Naučni članak

The importance of closed kinetic chain in rehabilitation of knee after ACL reconstruction

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Značaj zatvorenog kinetičkog lanca u rehabilitaciji kolena nakon rekonstrukcije ACL

Sažetak

Cilj studije je prezentovanje komparativne evaluacije između aktivnosti otvorenog i zatvorenog kinetičkog lanca u rehabilitaciji stabilnosti kolena nakon rekonstrukcije prednjih ukrštenih ligamenata (ACL) koristeći se ulogom proprioceptivnog sistema kolena sa svrhom ranijeg povratka sportskoj aktivnosti.

Ključne reči: kinetički lanac, rehabilitacija, ACL

Abstract

This study try to present a comparative evaluation between open kinetic chain(OKC) and closed kinetic chain(CKC) in rehabilitation the stability of knee, after ACL reconstruction, using the role of proprioceptive system of knee, because we want to obtain an early return to sport activity.

Key words: kinetic chain, rehabilitation, ACL

INTRODUCTION

The choice between exercises where the resistance to the knee extensors occurs with the distal segment of the limb not fixated and exercises where the distal segment is fixated , is hard to made. These forms of exercises are commonly referred to as open kinetic chain (OKC) and closed kinetic chain (CKC) exercises. Knee extensor exercises with distal fixation have also been adopted because of the suspicion that this type of exercise will result in greater enhancement of function and is safer for the patellofemoral joint than nondistally (Bennett 1993*)* fixated resistance of the knee extensors. The ability to select CKC versus OKC knee extensor training due to possible pain effects The aim of this study is to make a comparasion between the effects of open kinetic chain(OKC) and closed kinetic chain(CKC), after ACL reconstruction(ACLR) (Fitzgerald 1997)**.**

METHODS

Subjects

Within the first 2 weeks following surgery, these subjects were given a written and verbal explanation of the study and were invited to participate in the study. We studied 26 patients with age mean 25years.Alls are athletes and they suffered ACLR. We have 15patients with CKC, and 11patients with OKC. Subjects were included in the study if all of the following criteria were met: (1) number of days between surgery and pretest was less than 20, (2) number of days between the pretest and the posttest was less than 35, and (3) there were 8 to 13 treatment sessions between the pretest and the posttest. After initial testing, subjects were assigned to 1 of 2 treatment groups using block randomization This was done to keep a balance of subjects in each group throughout the study to ensure interim analysis could be performed with nearly equal numbers of subjects in the groups. Of the 15 subjects in group C (CKC training), 11 subjects had knee surgery prior to the ACL reconstruction surgery and 4 subjects had additional procedures (partial meniscectomy) at the time of the ACL reconstruction surgery. Of the 11 subjects in group O (OKC training), 7 subjects had knee surgery prior to the ACL reconstruction surgery and 4 subjects had additional procedures at the time of the ACL reconstruction surgery (Bennett 1993)**.** The mean period between original knee injury and ACL reconstruction surgery was 30 months for group C and 26 months for group O. We estimated our subjects using: clinical evaluation; functional evaluation; Our patients were tested at 2 weeks after ACLR and after 5weeks.

The target date for test initiation was 2 weeks post-ACL reconstruction surgery. Subjects were allowed to participate in the study if passive flexion of their injured knee was near 90 degrees and they were able to walk without a walking aid. These criteria were used to avoid having subjects enter the study before their walking and stair climbing could be tested. After subjects read and signed an informed consent form, they participated in the following tests: laxity of knee using Lachman test, knee status self-assessment questionnaire, knee girth using a cloth tape (Powers 1998); passive ROM in knee flexion and extension using a standard goniometer, isotonic knee extensor muscle performance in the OKC (1 repetition maximum [RM]), isotonic knee and hip extensor muscle performance in the CKC (1 RM on a leg press machine), biomechanical analysis of knee function during walking and stair use, isokinetic performance of the hip extensors in the OKC (with movement from 90° to 0° of hip flexion at 210°/s), and isometric (60° of flexion) and isokinetic performance of the knee flexors and extensors in the OKC (with movement from 90° to 0° of knee flexion at 60° and 210°/s)(Fitzgerald 1997). VAS-questions were: (1) How often does your knee hurt? (never; daily, even at rest), (2) How bad is the pain at its worst? (none; severe, requiring pain pills every few hours), and (3) Does your knee ache while you are sitting? (never; always). Visual analog scales were also used in the isometric knee testing. Pain amount (VAS score) and location were assessed after each contraction during this test series. We have chosen to include only the data from the knee extensor tests in order to focus analysis on anterior knee pain.(Bennett 1993) The pain during isometric testing was chosen because it was the highest during testing. Testing was performed with the subjects sitting with their hips flexed to approximately 80 degrees and the knee held by the actuator arm at 60 degrees of flexion. The injured leg was tested first. Prior to the start of each subject's efforts, the machine weighed the leg by moving the subject's leg

passively through the ROM, in order to account for the torque caused by the weight of the lower leg and fixation assembly.. No warm-up contractions were included, and each subject performed a 5-second maximal contraction of the knee extensors followed by 10 seconds of rest and then a 5-second maximal contraction of the knee flexors followed by 10 seconds of rest. This was repeated 3 times. After each contraction, the subjects completed a pain VAS. For each session, the following were recorded for the isometric contraction that produced the greatest torque: (1) pain amount, (2) pain location, and (3) torque output. The examiners were masked to subject group assignment.

Training

We used this programm 4times/week, 4weeks and we associated physical therapy with proprioceptive exercise for increase stability of knee joint. We had 2 treatment groups differed in the type of isotonic resistance training used for their hip and knee extensors. Subjects in group C performed unilateral CKC (Powers 1998) resistance training of the hip and knee extensors on a leg press machine with all subjects in this group using the same device for this exercise regardless of treatment site. The leg press machine was set so that the subjects were positioned supine with the hip and knee in approximately 90 degrees of flexion at the beginning of each lift and the trunk slightly inclined from a parallel-to-floor position. A small block of wood was placed under the heel of the leg being exercised, and the subjects were instructed to perform the exercise without making contact between the forefoot and the leg press platform. This was done in an effort to prevent the subjects from using their plantar flexors during the exercise. Subjects in group O exercised the same leg muscle groups (hip and knee extensors) in the OKC (Bennett 1993) using either ankle weights or machines designed for isolated resistance of those muscle groups (ie, knee and hip extension machines). For the hip and knee extensor muscle resistance exercises, 3 sets of 20 RM were done in each session. The training ROM for both hip and knee extensors in both groups was 90 to 0 degrees. Hypomobility massage, manual stretches and self-stretches of leg muscles, tibiofemoral and patellar mobilization.

RESULTS

Regards to mobility we observed a gain of mobility after 2weeks with 30% and after 5 weeks with 80%,if we used CKC. Regards Lachman test we observed positive test only at 3 patients(20%),that used CKC,and positiv test at 8patients(72%) that used OKC. Following adjustment for site treatment,when compared OKC exercise to CKC exercise,was found tolead to a 8% increase in looseness with a 95% confidence interval of –7% to +20%.This regards knee laxity. For the analysis of pain during maximum isometric contractions of the knee extensors, the torque data was first analyzed to determine whether one group was applying greater loads (ie, greater injured/uninjured ratios for maximum peak torque) to the knee than the other group during this testing. The injured/uninjured ratios were used instead of analyzing the torque in the injured leg alone. This was done to avoid problems that can occur when torque levels are influenced by factors other than the status of the injured knee (eg, lean body mass of the subject). That is, we wanted to compare the 2 groups for knee pain during knee physical stress, and we believed that this comparison required approximating the stress to tissue size (eg, of the patellar ligament). Thus, we standardized the torque of the injured knee to the torque of the uninjured knee torque. Therefore, the force applied to the knee

during isometric knee extensor contractions was not a potential confounder of the pain data collected in these tests.

CONCLUSIONS

These results indicate that the great concer about the safety of OKC knee extensor training in the early period after ACLR may not be well founded. Using CKC is important for rehabilitation knee afte ACLR because so we can increase the stability of knee,using resistance for extensors,that induce a increase of stimulation in proprioceptive system around knee joint, that favorise a good recovery of ACL and an early retur to sport activity.

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