

CALCULATION OF RESULTANT MUSCLE TORQUES IN LOWER EXTREMITY JOINTS, GENERATED DURING CLASSICAL DANCE ELEMENT CALLED ENTRELEACÉ

Joanna Gorwa¹, Robert. Michnik², Jacek. Jurkojć², Lechoslaw. B. Dworak¹

¹Department of Biomechanics, University School of Physical Education in Poznan, Poland;

²Biomechatronics Department, Silesian University of Technology, Zabrze, Poland

Introduction

Current research shows that some of dancing movements, especially during the landing phase (during the eccentric phase of muscle work related to amortization) cause high values of the vertical component of ground reaction force, which can reach the level of 9.4 BW (Picon, 2002; Dworak at all, 2004). Serious injuries often happen during these phases of jumps. Ankle joints, feet, spine, hip and knee joints are the regions that are mentioned most frequently. Since the correct/proper technique is a factor that significantly lowers the risk of injuries, the authors of this study assessed kinematic parameters and identified range of values for muscle torques of lower extremities joints for a classical dance element „entrelecé”. A motion analysis system and dynamometric platforms were used in this research.

Methods

The measurements were performed in the Biomechanical Laboratory of the Department of Biomechanics at the University School of Physical Education in Poznan.

Examined dancers performed all the movements barefoot. The kinematic values were determined with the use of the APAS motion analysis system, ground reaction forces were measured with the use of the Kistler dynamometric platforms. Motion was recorded by four Basler digital cameras with the frequency of 200 Hz. On the basis of momentary ground reaction forces and values of momentary kinematic parameters, using the inverse dynamic problem, resultant muscle torques of the lower limb were calculated for the Entrelecé element.

The calculations were performed with the use of a proprietary software developed in the Matlab environment.

Results

The maximal values of muscle torques in main lower extremities joints are shown in the table 1. The results are presented for all measurements.

n	Ankle joint [Nm/kg]	Knee joint[Nm/kg]	Hip joint[Nm/kg]
1	2,86	8,85	11,89
2	2,45	9,97	13,42
3	3,30	13,68	20,4
av	2,87	10,83	15,24

Table 1 Resultant muscle torques in lower extremities joints generated during Entrelecé element in the landing phase.

Discussion

During the landing phase of the Entrelecé element, the reaction force is applied on a forefoot. While the foot is lowering, the point of application of the reaction moves towards the dancer's long axis and the maximal value of the reaction occurs when point of application is in the vicinity of metatarsus.

Together with the increase of the horizontal value of GRF, the angle between the direction of the reaction and the plane of support (a floor) is changing. The hip joint was the most loaded one and the ankle joint the less loaded. During jumps the biggest loads were identified for the hip joint and the lowest for the ankle joint.

References

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