

RECORDING PROGRESS IN JUNIOR ATHLETES' PROPRIOCEPTIVE TRAINING USING MODERN SPORTS TECHNOLOGY

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Abstract: *This study investigates the efficacy of modern sports technology in monitoring and enhancing proprioceptive training among junior athletes. The research focuses on recording and analyzing the progress of young athletes engaged in proprioceptive exercises using state-of-the-art technological tools. Through a comprehensive examination of these advancements, this study aims to explore the impact of such technology on improving proprioception in junior athletes. The methods involve implementing specific training protocols while utilizing advanced tracking devices and analytical software to monitor and record the athletes' progress. The findings aim to provide insights into the effectiveness of modern sports technology in optimizing proprioceptive training among young athletes, thereby contributing to the enhancement of their overall athletic performance and injury prevention strategies.*

Key words: *modern technology, OptoJump, proprioceptive training, junior athletes.*

1. Introduction

In the realm of athletic development, the optimization of proprioceptive abilities stands as a cornerstone for performance enhancement and injury prevention among junior athletes. Proprioceptive training, focusing on the body's spatial awareness and control [1], plays a pivotal role in refining athletic skills and reducing the risk of injuries during training and competition. In recent years, the

integration of modern sports technology has revolutionized the assessment and augmentation of proprioceptive training methodologies. This study delves into the realm of junior athlete development, specifically exploring the application and efficacy of OptoJump technology in monitoring and advancing proprioceptive capabilities among three selected subjects. OptoJump, a cutting-edge tool within sports technology, offers a high-

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resolution measurement [6] system designed to precisely track and analyze various aspects of an athlete's movement and performance. By harnessing this technology, our study aims to elucidate the nuanced progress and intricacies of proprioceptive training within a select group of junior athletes.

Throughout this investigation, three subjects engaged in tailored proprioceptive training programs, incorporating OptoJump technology as a comprehensive monitoring tool. The utilization of OptoJump allowed for real-time measurement and evaluation of key proprioceptive indicators, providing invaluable insights into the athletes' proprioceptive progress and performance enhancements. [7]

This research endeavor seeks not only to shed light on the potential of modern sports technology, particularly OptoJump, in facilitating and refining proprioceptive training but also to offer practical implications for coaches, trainers, and sports scientists invested in optimizing junior athletes' development. The analysis of the impact of OptoJump technology on the proprioceptive training progression of these three subjects aims to contribute significantly to the broader understanding of employing advanced sports technology in fostering athletic prowess and injury resilience among young athletes.

2. Materials and Methods

Participant Selection:

Three junior athletes were recruited for this study based on specific criteria including age range (between 15 to 16 years), athletic background, and willingness to engage in a structured proprioceptive training program [2].

OptoJump Technology Setup:

The OptoJump system, renowned for its high-resolution measurement capabilities, was utilized as the primary technological tool for assessing and tracking proprioceptive training progress.

A standardized setup of the OptoJump system was arranged in a controlled indoor environment conducive to training and data collection. [4]

Proprioceptive Training Protocol:

A tailored proprioceptive training program was inspired by experienced trainers and sports scientists [9], emphasizing exercises targeting balance, coordination, and neuromuscular control.

The program comprised specific drills and exercises using balance boards, stability balls, and proprioceptive devices, aiming to challenge and enhance the participants' proprioceptive abilities.

The proprioceptive training took place over a period of 9 months, between March and November 2023, with a frequency of 2 trainings per week, the sessions being included in the athletes' specific fencing training.

Data Collection and Analysis:

Prior to commencing the training program, baseline measurements of proprioceptive capabilities were recorded using the OptoJump system for each participant.

Throughout the training period, regular training sessions were conducted, and data from the OptoJump system, including parameters such as ground contact time, flight time, and stability indices, were collected in real-time during the training sessions.





Comparative analysis between baseline measurements and subsequent sessions'

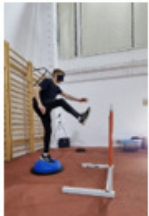


data allowed for the evaluation of proprioceptive training included progress in proprioceptive abilities. improvements in stability indices, changes in ground contact time [5], flight time, and overall enhancement in proprioceptive control.

Evaluation Criteria:

Parameters for evaluating the efficacy of control.

Table 1 - Effort dynamics in specific proprioceptive training of the 3 subjects

NO.	RESOURCES	INT.	MONTHS OF THE EXPERIMENT									TOTAL	% FROM GENERAL	
			M	A	M	J	J	A	S	O	N			
1. On the Bosu ball, standing on the attacking foot on the whole sole, and with the knee of the trailing foot on the fitness ball. Energetic arm movements are performed back and forth, while maintaining balance.														
	 5 X 30 reps., Pause: 30 sec.	60%	30	30	30	30	.	.	30	30	30	210	16,9	
2. Standing in a forward lunge, with the attacking leg behind on the fitness ball and the trailing leg forward on the Bosu ball, the lift on the impulse leg and the lifting of the attacking leg with the push of the calf forward - up (simulating the attack) are performed.														
	 5 x 10 reps., pause 60 sec.	70%	30	30	30	30	.	.	30	30	30	210	16,9	
3. Standing with legs bent at 90 degrees on inverted balance ball, leaning against wall with back on fitness ball, kicking leg forward														
	 5 x 10 reps, pause 60 sec.	80%	30	20	10	.	.	.	30	20	10	120	9,7	
4. Lying prone, resting on the toes on the fitness ball and on the hands on the balance ball Bosu inverted, pulling the trailer leg forward - to the side														
	 5 x 10 reps., pause 60 sec.	80%	30	20	20	20	.	.	30	20	30	170	13,7	

5. Standing on the impulse leg on the Bosu ball, lifting the attacking leg with simulating the attack on the hurdle.													
	85%	.	30	40	30	.	.	30	50	40	220	17,7	
3 x 10 reps. Pause 60 sec.													
6. Sitting on the landing leg on the Bosu ball and the trunk slightly bent forward, pulling the trailer leg over the fence placed behind.													
	90%	.	.	60	60	.	.	.	40	60	220	17,7	
3 x 10 reps, pause 60 sec.													
7. Stepping over small fences, the impulse (trail) foot pushes off the balance board before the hurdle, and the attacking foot also lands on the balance board after the hurdle.													
7		85%	.	10	20	20	.	.	10	10	20	90	7,3
3 X 10 reps, pause 90 sec.													
TOTAL		≤60%	60	60	60	60	.	.	60	60	60	420	33,8
		60%-100%	60	80	150	130	.	.	100	140	160	820	66,2
GENERAL TOTAL		60%-100%	120	140	210	190	.	.	160	200	220	1240	100

Ethical Considerations:

Ethical guidelines and consent procedures were strictly followed, ensuring the safety and well-being of the participating athletes throughout the study.



All participants and their legal guardians provided informed consent before engaging in the study.

Baseline Proprioceptive Measurements:

Prior to the commencement of the training program, baseline proprioceptive measurements were recorded using the OptoJump system for each of the three subjects.

Across the training sessions, notable improvements in proprioceptive indicators were observed for all three subjects.

Table 2 - Sequence from the proprioceptive training test session

No.	RESOURCES	RECORDING TECHNOLOGY	TEST DURATION
1.	<p>From a sitting position facing the hurdle, with the attacking leg resting on the fence post, energetic jumps are performed on the impulse leg for 15 seconds.</p>  <p>Fig. 1. <u>OptoJump</u> impulse leg test</p>	<u>OptoJump</u>	15 sec.
2.	<p>From the sitting position with the back to the fence, with the trailing leg resting on the fence post, perform energetic jumps on the attacking leg (landing) for 15 seconds.</p>  <p>Fig. 2 – <u>OptoJump</u> landing leg test</p>	<u>OptoJump</u>	15 sec.

3. Results

The two tests were monitored using OptoJump, which recorded a series of presented parameters, of which we considered relevant for the most accurate interpretation of the results, the following:

- Tcont. [s]: Contact times

- Power [W/kg]: Power

During the 3 testing sessions, initially in march 2023, intermediate in july and the final one in november 2023, the subjects performed the 2 tests using the OptoJump platform.

In the case of parameter 1, contact times, we measured the duration of contact times of the sole of the foot with

the ground for each jump [10], knowing that in order to obtain the best possible results in hurdles, the contact with the ground must be as short as possible [11].

In the case of parameter 2, the power, we measured the impulse power in the ground for the most efficient detachment. The higher the impulse power, the better the breakaway in the hurdle runner's stride. [9]The expectations of this study were confirmed and all of the three subjects registered progress in all of the tests due to the proprioceptive training.

S1 Test 1 [TCont.] from 0.412 to 0.362 s., [Power] from 4.99 to 8.19 W/kg., Test 2 [TCont.] from 0.480 to 0.366 s., [Power] from 3.18 to 8.33 W/kg.;

S2 Test 1 [TCont.] from 0.439 to 0.390 s., [Power] from 3.29 to 6.76 W/kg., Test 2 [TCont.] from 0.466 to 0.388 s., [Power] from 3.76 to 6.88 W/kg.;

S3 Test 1 [TCont.] from 0.402 to 0.348 s., [Power] from 4.33 to 10.02 W/kg., Test 2 [TCont.] from 0.463 to 0.347, [Power] from 3.99 to 9.97 W/kg. (Table 3 and Table 4).

Limitations:

Potential limitations, such as sample size constraints or environmental factors affecting data collection, were acknowledged to provide context for the study's outcomes.

Table 3 - OPTOJUMP RESULTS – TEST NO. 1













No.	SUBJECTS	CONTACT TIMES	POWER
1	SUBJECT 1		
2	SUBJECT 2		
3	SUBJECT 3		

Table 4 - OPTOJUMP RESULTS – TEST NO. 2

No.	SUBJECTS	CONTACT TIMES	POWER
1	SUBJECT 1		
2	SUBJECT 2		
3	SUBJECT 3		

4. Conclusions

Significant Progression in Proprioceptive Abilities:

Efficacy of OptoJump Technology:

The utilization of OptoJump technology in monitoring and evaluating the progress of junior athletes engaged in proprioceptive training has proven to be highly effective.

The high-resolution measurement capabilities offered valuable insights into the nuances of proprioceptive development among the selected subjects.

The results of this study demonstrate substantial improvements in various proprioceptive parameters among the three subjects.

Reductions in ground contact time and enhancements in stability indices and flight time signify the efficacy of the designed training program.

Individual Variations and Training Responses:

Notable variations in the progression of proprioceptive abilities were observed among the three subjects.

Individual performance profiles indicated diverse responses to the training program, emphasizing the importance of tailored approaches in athlete development.

Practical Implications for Training and Sports Science:

The findings provide practical implications for coaches, trainers, and sports scientists involved in junior athlete development.

Tailored proprioceptive training programs utilizing advanced technologies like OptoJump can contribute significantly to enhancing athletic performance and mitigating injury risks among young athletes.

Future Directions and Considerations:

Further research with a larger sample size and extended training periods could offer deeper insights into the long-term effects and sustainability of proprioceptive improvements.

Exploring the integration of other technological advancements alongside OptoJump might provide a more comprehensive understanding of proprioceptive training methodologies.

Limitations and Recommendations:

Acknowledgment of limitations, such as the small sample size, emphasizes the need for cautious interpretation of the findings.

Recommendations for future studies include incorporating diverse training protocols and assessing the transferability of proprioceptive enhancements to sport-specific skills.

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