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The Influence of Hop Width during the Crossover Hop Test

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Study Design

Repeated measures design

Purpose

To assess the influence of hop width on performance of the crossover hop test (XHOP).

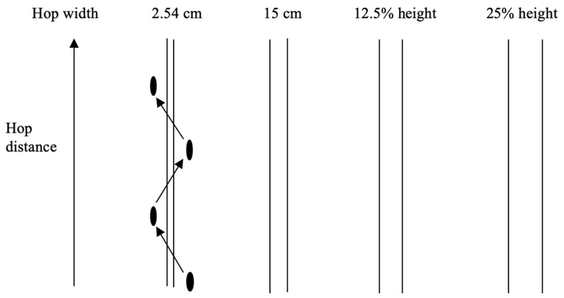
Background

The anterior cruciate ligament (ACL) is a commonly injured ligament of the knee.[1] Female athletes are at higher risk of sustaining an ACL injury, and many individuals will subsequently undergo ACL reconstruction (ACLR).[2] Following ACLR, there is concern for an ACL graft rupture. Early return to sport is one of the risk factors for ACL graft rupture as there is a lack of consensus for return to sport timeline expectations.[3] Currently, a battery of performance tests is used to guide return to sport decision making.[4] One of those tests includes a series of hop tests, and one of those single leg hop tests is the crossover hop. It is performed by jumping back and forth across a line while simultaneously progressing as far forward as possible. The literature describes a 15 cm width in the original study[5]; however, clinicians will often use a standard tape measure, which is much more narrow. Although the width of the line may impact performance, this aspect of the test is seldom manipulated and often overlooked by clinicians.

Participants

Thirty-three physically active females without history of ligamentous knee injury (mean ± SD, age: 22.5 ± 2.3 years, height: 1.7 ± 0.1 m, mass: 66.0 ± 10.5kg).

Figure 1. Hop width parameters during the XHOP.



Methods

Prior to testing, participants performed a warm up consisting of squats and vertical jumps.[6] Then, participants performed the XHOP with both limbs for the following conditions of hop width: 2.54cm (narrow), 15cm (standard)[7], 12.5% of participant height (HT1), 25% of participant height (HT2). These conditions are depicted in Figure 1. Hop width and limb order were randomized prior to testing. Hop distance was recorded for two successful jumps at each width with a maximum of five attempts for each condition.[8] Participants were allowed thirty seconds rest between trials.

Results

Table 1. Pairwise comparisons post hoc test results.

					95% Confidence Interval for Difference[b]	
Hop width (I)	Hop width (J)	Mean Difference (I-J)	Standard Error	Significance[b]	Lower Bound	Upper Bound
HT2	Narrow	-45.674*	9.194	.000	-71.531	-19.817
	Standard	-32.689*	6.992	.000	-52.352	-13.027
	HT1	-32.962*	6.538	.000	-51.349	-14.576

Based on estimated marginal means
*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Bonferroni.

❖HT2 condition was significantly different compared to all other conditions: narrow (p <0.001, d = 0.78), standard (p <0.001, d = 0.57), and HT1 (p <0.001, d = 0.58).

Figure 2. Hop distance combined mean for each hop width condition.

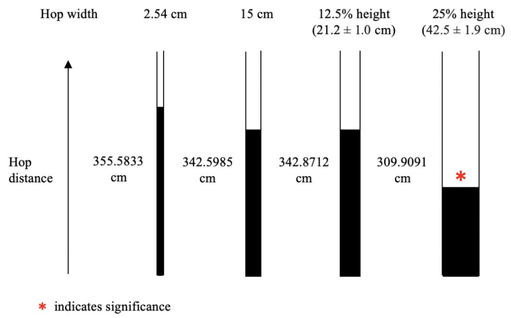
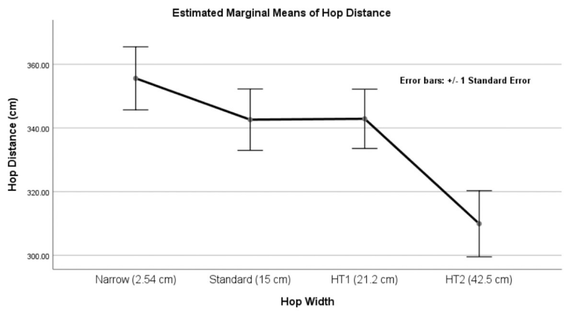


Figure 3. Estimated marginal means of hop distance.



❖Figure 2 represents the mean hop distance for each condition, with HT2 indicated as statistically significant (p <0.05).
❖Figure 3 represents the mean hop distance for each condition with 1 standard error of measurement for each condition. A downward trend in hop distance is evident as the XHOP became wider with each condition.

Discussion

❖There was no difference found in hop distance between the narrow and standard conditions. This suggests that using the original intent of a 15 cm wide ruler did not seem to influence hop distance as compared to a standard ruler or narrow condition. Therefore, it might not make a difference which condition is used in terms of hop distance.
❖There was decreased hop distance found when comparing 25% of height to all other conditions with a moderate effect size. The average mean width of HT1 was 21 cm, which may indicate the width is too similar to the standard of 15 cm to detect a difference. The condition of HT2, though, was 42 cm making it almost three times the span of the standard condition. It is reasonable to assume this condition was more challenging and required a greater level of athleticism.
❖Limitations of this study include possible learning effect and decreased generalizability.

Conclusion

Considering the prevalence of re-tear or contralateral tear following ACLR regardless of achieving ≥90% LSI, clinicians may need to evaluate the efficacy of current hop tests as a return to sport assessment. It may be beneficial to shift focus towards frontal plane assessments that effectively meet the demands of the lower extremity required during competition. Overall, additional research is suggested to more thoroughly understand the clinical implications of normalizing the XHOP for return to sport decision making.

References

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