MAGNITUDE, DEVELOPMENT AND INTERRELATIONSHIP OF MORPHOLOGICAL AND FUNCTIONAL ASYMMETRY IN TENNIS PLAYERS

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ABSTRACT OF THE RESEARCH

BACKGROUND

Almost every individual tends to have a preferred upper and/or lower extremity when performing voluntary movements. The preferred use of an upper or lower extremity eventually results in morphological (e.g., in terms of bone and muscle tissue) and functional (e.g., in terms of strength, power and agility) asymmetry magnitudes between the right and left upper or lower extremity. These asymmetry magnitudes can be further accentuated by (intensively) practicing a unilateral sport such as tennis. Research on morphological and functional asymmetry of both the upper and lower extremity in adult female as well as male and female elite youth tennis players, however, is scarce. Therefore, this doctoral research project aimed to increase our current knowledge and understanding regarding morphological and functional asymmetry by examining the magnitude, development and the interrelationship of both types of asymmetries in elite adult female as well as mixed elite youth tennis players.

RESULTS

The meta-analysis in **Study 1** clearly indicated that upper extremity bone mineral content (BMC) was significantly higher in the racket arm compared to the non-racket arm. Additionally, male tennis players, adult tennis players and early starters demonstrated higher upper extremity BMC asymmetry magnitudes compared to female tennis players, youth tennis players, late starters and senior tennis players, respectively. The cross-sectional research presented in **Study 2 to 5** examined upper as well as lower extremity morphological and functional asymmetry magnitudes in elite adult female tennis players and male and female elite youth tennis players. These studies all reported significant upper and lower extremity morphological and functional asymmetry magnitudes ranging from 1.9 to 15.6 %. Additionally, lower extremity functional asymmetries were found to be direction-specific across tasks (i.e., the same lower extremity did not consistently performed better on different unilateral physical performance tests). In **Study 4 and 5**, the relation between lean mass (LM) and functional asymmetry in terms of magnitude and direction was examined in elite adult female as well as male and female elite youth tennis players. Both studies found that the examined types of asymmetry were not related in terms of their magnitudes, which means that higher magnitudes of LM asymmetry do not imply higher magnitudes of functional asymmetry. Both studies also reported that the lower extremity showing the highest absolute value for LM did not consistently perform better compared to the other lower extremity on the physical performance tests. This was in contrast with the upper extremity where the racket arm always performed better on the physical performance tests compared to the non-racket arm.

Using a two-year longitudinal study in **Study 6**, the development of upper extremity morphological asymmetry magnitudes of bone mineral density (BMD), BMC and LM were examined in male and female elite youth tennis players according to their maturity offset. As opposed to upper extremity LM asymmetry magnitudes, both BMD and BMC asymmetry magnitudes increased significantly along with the players' maturation. Finally, in **Study 7**, the development of upper and lower extremity functional asymmetries according to maturity offset was examined in male and female elite youth tennis players using a three-year longitudinal design. It was found that functional asymmetry magnitudes did not significantly change according to players' maturity offset. When examining the consistency in directionality across time as to which extremity performed dominantly across the yearly test occasions, perfect levels of agreement were found for the upper extremity tests whilst only poor to fair levels of agreement were found for the lower extremity.

CONCLUSION

To conclude, statistically significant morphological and functional asymmetries at the upper and lower extremity level were found in both elite adult female as well as elite youth (male and female) tennis players. However, there was no relation apparent between LM and functional asymmetry in terms of magnitude and direction. Only upper extremity BMD and BMC asymmetry magnitudes increased significantly according to maturity offset in elite youth tennis players, which was opposed to upper extremity LM asymmetry magnitudes as well as upper and lower extremity functional asymmetry magnitudes. Future research is needed to prospectively examine the relation between the magnitude and development of morphological and functional asymmetry linked to injury risk as well as tennis/sports performance.

CURRICULUM VITAE

Laurent Chapelle graduated from the Vrije Universiteit Brussel in 2015 obtaining a Master of Science degree in Sports Physiotherapy. After completing these studies, he decided to further specialize in Exercise Physiology. This was achieved by obtaining a Master of Science degree in Sport and Exercise Physiology from St Mary's University, Twickenham (UK) in November 2016. Since 2017, he holds a full-time position as a research and teaching assistant at the Vrije Universiteit Brussel.