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Evaluation of Foot Posture, Pain and Ankle Proprioception in Classical and Western Dancers- A Cross Sectional Study

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Abstract

Background: *The health issues of dancers are well intentioned of consideration for many reasons and musculoskeletal problems and pain are two important factors which alters the dancers dance career specifically in foot and ankle region due to obvious use. Hence foot and ankle assessment becomes mandatory to avoid further injuries and complications and as there is dire dearth of literature pertaining to the comparison between classical and western dancers foot posture, ankle proprioception and pain,hence the present study was conducted.*

Aims and Objectives: *To evaluate foot posture, ankle proprioception, and pain in classical and western dancers.*

Methods and Materials: *primary data collection was done from dancing schools and studios using convenience sampling. 55 classical and 55 western dancers between the age group of 15 to 25 were included using inclusion criteria and were assessed for foot posture index 6 and visual analogue scale for foot posture and pain respectively and subjected to a clinical test objective joint position sense for ankle proprioception.*

Result: *Foot posture index for both foot were highly significant in between two groups with a p value of < 0.005.classical dancers have more pronated foot when compared to western dancers, similarly pain is also significant in classical when compared to western dancers.*

Conclusion: *the study concludes that there is significant change in foot posture of classical dancers and pain was more observed in classical dancers than western dancers and there was no adequate loss of proprioception in ankle joint in classical as well as western dancers.*

Introduction

Dance provides an active, non-competitive form of exercise that has potential positive effects for physical health as well as mental and emotional wellbeing.[1] There are different types of dance forms in the world and established by different places and culture. In India according to states different dance forms are known like Bharatnatyam, Katthak, Odyssey, Kuchipudi, Manipuri and many more and western dance forms are Hip-Hop, Locking and Popping, Jazz, Salsa, Tap dance, Cabaret, Belly dancing, Ballet, Passo etc. dynamic and energetic dance form is otherwise called as classical dance and it is also precise and balanced. It comprises of rhythmic stamping of the feet and jumps[2]. There are different movements in classical dancing in which foot work is crucial. The stresses positioned on dancer's lower extremities leave them at danger for musculoskeletal injuries[2]. Dancers may expect

great number of foot and ankle injuries. It has been estimated that approximately 90% of professional dancers will agonise at least one musculoskeletal injury during their career.[3] The shafts of three central metatarsals (63%) and stress fractures on anterior tibial cortex (7%) is the most common site for stress fracture in dancers .These fractures are common when only toes touch the ground in classical dance such as Bharatnatyam[2], katthak as well as in ballet dancing. Different causes of dance injuries are anatomical placement, poor exercise, technical errors, unskilled choreography or style and environmental factors including flooring surfaces.[3] The health complications of dancers are worthy of consideration for numerous explanations first because most dancers initiate learning at young age ,there is potential for countless influence on their future fitness .second ,the interaction of physical and aesthetic demands in dance may lead to various health problems especially appropriate to dancers.[4]. Many activities that require lower extremities to react to forces are running, jumping and landing.[5] the foot reacts to these forces by either pronating or supinating the hind foot.

An excessively supinated foot is characterized by a high arch and hypomobile mid foot, may not adequately adapt to the underlying surface, increasing the demand on the surrounding musculoskeletal structures to maintain postural stability and balance. Further it has been suggested that the cavus foot has less plantar sensory information to rely on than the normal or pronated foot. Conversely, excessive pronation is characterized by flattening of medial arch and a hypermobile mid foot but may also place greater demands on the neuromuscular systems to stabilize the foot and maintain upright stance. The foot work compared in single stance postural control in individuals with different foot types as defined by the degree of forefoot and rare foot varus and valgus influences for orthotic intervention on dynamic balance.[6]

Proprioception is the ability to detect without the visual input, the spatial position and /or movement in relation to the rest of the body[7]. Proprioception is a complex somatosensory modality that utilizes inputs from muscle joint and cutaneous afferent fibers and consists of two components, the sense of limb movement (kinaesthesia) and static limb position (joint position sense).[7] Proprioception refers to perception of position and motion of one's body in space.[8] Somatosensory system is the most important contributor for postural control. The central nervous system contribute to the postural stability and motor control.[7] Under static and dynamic conditions foot type affects the postural stability.[9] for the control of upright posture in individuals without pathologic conditions the importance of muscle spindles, particularly of lower limb has been well established in numerous studies.[6]proprioception refers to perception of position and motion of one's body in space.[8]

There is lack of research work done in classical dancers and proprioception and pain evaluation in them and it is a flaw that we cannot inhibit injuries and offer the precise management. As an occupational group dancers have received little attention in the health literature.[4] The want of careful and in depth study and analysis of the Indian classical dancers with regard to their training and practice patterns is the main reason for this scenario. Since flexibility plays a fundamental role in the range of performance. There is need to study on this characteristic of Indian classical dancers. The traditional practices of the dancers need to be carefully studied and contrasted with the modern system of physical training.[3]

Materials and Methods

Institutional Review Board Approval:

Ethical clearance was obtained from the Institute of Ethical Board and was conducted in conformity with ethical and human principles of research.

Participants

Participants were included according to inclusion and exclusion criteria. Written informed consent was obtained from the study participants and was

included in group A and group B according to their dancing preferences.110 participants were included in the study from various dancing school and groups in Belgavi within three months. The inclusion criteria were 1. Dancers with the age between 15 to 25 years.2.Both males and females included in the study.3 Dancers practicing for two or more than two years.4.Dancers dancing for three or more than three hours. The exclusion criteria were 1. Dancers who have undergone any lower limb surgeries. 2. Dancers with recent foot and ankle injuries in last 6 months.

Procedure

Participants in various dance schools and groups were screened. 55 participants were included in group A i.e. Classical dancers and 55 participants were included in group B i.e. western dancers. Demographic data was obtained that included age, gender, BMI, years of dancing career, hours of dancing per week and both groups were assessed for foot posture, pain and ankle proprioception.

Results

The presented study titled as assessment of foot posture, ankle proprioception and pain in classical and western dancers-an observational study included 110 participants in which group A included 55 participants i.e. classical dancers and group B included 55 participants i.e. western dancers. The foot posture index was assessed by foot posture index -6, ankle proprioception was assessed by objective joint position sense test and pain in foot or ankle region was measured by visual analogue scale.

Statistical analysis for the present study was done manually as well as using statistical package of social sciences (SPSS) version 21 so as to verify the results obtained. For this purpose data was entered into an excel spread sheet, tabulated and subjected to statistical analysis. Various statistical measures such as mean, standard deviation, and test of significance such as paired t –test was used. Nominal data from patient's demographic data i.e. the age, BMI, years of dancing career, hours of dancing per week were analyzed using t-test. Comparison of the outcome measures foot posture and ankle proprioception was done by t-test while for comparison of pain by VAS was done by Mann – Whitney U test and was utilized to measure the difference between two groups (Intergroup comparison). Probability values less than 0.05 were considered statistically significant and probability values less than 0.001 were considered highly significant. Total number of male participants in group A was 2 and female participants were 53. In group B, the total number of male participants was 13 and female participants were 42.

Comparison of group A and group B with respect to foot posture index scores at right and left sides by t test

Sides	Groups	Mean	SD	SE	t - value	P – value
Right side	Group A	6.29	2.62	0.35	4.9598	0.0001*
	Group B	3.95	2.33	0.31		
Left side	Group A	6.33	2.63	0.35	4.8922	0.0001*
	Group B	4.00	2.36	0.32		

*p<0.005

Distribution of foot types in right and left foot in group A

Type of foot	Highly supinated	Supinated	Normal	Pronated	Highly pronated	Total
Right foot	0	0	12	37	6	55
%	0	0	21.82	67.27	10.91	100
Left foot	0	0	13	37	5	55
%	0	0	23.64	67.27	9.09	100

Distribution of foot types in right and left foot in group B

Type of foot	Highly supinated	Supinated	Normal	Pronated	Highly pronated	Total
Right foot	0	2	35	17	1	55
%	0	3.64	63.64	30.91	1.82	100
Left foot	0	2	34	18	1	55
%	0	3.64	61.82	32.73	1.82	100

Comparison of group A and group B with respect to pain at right and left sides by Mann-Whitney U test

Sides	Groups	Mean	SD	SE	Sum of ranks	U - value	P – value
Right side	Group A	1.00	2.01	3360.50	1204.50	-3.2846	0.0010*
	Group B	0.04	0.27	2744.50			
Left side	Group A	0.71	1.67	3327.50	1237.50	-3.2969	0.0010*
	Group B	0.00	0.00	2777.50			

Discussion

In the present study assessment was done for foot posture using foot posture index -6, ankle proprioception by objective joint position sense and pain by visual analogue scale in classical and western dancers.55 classical and 55western dancers were included in the study. Classical dancers consisted of 2 male and 53 female participants; this could be because of the reason that this generation has seen a gradual decline of male classical dancers.

The age group included in this study was 15 to 25 years and the mean age was 18.16 years for classical dancers while it was20.04 for western dancers and the comparison between classical and western dancers was highly significant in this study. In the presented study we found that weight and BMI was not statistically significant. It was positively correlated with another study done by Redmond AC.et.al to establish normative FPI reference values and it comprises of 1468 individual observations and they included information related to Centre, age, gender, pathology, fpi score and BMI and they concluded that a set of population norms for children, adults and older people have been derived from large sample. Foot posture is affected by age and the presence of pathology but not influenced by gender or BMI.[10]so we can say gender difference or ratio between male and female in classical dancers does not affect the study results. We have included the individuals who are dancing for 2 or more than 2 years and 3 or more than 3 hours of dancing per week. as the literature shows that most of the problems occurring in dancers develop subtly over a period of time rather than through a single traumatic episode.[11]

In this study most of the dancers have started their practice at very young age and the literature shows that high impact forces during dance interferes with the growth and development of arches of foot by changing the anatomical structure so more exposure of dancing at early age may lead to change in foot posture, Increased stress over the foot arches causes the ankle and foot rolling. If it rolls medially it is pronated type of foot and if it rolls to lateral side it is supinated foot.[12] A study done by K.Vijaykumar and Dr.Senthil Kumar on morphometric analysis of ankle and foot in classical and Bharatnatyam dancers using foot posture index and plantar scan images showed that 70% of dancers had flat arched foot and 20% of dancers had high arched foot with high foot deviations. They concluded that the ankle and foot problems can be reduced by regular diagnosis and assessment, proper warm up and stretching techniques and foot wear modifications should be made to prevent deformities.[12] for this study we used FPI - 6 and demonstrates good construct validity.[13] similarly in presented study the comparison between classical and western dancers for foot posture is highly significant for right as well as left foot. In classical dancers many individuals were having pronated type of foot and this could be because of the excessive strain like loading the foot with

continuous foot tapping movements during dancing on the hard surface produces high level of compressive force over the heel, tarsal and metatarsal joint complex may alter the integrity of the structure of the foot arch thus leading to flatness of foot or pronated foot.

Several deteriorating changes occur during aging process in foot arch and it is one of the structure which changes significantly. Extended stress over the joints, increase body mass and laxity of ligaments can lead to flatness of foot.[12]

Howard garderners schema of multiple intelligence by using whole body (or its parts) to solve problems says that presumably professional dance training strengthens the accuracy of proprioceptive inputs and shifts to tendency to depend on vision for motor control to a more internally based system of reference.[14] In presented study ankle proprioception was compared in between classical and western dancers and the comparison was not statistically significant for right and left foot this could be because the one could infer that proprioceptive acuity in integral to how dancers attend, learn and self-correct, potentially providing dancers with an advantage in motor planning, motor control and postural instability as the body is the vehicle of expression, it would seem likely that dancers have an augmented inner body sense compared to non-dancers.[13]

The foot pain was measured in classical and western dancers using visual analogue scale. All through discussion with choreographer, dance instructor and students while doing pain assessment we perceived that students learning classical dance have more pain in foot and ankle region due to constant tapping of foot on the floor[12] these are the major reasons which affects dancers who are taking part in competitions thus making them loss of salary, temporary unemployed which leads to seize the dance career. Hence dancers requires a regular health assessment for their medical condition and for further precaution should be taken care before involving in any type of physical activity.[12]and rehabilitation can improve the stability in foot and ankle.[15]

Conclusion

The study concludes that there is significant change in foot posture and pain in classical dancers and was more observed in classical dancers when compared with western dancers and there was no adequate loss of proprioception in ankle joint in classical as well as in western dancers.

Future scope

The present study can be conducted on a large sample size and it can be carried for other age groups. Independent study can be done by specific type of dance form or the comparison can be done in two forms within classical dancing or two forms within western dancing.

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