Screening Practices in Dance

Applying the research

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Introduction

Dance is an art form with high physical and psychological demands that warrant scientific investigation. This is evident by reports of an overall 80% injury occurrence in the dance population (Laws, 2005, in Wyon et al., 2007). Since 1963 there have been over 2000 articles published in over 440 periodicals in relation to dance medicine and science. The most popular research topics have included technique, psychology, overuse injury and conditioning (Solomon & Solomon, 2003). Unfortunately, there have been no screening tools published that predict a risk of injury to dancers. The need exists for dance professionals to participate in research to further the knowledge base in relation to dancer health and performance and to identify predictors of injury risk (Potter et al., 2007).

There is a high incidence of menstrual dysfunction, musculoskeletal injury and low bone mineral density in the dancer population. The three issues are interrelated (Koutedakis et al., 1997 & To et al., 1995; in Koutedakis & Jamurtas, 2004). Medical screenings can identify these health concerns and action can avoid detrimental outcomes. Menstrual dysfunction and low bone mineral density can be related to dietary restrictions and low body mass indices[1] seen in dance populations (Benson et al., 1985; Bonbright, 1989 & 1990; in Koutedakis & Jamurtas, 2004). Body mass indices below 17 can lead to amenorrhea[2], and Benson and colleagues (1985) state that very lean dancers are more prone to injury than healthier body weights (in Koutedakis & Jamurtas, 2004). Intense training can lead to hormonal changes that may affect the make up or trabecular of bone[3] (Koutedakis & Jamurtas, 2004). It has been reported in a study that 13 year old dancers who 'trained $\underline{\geq}$ 8.25 hours per week were most likely to have reported sustaining an injury in the previous 12 months ($p+0.001$)[4,' (Purnell et al., 2007, p. 237).

Scoliosis[5] is also a medical condition commonly reported in dancers & a higher risk of progression presents at pre-adolescent or peri adolescent stages of development (Bunnell, 1986, in Liederbach, Spivak & Rose, 1997). Early identification through screening may allow for treatment options to have an affect on curve progression (Bunnell, 1979, in Liederbach et al., 1997). Relationships have been reported between the presence of scoliosis and delayed menarche[6], secondary amenorrhea, and stress fracture (Warren et al., 1986, in Liederbach, 1997), demonstrating the importance of screening to identify and address these issues in young dancers.

Screening protocols aim to measure and monitor physical and psychological parameters. They are commonly used in tertiary dance programs and professional companies either upon acceptance or as part of the audition process. As outlined above, screening would also be beneficial in younger dancers, which is less commonly conducted. However, 'screening should not be confused with an audition' (Potter et al., 2007, p. 1). Past practices may have included screenings as a filtering tool for acceptance to schools and companies, but presently, screening tools are used to provide baseline characteristics for an individual, with the hope of guiding education and training programs and adding to the growing scientific research base (Potter et al., 2007).

Screening allows for individual baseline characteristics to be established. This information can guide conditioning programs in addressing strengths and weaknesses and educate teaching staff about a dancer's physical limitations and possible areas for improvement through further training. The findings can guide curricular changes and be used to monitor changes in fitness and growth. The information can be pooled to identify norms in specific dance populations and expand the growing scientific knowledge base. Most importantly, the information gained by screenings should not be an end in itself, but used to educate the dancer of their physical characteristics (Potter et al., 2007).

As previously mentioned, screenings are more commonly performed when entering tertiary dance programs or companies. Another suggested time is when a dancer commences *pointe* work. One study showed that dancers more commonly start pointe work around the age of 12, a time when rapid growth spurts occur (Meck et al., 2004). When dancing *en pointe*, a force of 12 times body weight is being experienced through the foot and ankle (Dozzi et al., 1994 in Meck et al., 2004). This force, coupled with growth changes leaves the growth plates vulnerable to injury. A screening at this pre-adolescent growth period enables a health professional to educate the dancer about the demands of *pointe* work, to ensure adequate strength of the intrinsic muscles of the feet, and evaluate the standard of technique attained to allow safe progression onto *pointe* (Guggenheim, 1994). It also allows for early screening of scoliosis, and introduces young dancers to the health profession, so they are confident of seeking rapid advice in the unfortunate event of injury.

Injury reporting practices are another screening process that may help to identify risk factors to injury. The importance of injury reporting has been stressed by Liederbach and Richardson (2007) and has been used in the sporting community for over three decades. The reporting of injuries will help health professionals to develop screening tools that may aid in the prediction of risk factors for injury. Reporting guidelines for injury screening have been proposed by Bronner and colleagues (2006). They suggest that pre-season screening of intrinsic risk factors be performed to provide baselines and document existing pathology. They also suggest tracking extrinsic risk factors that might include exposure in terms of numbers of hours, equipment and technique demands. Finally, the reporting of injury occurrence should occur where the 'severity, injury type, location, tissue, activity and style of dance and choreography is also included' (Bronner et al., 2006, p. 69).

In medical screenings, general health, medical history, anthropometric[7] measures and developmental milestones are assessed. Musculoskeletal screenings include an injury history, physical assessment, range of motion, level of hypermobility,[8] postural alignment, functional and motor imbalances, and strength. Cardiovascular, psychological, nutritional and dynamic technique assessments should also be included in dance screenings (Potter et al., 2007).

Dance specific tools exist for the assessment of cardiovascular fitness. The Dance Specific Aerobic Fitness Test (DAFT) was designed by Wyon and colleagues (2003a). The test consists of 5 progressive dance stages of low technical demand so that skill does not influence results. Each stage places progressive aerobic demands on the participant and is designed to reduce the dancers' exposure to less impacting forces than traditional treadmill fitness tests. The third stage of the test has been shown to place similar cardiovascular demands on the dancer as is required for performance. This benchmark could be used as an indicator of when a dancer has gained adequate fitness to return to performance post injury or holiday period (Wyon et al., 2003a).

Molnar (1995) has provided dancers and dance teachers with dynamic evaluation guidelines, which can aid the teacher in technique assessment or screening. Dance screenings are more commonly performed by physiotherapists. As Molnar (1995, p. 288) states:

> The technique assessment is a useful tool for determining a) where and how the student initiates movement, b) what level of technical skill has been achieved, c) whether any faulty technique patterns are habitual, and d) if there are any obvious asymmetries, neuromuscular imbalances, or both in the range of motion).

Inherent joint hypermobility (IJH) is prominent in classical ballet dancers. This is a heritable connective tissue disorder where laxity occurs in ligament, tendon and muscle due to changes in collagen makeup (McCormack et al., 2007). One third of dancers in a study by McCormack and colleagues (2007), were identified with IJH. The group demonstrated that there was a non-

significant increase in ankle trauma in females (p=0.02), muscle tears also in females (p=0.13) and shoulder capsulitis in males (p=0.2) in those with IJH. There was also an increased incidence of tendon injury (p=0.02), increased time off dance post injury in excess of six weeks (p=0.058) and one third of females with IJH had recurrent long term injury compared to those without IJH (McCormack et al., 2007).

Psychological screening can be conducted through the use of the Profile of Moods State questionnaire which is a method to monitor overtraining. It is a 65 item questionnaire with six mood subscales (Wyon, 2001). The subscales include tension, depression, anger, fatigue and confusion, all negative mood subscales and one positive subscale, vigour. Wyon (2001) reports, by tapering schedules, which involve decreasing work volume and the maintenance of work intensity, total mood disturbance (TMD) scores were positively influenced in a youth dance company. TMD had increased pre-tapering period compared with scores attained during the pre-rehearsal period, and had reduced to baseline post-tapering period which means there was a greater chance of the dancers performing optimally.

The research

Even though screening tools have not yet been successful in predicting risk factors to dance injury, research has provided us with a better understanding of the physiological demands of dance and other factors related to injury that have been discussed. Dance is classed as a high intensity intermittent form of exercise (Wyon, 2005a). In dance, both the aerobic and anaerobic energy systems are utilised during performance; however, class has been reported (Wyon, 2004) to only stimulate the anaerobic system that produces energy bursts for 10-12 seconds. The suggestion has been made to adapt the traditional structure of class to provide an aerobic training stimulus or to introduce supplemental training into dance schedules (Wyon et al., 2003b). The warm up section of class consists of low intensity exercise, whereas the centre section of class has periods of high intensity exercise of 10 to 40 seconds duration, with rest periods of two to five minutes between each, high intensity burst. During performance the high intensity exercise durations are between one and four minutes. This illustrates a discrepancy between the demands of class and performance. Furthermore, Wyon and colleagues (2005b) showed that in a contemporary dance company, there was no change in aerobic fitness during the rehearsal period, but a significant increase during the performance period. This strengthens recommendations given by Wyon (2005a) that the skill development of a dancer must be matched by the physiological development of fitness.

Fatigue has been found to be the main perceived cause of injury in dancers (Wyon et al., 2007). This may be related to the discrepancy that exists between the cardiovascular demands of class and performance (Wyon et al., 2005a). If a dancer's aerobic fitness is not adequate for the demands of performance then the dancer will utilise anaerobic energy sources which are in short supply, leading to fatigue. Perhaps dance training practices are insufficient to prepare the body for the demands of dance, or the physiological stress that a dancer is faced with is too great.

Practical recommendations

Specific recommendations have been given by Wyon (2004). Two to three aerobic training sessions should be performed each week. These can consist of supplemental training sessions or be incorporated into class structure. Supplemental training may include various modes such as cycling, running or swimming, but the specificity of the training to dance should be considered. Sessions should last for 20 to 30 minutes and be of an interval training nature. Two minutes exercise should be in the aerobic training zone of 60-85% of heart rate max, interspersed with two minutes low intensity exercise. Heart rate max is a simple calculation where the percentage is determined by subtracting an individual's age from 220. This can be incorporated into class work by increasing the length of an exercise and reducing the rest periods between each exercise. Anaerobic fitness for dancers is sufficiently trained in traditional class structures.

A study has looked at a dance specific interval training program (Macey, 2007). A program was designed after observing dance classes, rehearsals and performances to determine 'predominant muscle groups utilised, and the use of floor work, travel sequences and dynamic actions' (Macey, 2007, p. 65). Dance sequences were choreographed and testing consisted of a 6.5 minute warm up, three dance specific exercise sets of 6.5 minutes, interspersed with one-minute active rest periods. The study recorded heart rate, maximal oxygen uptake and blood lactate levels which were found to be of similar values to those identified in other studies on dancers in rehearsal and performance. This demonstrates the specificity of an interval training program to dance performance (Macey 2007).

Overtraining is another aspect that can lead to fatigue. The factors that can contribute to overtraining are the hours of training, the monotony of rehearsal, inadequate rest periods, decreased aerobic fitness as previously discussed, hydration and nutrition (Liederbach et al., 2001). The training hours can be monitored with scheduling. Kadel and colleagues (1992) found that training greater than five hours per day increased the risk of stress fractures.

Periodisation of schedules is useful in promoting performance. A study, utilising a tapered schedule for a dance company showed that dancers 'felt rested and wanted to perform which they stated as being unusual' (Wyon, 2004, p. 10). It is advised that the three to four days leading up to performances be of reduced workload, requiring choreography to be completed prior to that time. These days may consist of a class and a single run-through rehearsal. On the day of performance, minimal dancing should occur with the warm up class being of shorter duration (Wyon, 2004).

Training exposure should also be considered when scheduling. A study of jumping exposures reported that 87% of dance related anterior cruciate ligament (ACL) injuries, occurred during one legged landings (Liederbach, et al. 2006). The female to male ratio of ACL injuries was ten times greater in modern dance than for ballet. They showed that ballet classes required 38% more total jumps than for a modern dance class and twice as many angular jumps ($p<0.05$). This information should be kept in mind when dancers are

required to swap from modern to classical repertoire or training. Modern dancers may need to graduate a return into jumping, when returning to classical training.

Conclusion

Screening practices, although not shown to predict the risk of injury, can be useful in identifying relationships to injury and disease. This process introduces individuals to health professionals and enables education and immediate action to be taken if injury were to occur. In particular, screening may identify scoliosis, menstrual dysfunction, low bone mineral density, fatigue, errors in technique and poor nutrition such as inadequate calcium intake. Injury reporting systems should be adopted to aid health professionals in designing screening tools that potentially will predict risk factors for injury. Adaptations can be made to traditional class structures to facilitate improved aerobic fitness in dancers, avoid the effects of fatigue – a major perceived risk to injury – and to enhance performance. In addition, scheduling can also be designed to reduce the risk of overtraining and in turn, fatigue and injury.

Notes

[1] Body Mass Index – kg/m^2, normal range = 18.5 – 24.9 (Balady et al., 2000).
[2] Amenorrhea – absence of secondary sexual characteristics and menstruation by age 14 or normal secondary sexual characteristics and no menstruation by age 16. Primary amenorrhea is when menstruation never starts, secondary amenorrhea is when menstruation ceases (Wikipedia, 2009).
[3] Trabecular of bone – the interior framework of bone (Wikipedia, 2009).
[4] This P value represents that in this study, 99.9% of 13 year old girls that train more than 8.25 hours per week are likely to sustain an injury in a 12 month period.
[5] Scoliosis – a medical condition that involves a curvature of the spine (Wikipedia, 2009).
[6] Menarche – is the first menstrual period (Wikipedia, 2009).
[7] Examples of anthropometric measures are range of motion, strength, height, weight.
[8] Hypermobility refers to an inheritable disorder that affects the connective tissue in which collagen rich tissues are lax and fragile (McCormack et al., 2007).

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