Effects of Copenhagen Adduction Exercise Performed at Different Loading Intensities on Hip Muscle Strength Improvement and Lower Extremity Performance

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Summary

This study examined the effects of Copenhagen Adduction Exercise (CAE) at different loading intensities on hip muscle strength and jumping performance in adolescent taekwondo athletes. Athletes were divided into two groups: the Classic CAE group and the Modified CAE group. After an 8-week training period, both groups showed significant improvements in isometric and eccentric hip adductor strength ($p<0.008$). However, the Classic CAE group demonstrated greater eccentric strength gains and improved lateral and forward jump performance ($p<0.008$), though they also reported higher perceived exertion levels ($p<0.05$). These findings suggest that while both methods enhance hip adductor strength, classic CAE may offer superior benefits for eccentric strength and jumping performance in adolescent taekwondo athletes. Further research is needed to explore the impact of CAE on functional performance in different sports.

Introduction

Hip and groin injuries commonly occurs in sports that require kicking, reaching and rapid change of direction [1]. Decreased hip adduction strength has been recognized as an important modifiable risk factor for groin injury [2]. Increasing the hip adductors strength is essential in lowering the rate and occurrence of groin injuries. Due to its ability to produce a high degree of activation in the adductor longus muscle and to increase eccentric muscle strength, Copenhagen adduction Exercise (CAE) has recently become a widely used approach in the prevention of groin injuries [3,4]. The aim of this study was to compare the effects of CAE at different loading intensities, included in the routine training program, on hip muscle strength improvement and jumping performance in adolescent taekwondo athletes.

Methods

This study designed as prospective cohort study. The athletes included in the study were divided into two groups as Modified CAE group and Classic CAE group. The exercise training was incorporated into the routine training program for both groups for 8 weeks, twice a week. While the classic CAE training was applied dynamically for 8 weeks, the modified CAE training was applied isometrically for the first 5 weeks and dynamically in the following weeks. 13 athletes in the modified CAE group (mean age 15.69±1.03 years) and 13 athletes in the classic CAE group (mean age 15.46±1.33 years) completed the study. Measurements were performed at baseline, at 4th week, at 8th week and at 16th week (follow-up). Eccentric muscle strength of the hip adductors were measured with a manual hand-held dynamometer; lower extremity jumping performance was assessed with single leg forward hop tests. A two-way (group × time) repeated measures analysis of variance test was used to examine the changes over time in different exercise groups.

Table 1: Comparison of eccentric hip adduction strength between groups.

	MCAE group Mean±SD	CCAE group Mean±SD	Time effect	Group x Time interaction
0.wk	3,09±0,67	2,79±0,57	$F_{(3,72)}$=40,200 **p<0,001** np^2=0,626	$F_{(3,72)}$= 5,281 **p=0,002** np^2=0,180
4.wk	3,46±0,69	3,58±0,57		
8.wk	3,76±0,69	4,02±0,58		
16.wk	3,43±0,64	3,79±0,95		

Results and Discussion

As a result of the study; it was found that both exercise trainings improved eccentric hip adductor muscle strength ($p<0.008$) (Figure 1). The hip eccentric adductor strength improvement was higher in the classic CAE group ($p<0.05$) (Table 1). It was also found that single leg forward jump performance improved over time in the classic CAE group ($p<0.008$) (Table 2). Perceived exertion level was higher in the classic CAE group ($p<0.05$).

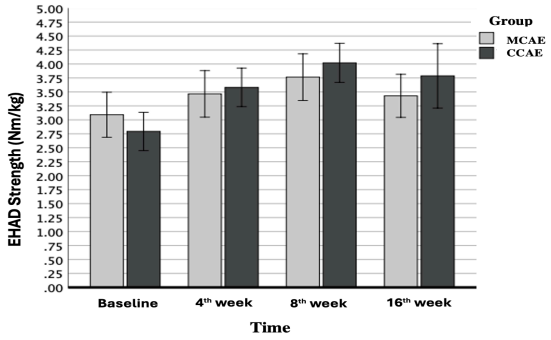

Figure 1: Presentation of eccentric hip adduction strength improvements (EHAD) between groups.

Conclusions

In conclusion, for adolescent taekwondo athletes, CAE training is recommended to be performed dynamically for 8 weeks for performance improvement and to achieve advanced eccentric strength improvement in the hip adductors. There is a need for studies to investigate the effects of CAE training on functional performance in different sports.

References

[1] Hölmich P et al. (2007). *Br J Sports Med*, **41**: 247-52.
[2] Engebretsen AH. et al (2010). *Am J Sports Med*, **38**: 2051-7.
[3] Harøy J et al. (2019). *Br J Sports Med*, **53**: 150-7.
[4] Harøy J et al. (2017). *Am J Sports Med*, **45**: 3052-9.

Table 2: Comparison of single leg forward hop tests between groups.

	MCAE group Mean±SD	CCAE group Mean±SD	Time effect	Group x Time interaction
0.wk	185,46±16,47	185,00±16,12	$F_{(3,72)}$=22,241 **p<0,001** np^2=0,481	$F_{(3,72)}$=10,152 **p<0,001** np^2=0,297
4.wk	185,69±15,40	200,85±16,45		
8.wk	190,38±16,68	209,31±21,83		
16.wk	189,85±17,12	203,15±23,89		