The Relationship Between Hip Biomechanics and Lower Extremity Performance in Adolescent Tennis Players

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Summary

This study examined the relationship between hip biomechanics and performance in adolescent tennis players. Fifty-five players participated. A strong correlation was found between the Hip Stability Isometric Test and horizontal jump test (r=-0.427, p=0.001). Muscle strength was negatively correlated with performance test completion times. These findings highlight the critical role of hip biomechanics in both optimizing athletic performance and preventing injuries in adolescent tennis players.

Introduction

Tennis is a sport that requires the integrated use of muscle strength and neuromuscular coordination, involving frequent movements such as sudden direction changes, asymmetrical and rotational motions, jumping, and lateral sliding [1]. Repetitive movements increase the load on the lower extremities, leading to biomechanical alterations and consequently affecting performance [2].

Methods

55 adolescent tennis players (mean age = 11.37 ± 1.75 years, mean BMI = 18.44 ± 2.51 kg/m²) were included in the study. FAA, HipSIT test and muscle strength of the hip flexors, extensors, abductors, adductors, IR, and ER were measured using a hand-held dynamometer (Lafayette Manual Muscle Tester, Lafayette Indiana Instruments). Performance evaluation was conducted using the sprint test, T-test, horizontal jump test, and vertical jump test. The Pearson correlation test was used to compare the correlation outcomes.

Results and Discussion

The average femoral anteversion angle of the tennis players was 27.44±3.44°. The average hip muscle strength values were as follows: flexors 2.01±0.41 N.m/kg, extensors 1.61±0.54 N.m/kg, abductors 1.79±0.33 N.m/kg, adductors 1.79±0.53 N.m/kg, internal rotators 1.44±0.33 N.m/kg, and external rotators 1.64±0.47 N.m/kg.The strong correlation was found between the HipSIT and the horizontal jump test (r=-0.427,p=0.001). The relationship between the biomechanic outcomes and performance outcomes, was presented in Table 1. Muscle strength was negatively correlated with performance test completion times.

Conclusions

Exploring the relationship between hip biomechanics and performance in adolescent tennis players is crucial for optimizing athletic potential and prevention young athletes from injuries during their critical developmental years.

Acknowledgments

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References

[1] Abrams G et al (2012) Epidemiology of musculoskeletal injury in the tennis player. *British Journal of Sports Medicine* **46**(7):492-498.
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Table 1: Relationship Between Biomechanic Findings and Performance Findings

Variables	Sprint Test		T-Test		Horizontal Jump Test		Vertical Jump Test	
	r	p	r	p	r	p	r	p
FAA	0.098	0.476	0.105	0.445	-0.045	0.747	-0.173	0.249
HipSIT	-0.315	**0.019***	-0.290	**0.032***	-0.427	**0.001***	-0.302	0.093
Hip Flexors Strength	0.022	0.874	0.063	0.651	-0.106	0.448	-0.340	**0.017***
Hip Extensor Strength	-0.195	0.237	-0.250	0.066	-0.283	**0.038***	-0.258	0.154
Hip Abductor Strength	-0.353	**0.008***	-0.351	**0.009***	0.293	0.075	-0.120	0.418
Hip Adductor Strength	-0.197	0.157	-0.245	0.071	0.196	0.152	-0.355	**0.011***
Hip IR Strength	-0.166	0.230	-0.170	0.220	-0.056	0.692	0.066	0.726
Hip ER Strength	-0.101	0.496	-0.105	0.448	-0.044	0.758	-0.349	**0.014***

FAA: Femoral anteversion angle, HipSIT: The Hip Stability Isometric Test , IR: Internal rotator, ER: External rotator