal examination findings, an X-ray could be clinically warranted at that time. Similar to the management of other medical conditions, when a practitioner is considering a dancer for pointe participation, they should use all of the available tools discussed at the beginning of this article to perform a thorough evaluation.

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Authors

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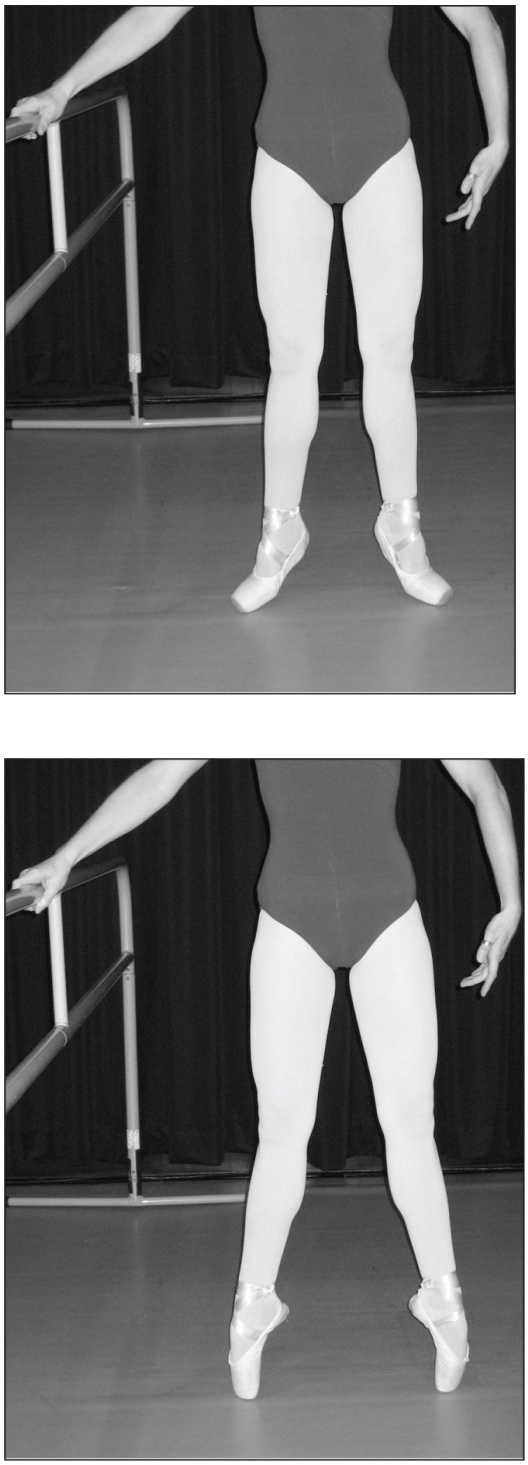

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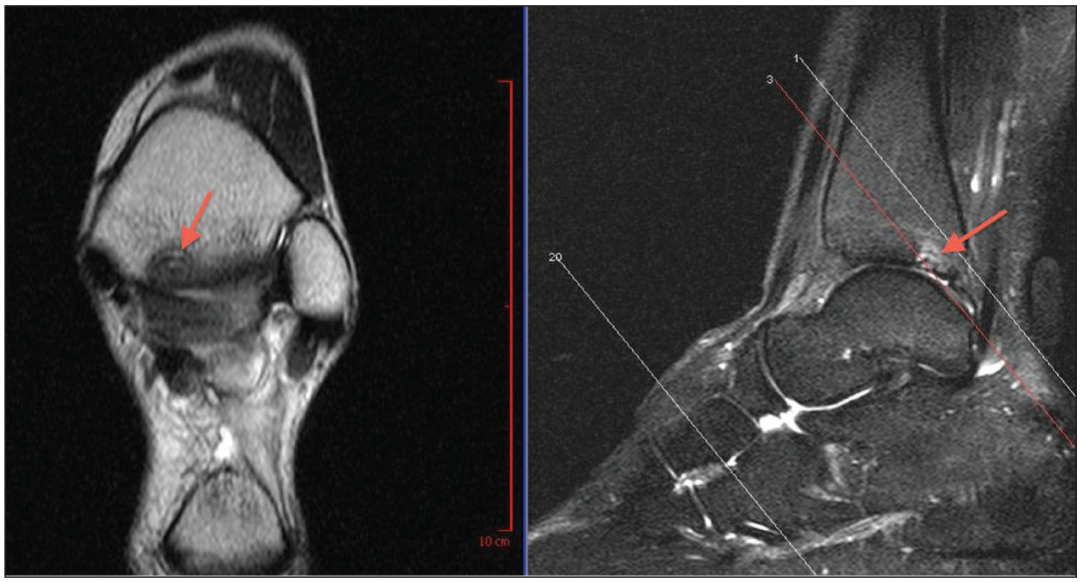

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The primary concern with age involves assumptions about skeletal maturity and the effect that the repeated stress of being *en pointe* can place on the growth plates of the feet. Cartilaginous physeal plates are a region of low strength relative to the surrounding bone and are susceptible to fracture.[13] A dreaded sequelae of physeal injury is growth plate arrest, which can be seen in the sport of gymnastics, where repeated upper extremity weight bearing on an open distal

radius growth plate results in radial shortening.[14] However, a similar injury pattern has not been reported in ballet, and there are no reports in the literature of growth plate arrest from dancing *en pointe* while growth plates are open.

Furthermore, complete ossification of the growth plates in the phalanges and the first metatarsal does not occur until approximately age 18 years, and withholding a ballerina from progressing to pointe until then would prevent her from serious consideration as a professional dancer. Thus, radiographs requested to assess the status of growth plates do not contribute to the decision-making algorithm for transitioning to pointe, so they should not be routinely ordered.

Technique

Proper turnout is important in classical ballet, and it involves external rotation of the hips and lower extremities so that the feet point outward, ideally at a 180-degree angle with each other. Ideally, the hips contribute 60% of the movement and the feet contribute the remaining 40%.[1] However, dancers can cheat to achieve the desired turnout by overpronating the feet, increasing lumbar lordosis, or using excess external tibial torsion. Assessment of pointe readiness should include an evaluation of turnout in 1st, 2nd, and 5th position to discover any such compensatory malalignments, and correction of these technical errors should take place before transition to pointe work.

Flexibility

Dancing *en pointe* requires complete plantarflexion of the foot-ankle complex to a minimum of 90 degrees. Plantarflexion occurs from the combined motion of the talocrural, subtalar, midtarsal, and metatarsophalangeal joints, with 70% of the flexibility coming from the talocrural joint.[7] In full pointe, static stability is provided by a locked subtalar joint, as the posterior lip of the distal tibia rests on the superior calcaneus. In the partial pointe position, the subtalar joint is not locked, and may contribute to increased injury such as inversion ankle sprains. Evaluation of ankle flexibility should be measured with a goniometer in a non–weight-bearing position, using the medial malleolus, fibula, and first metatarsal as landmarks (**Figure 6**).

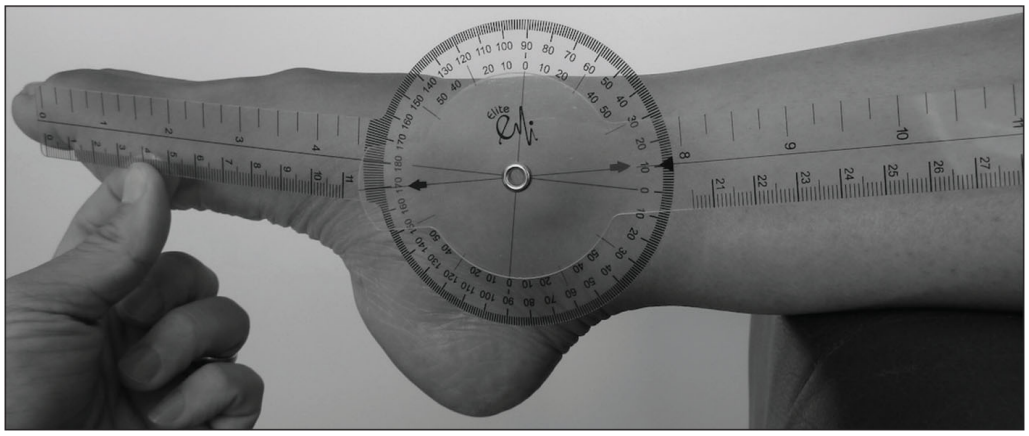

Figure 6. Measurement of ankle plantarflexion using a goniometer. Courtesy of Jeffrey C. Lai.

Anatomy

Forefoot type can affect a dancer's ability to transition to pointe.[1] The “Giselle” or “peasants” foot, where the first three toes are the same length, is the ballerina's ideal forefoot type, because the weight is distributed evenly throughout the toes. The “Grecian” foot and the tapered foot unduly transmit forces across the longer second and first toes, respectively. However, there are no specific requirements for a particular foot type.

Similarly, midfoot arch type can influence the ease at which a dancer can transition. The flat foot is the most challenging type because it hinders the dancer's ability to achieve full ankle plantarflexion, which is a requirement for safely dancing *en pointe*. The cavus foot and its associated high arch is thought to look attractive *en pointe*, but is functionally rigid and stiff, which may affect its shock-absorbing capabilities.[1]

Strength, Proprioception, and Postural Control

Several functional capacity screening tests can be used to assess strength, alignment, proprioception, and postural control in the young ballerina. Richardson et al.[6] identified three tests that were significantly predictive of pointe readiness, as determined by an experienced dance teacher.

The “Airplane” test starts with the dancer standing on one leg, with the trunk pitched forward, arms abducted horizontally, and the non-support leg extended to the back (**Figure 7** and **Figure 8**). The dancer then performs 5 plies (bends) while adducting the arms so that the fingertips touch the ground. A pass is defined as 4 of 5 plies maintaining neutral lower extremity alignment. Inability to pass the “Airplane” test was associated with being deemed not ready for pointe.

Figure 7.
Dancer demonstrating the starting position of the “Airplane” test. Courtesy of Jeffrey C. Lai and Connie Lai (pictured).

Figure 8.
Dancer demonstrating the plié position of the “Airplane” test. Courtesy of Jeffrey C. Lai and Connie Lai (pictured).

The “Saute” test is the strongest positive predictor of pointe readiness. To perform this test, the dancer performs 16 consecutive single-leg Saute jumps. A pass is defined as 8 of 16 properly executed jumps, in which the dancer keeps the pelvis neutral, the trunk upright, the knees extended, and the toes pointed while in the air.

The “Topple” test is also strongly correlated with pointe readiness. The dancer performs a single pirouette with the gesture leg in passe (bent upwards) and the support leg fully extended, while maintaining an upright trunk and demonstrating a controlled, decelerated landing.

Training

There is variability among ballet teachers and schools regarding the prerequisite amount of training needed to transition to pointe work. The typical dance school offers several levels of classes, ranging from once per week to daily. Auditions are required to advance from one level to the next. Accordingly, the young dancer can be assessed for pointe readiness based on her technical ability and not on a certain number of years of training.

Recommendations and Summary

When evaluating a dancer for pointe readiness, it is most important to consider each case individually. There are no absolutes in the clearance of a dancer to participate *en pointe*. It is true that premature participation *en pointe*, when a dancer is truly not ready, can lead to injury, pain, and a premature retirement from ballet. However, if the dancer is appropriately screened and prepared, their transition to pointe can be a successful experience. It is true that recommendations including age limits do exist. However, if the dancer demonstrates appropriate technique, anatomy, stability, and has completed pre-pointe ballet training, a transition to pointe at a younger age can be appropriate. Performing an X-ray as a general screen is no longer recommended for determining pointe readiness. Certainly, if there are any concerning findings during the pointe screening, such as injury history or abnormal examination findings, an X-ray could be clinically warranted at that time. Similar to the management of other medical conditions, when a practitioner is considering a dancer for pointe participation, they should use all of the available tools discussed at the beginning of this article to perform a thorough evaluation.

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