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Development of Upper and Lower Extremity Functional Asymmetries in Male and Female Elite Youth Tennis Players: A Longitudinal Study

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INTRODUCTION:

Functional asymmetries are defined as side-to-side differences in physical performance (e.g., regarding strength, power and agility) between both upper or lower extremities. Although every individual naturally develops a certain magnitude of functional asymmetry, systematically performing a predominantly unilateral sport (i.e., such as tennis) may increase the already present inter-limb differences. Previous research has shown that functional asymmetries have been reported to increase injury risk whilst decreasing sports performance. Nevertheless, longitudinal studies examining how the magnitude of functional asymmetry and its consistency in directionality develops according to chronological age are currently lacking. Therefore, this three-year longitudinal study aimed to examine the development of upper and lower extremity functional performance values, together with asymmetry magnitudes and directionality.

METHODS:

Dominant (i.e., the best overall result of a performance test independent of extremity) and non-dominant physical performance values (i.e., the best result of the same performance test of the same extremity on the other body side) were determined yearly (i.e., and up to 3 years) using unilateral strength, power, speed and agility tests in 53 male and 37 female elite youth tennis players aged 8 - 17 years. For each test occasion, functional asymmetry magnitude percentages were calculated using the percentage difference method. Using R version 4.2.2, linear mixed effect models examined the development of performance values according to chronological age, performance dominance and sex. Similarly, the development of functional asymmetry magnitudes was examined according to players' chronological age and sex. Kappa coefficients (k) examined the consistency in directionality (i.e., which extremity performed dominantly across test occasions).

RESULTS:

Regardless of sex, the dominant and non-dominant performance values of every test significantly ($p < 0.05$) improved according to chronological age. No sex differences were apparent except for strength and power related tests, with male players performing significantly better compared to female players. Functional asymmetry magnitudes ranged from 2.5 % to 14.6 % and did not significantly change with increasing chronological age (i.e., range = -0.3 % to 0.2 % per year). The dominant upper extremity (i.e., which holds the racket) consistently displayed the dominant performance value (i.e., k-value = 1.00) across test occasions, which was not the case for the lower extremity (i.e., k-value range = -0.28 to 0.31).

CONCLUSION:

The functional asymmetry magnitudes, showing a high amount of direction-specificity and variation in individual developmental patterns, did not change significantly according to chronological age over a 3-year period. It is, therefore, uncertain whether aiming for a reduction in asymmetry magnitude is favourable.

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