

OPEN VS CLOSED KINETIC CHAIN REHABILITATION: EFFECTS ON THE KNEE EXTENSOR MECHANISM AFTER KNEE SURGERY

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Introduction

There is a common belief amongst clinicians that closed kinetic chain (CKC) resistance training of the knee extensors is less harmful to the knee extensor mechanism than open kinetic chain (OKC) training of this muscle group. The belief that knee extensor CKC resistance exercise is safer than OKC exercise for the knee extensor mechanism is based on the decreased patellofemoral joint pressure typical of the CKC method during resistance of the knee extensors in the more extended range of motion (Steinkamp et al. 1993). The knee extensor mechanism may be susceptible to overuse-type problems after knee anterior cruciate ligament reconstruction surgery, especially if the knee extensor mechanism is the graft source. Closed and open kinetic chain training have been compared for their effects on the knee extensor mechanism after anterior cruciate ligament reconstruction in two studies (Bynum et al. 1995, Morrissey et al. 2002) with the results not offering clear conclusions. The purpose of the present study is to offer additional information to the growing body of knowledge about possible differences between these two forms of exercise.

Methods

In particular, the effects of the two exercise methods on the knee extensor mechanism in the period from 9-15 weeks after anterior cruciate ligament reconstruction were compared in a randomised controlled trial. This was done in 49 subjects with the following personal characteristics for each group.

Variable	CKC group Mean (SD) range	
Gender	5F 20M	7F 17M
Graft type (H = hamstrings, PT = patellar tendon)	H = 15, PT = 10	H = 6, PT = 18
Age (years)	32 (8) 19-49	33 (7) 23-56
Pre-test body mass (kg)	81 (12) 60-118	76 (14) 53-108
Pre-test height (cm)	177 (8.5) 162-195	172 (9) 157-187
Time from injury to surgery (days)	811 (821) 38-3082	1340 (1670) 114-6519
Final load in knee extensor training (kg)	79 (45) 0-250	5.2 (4.4) 0-18
Sessions attended	12 (4) 5-18	11 (4) 3-17

Immediately prior to and after their respective training programmes the subjects were tested using the Hughston Clinic knee self-assessment questionnaire. In the analysis for this report, results of responses to questions 1 (How often does your knee hurt?), 2 (How bad is the pain at its worst?), 14 (Do you have problems climbing stairs?), 15 (Do you have problems going down stairs?), 22 (Do you have problems kneeling?), 23 (Do you have problems squatting?), 25 (Does your knee ache while you are sitting?) and 26 (Do you have problems getting in and out of a chair?) were analysed because of their relationship to the status of the knee extensor mechanism. Regression analysis was run for the post-test scores for each of these questions and the following were considered for their possible effects on these scores: 1) graft type; 2) age; 3) group (CKC vs OKC); 4) injury-to-surgery period; and 5) pre-test score for the individual question.

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Results

For all questions graft type, group and injury-to-surgery period was not significantly related to post-test score. Furthermore, pre-test score was significantly related to post-test score (in all cases the relationship was positive, i.e. the higher the pre-test score, the higher the post-test score; Pearson's

coefficients range: 0.406 to 0.663). For questions 14 (stair ascent), 15 (stair descent), 23 (squatting) and 26 (in and out of chair), the post-test score was related to the age of the subject (with higher age correlating with poorer (i.e. higher) post-test score); range of Pearson's coefficients = 0.255 to 0.348).

Conclusions

These results indicate that there are no differences in the short-term effects of CKC and OKC knee extensor resistance training on the knee extensor mechanism in middle stage rehabilitation after anterior cruciate ligament reconstruction.

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References

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