

Anteroposterior Stability and Knee Strength after Anterior Cruciate Ligament Reconstruction in Patients Older than 50 Years Compared to Younger Patients

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Purpose: The treatment for anterior cruciate ligament injury in middle-aged people older than 50 years remains controversial. This retrospective study was conducted to test the hypothesis that clinical outcomes are similar in the two age groups for anterior cruciate ligament reconstruction.

Methods: A total of 41 patients were included. Twenty patients older than 50 years and 21 younger than 40 years. Patient data collected included preoperative and postoperative range of motion, visual analog scale, Lysholm Knee Scoring, International Knee Documentation Committee Knee Evaluation Form scores, anterior drawer test, Lachman test and pivot-shift test.

Results: There were no significant differences in postoperative range of motion, visual analog scale score, anterior drawer test, Lachman test and pivot-shift test. Lysholm score and International Knee Documentation Committee knee evaluation form score between the two groups were significantly better in the younger age than the older group.

Conclusions: Anterior cruciate ligament reconstruction in younger patient is more effective comparable to patients older than 50 years in the treatment of anterior cruciate ligament tears.

Keywords: older than fifty years, younger patients, anterior cruciate ligament reconstruction

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Introduction

Anterior cruciate ligament injury is one of the most common sports injuries. Anterior cruciate ligament reconstructions are performed most often in young athletic patients⁽¹⁾. With increasing mean age and life expectancy, the physical activity level in the elderly population is also increasing. Middle-aged individuals participate in sports activities more often than previously reported⁽²⁾. Therefore, ACL injuries are becoming more frequent in middle-aged patients⁽³⁾.

In young and active individuals, ACL reconstruction has been regarded as a reliable procedure with excellent outcome for ACL insufficiency. The treatment for ACL injury in middle-aged people older than 50 years remains controversial. Traditionally, these individuals are frequently managed with conservative treatments because did not perform highly demanding activities and possible inferior surgical outcomes⁽⁴⁾. However, recent studies showed that conservative treatment might increased risk of residual instability, re-injury and degenerative joint changes⁽⁵⁾. Several studies have shown excellent results of ACL reconstruction in patients over 40 years old, including a greater

return to sport activity⁽⁶⁾. Surgical treatment showed favorable outcomes in terms of joint stability and patient satisfaction, with comparable results to younger patients⁽⁷⁾. Moreover, only a few studies compared the outcomes after ACL reconstruction between patients older than 50 years and young patients⁽⁸⁻⁹⁾.

Purpose

The purpose of this study was to retrospectively compare the clinical outcomes of two age groups, patients older than 50 years and younger patient, and to determine during reconstruction of a ACL rupture improves the stability of the knee joint.

Patients and Methods

A retrospective cohort review was conducted between 2007 and 2017 of patients diagnosed with anterior cruciate ligament tears based on physical examination and magnetic resonance imaging (MRI). In younger group, we matched subjects selection for an equal number of both group. Inclusion criteria included associated meniscal tears, associated chondral defect, associated medial collateral ligament injuries grade I, normal alignment, normal contralateral knee and willingness to participate in the prescribed physical therapy program. Exclusion criteria included the

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presence of fractures, associated medial collateral ligament injuries grade II-III, overall erosion of the cartilage and having undergone revision. During follow-up, 4 cases were lost, leaving 41 cases enrolled in our study.

Surgical Technique

Each surgical procedure was performed by a single surgeon. In all cases, autologous hamstring tendon was harvested from the ipsilateral side of the knee joint. Both the semitendinosus and gracilis tendons were harvested. The graft tendon was fixed on the femoral side with an Endobutton loop. Then, the graft tendon was fixed in tibia using bioabsorbable interference screws

All the isolated ACL injury patients received the same postoperative physical therapy program. For the first 3 weeks postoperatively, patients were limited to partial weight bearing with a crutch. After 3 months patients could start jogging. Six months postoperatively, patients were allowed to participate freely in sporting activities. In the cases with a meniscal or cartilage injury, ROM exercise was restricted for 3 weeks and weight bearing restricted for 6 weeks.

All tests were administered by the same person. All the preoperative assessments were performed on the day before surgery. MRI was used when the indications for surgery were uncertain. Postoperative assessment was performed at the two years after surgery. Preoperative and postoperative results were compared. The objective evaluation measured the mean values of the range of motion (ROM) of the knee joint. Subjective evaluation consisted of visual analog scale (VAS) score, Lysholm score, and International Knee Documentation Committee (IKDC) Knee Evaluation Form score. For measurement of anterior tibial-femoral translation, the anterior drawer test, Lachman test, and pivot-shift test were performed.

Descriptive statistics were calculated for all data categories. Chi-square was used to compare categorical variables. Independent sample Student's t-test was used to compare continuous variables between groups. *P*-values less than 0.05 were considered statistically significant.

Results

The 41 patients in the study had an average age of 40.2 years (range 18-60 years). Patients were divided into two groups based on the age, the older

patient (> 50 years) group of 20 patients and younger group (< 40 years) of 21 patients. All patients were followed up for more than two years after discharge from the hospital. The average follow-up was 27.1 months (range 24 months to 39 months). Demographic data are shown in Table 1.

Preoperatively, the mean ROM was $129.8^\circ \pm 16.6^\circ$ in the older group and $131.8^\circ \pm 17.3^\circ$ in the younger group. Postoperatively, the ROM values were $140.8^\circ \pm 8.9^\circ$ and $143.7^\circ \pm 7.5^\circ$, respectively; the difference was not statistically different ($P = 0.265$). There were no cases of limitation of ROM at the final follow-up.

Preoperatively, the VAS scores were 4.7 ± 1.9 in the older group and 4.5 ± 1.8 in the younger group. Postoperatively, the figures were 1.9 ± 0.8 and 1.8 ± 0.9 , respectively, with no significant difference between the groups. Preoperatively, the Lysholm scores were 68.6 ± 8.7 in the older group and 69.7 ± 8.9 in the younger group. Postoperatively, they were 83.6 ± 5.6 and 87.3 ± 5.5 , respectively, the Lysholm scores was significantly better in the younger group than the older group ($P = .039$). Finally, preoperatively, the IKDC Subjective Knee Evaluation Form scores were 66.4 ± 6.2 in the older group and 68.7 ± 7.5 in the younger group, and postoperatively, they were 84.5 ± 6.3 and 88.9 ± 5.5 , respectively, the IKDC Subjective Knee Evaluation Form scores was significantly better in the younger group than the older group ($P = .022$) (Table 2).

Preoperatively, the anterior drawer test was positive everyone in both groups. Postoperatively, the anterior drawer test was negative in 16 cases (80%) in older group and 19 cases (90.4%) in younger group. There were no cases of 2+ or worse and no significant differences between the groups. Preoperatively, the Lachman test was positive everyone in both groups. Postoperatively, the Lachman test was negative in 18 cases (90%) in older group and 20 cases (95.2%) in younger group. There were no cases of 2+ or worse. There were no significant differences between the groups. Preoperatively, the pivot-shift test was positive everyone in both groups. Postoperatively, the pivot-shift test was negative in 17 cases (85%) and 19 cases (90.4%). There were no cases of 2+ or worse. There were no significant differences between the groups. (Table 3)

Table 1 Patient demographics.

	Older group (n=20)	Younger group (n=21)	P- value
Gender (M/F)	18:2	17:4	0.412
Age (years) (SD)	54.3 (2.8)	26.3 (3.1)	< 0.001
Injury time to operation (months) (SD)	7.2 (2.5)	7.8 (2.8)	0.473
Meniscus injury (%)	12 (60%)	14 (66.67%)	0.196
Chondral defect (%)	6 (30%)	3 (14.28%)	0.224
Follow-up (months) (SD)	26.8 (3.0)	27.4 (3.2)	0.539

Table 2 Clinical Scores.

	Older group (n=20)	Younger group (n=21)	P- value
VAS score			
Preoperative	4.7 ± 1.9	4.5 ± 1.8	0.731
Last follow-up	1.9 ± 0.8	1.8 ± 0.9	0.709
Lysholm score			
Preoperative	68.6 ± 8.7	69.7 ± 8.9	0.565
Last follow-up	83.6 ± 5.6	87.3 ± 5.5	0.039
IKDC subjective knee evaluation form			
Preoperative	66.4 ± 6.2	68.7 ± 7.5	0.292
Last follow-up	84.5 ± 6.3	88.9 ± 5.5	0.022

Table 3 Results of Anterior Stability Test.

Test	Older group (n=20)		Younger group (n=21)		P-value (Distribution at last follow-up)
	Preoperative	Last follow-up	Preoperative	Last follow-up	
Anterior drawer					0.342
—	0	16	0	19	
1+	1	4	2	2	
2+	17	0	17	0	
3+	2	0	2	0	
Lachman					0.519
—	0	18	0	20	
1+	2	2	3	1	
2+	16	0	16	0	
3+	2	0	2	0	
Pivot shift					0.592
—	0	17	0	19	
1+	3	3	3	2	
2+	14	0	15	0	
3+	3	0	3	0	

There were a total of 16 cases (39.02%) of medial meniscal tear: 7 (35%) in the older group and 9 (42.85%) in the younger group. There were no significant differences between the groups. There were a total of 18 cases (43.90%) of lateral meniscal tear: 8 (40%) in the older group and 10 (47.6%) in the younger group, there were no significant differences between the groups. There were a total of 10 cases (24.39%) of cartilage injury: 7 (35%) in the older group and 3 (14.28%) in the younger group. There were no significant differences between the groups. (Table 4). There were no significant differences between the patterns of meniscal tears between the groups (Table 5). In cases with meniscal tear, a meniscectomy or meniscal repair was performed. Injuries of Cartilage injury of International Cartilage Repair Society grade IV with an area of more than 1 cm² surrounded by normal cartilage were treated by microfracture; cases with overall erosion of the cartilage were excluded from the study. A meniscectomy was performed in 3 (15%) of the 7 cases of medial meniscal tear in the older group, and meniscal repair was performed in the remaining 4 (20%). Meniscectomy was also performed in 2

(9.52%) of the 9 cases of medial meniscal tear in the younger group, and meniscal repair was performed in the remaining 7 cases (33.33%). There were no significant differences between the groups. A meniscectomy was performed in 3 (15%) of the 8 cases of lateral meniscal tear in the older group, and meniscal repair was performed in the remaining 5 (25%). Meniscectomy was also performed in 3 (14.28%) of the 10 cases of lateral meniscal tear in the younger group, and meniscal repair was performed in the remaining 7 cases (33.33%). There were no significant differences between the groups. A microfracture was performed in 4 (20%) of the 7 cases of chondral defect in the older group and 1 (4.76%) of the 3 cases of chondral defect in the younger group. There were no significant differences between the groups. (Table 6)

There were 3 cases with limited ROM of the joint post-surgery, one patient in the younger group and two in the older group. In these 3 cases, physical therapy was performed postoperatively for 3 months. At the two years after surgery, there were no cases with limited ROM and no cases with infection at the two years after surgery.

Table 4 Combined Injuries.

	Older group (n=20)	Younger group (n=21)	P-value
Medial meniscus	7 (35%)	9 (42.85%)	0.606
Lateral meniscus	8 (40%)	10 (47.6%)	0.623
Chondral defect	7 (35%)	3 (14.28%)	0.122

Table 5 Patterns of meniscal tears.

	Older group (n=15)	Younger group (n=19)	P-value
Vertical	3	4	0.867
Oblique	2	5	
Radial	4	3	
Horizontal	3	4	
Complex	3	3	

Table 6 Treatment of Combined Injuries.

	Older group (n=20)	Younger group (n=21)	P-value
Medial meniscus			
Meniscectomy	3 (15%)	2 (9.52%)	0.592
Repair	4 (20%)	7 (33.33)	0.335
Lateral meniscus			
Meniscectomy	3 (15%)	3 (14.28%)	0.984
Repair	5 (25%)	7 (33.33%)	0.557
Chondral defect			
Microfracture	4 (20%)	1 (4.76%)	0.136
Observation	3 (15%)	2 (9.52%)	0.592

Discussion

The finding of this study is that most of the patients, regardless of age, can have significantly improved outcomes, including stability and total clinical scores compared with preoperative status. Knee stability is not restored by conservative treatment alone. The 37% of patients who were managed conservatively had recurrent injuries⁽¹⁰⁾. Decreased lower limb strength (mainly involving the quadriceps) which is typical following ACL injury can lead to functional deficits⁽¹¹⁾.

Blyth et al. showed that the Lysholm score improved to 93 following ACL reconstruction in patients older than 50 years⁽¹²⁾. These studies had follow-up periods of 2–8 years. Because the Lysholm score range assumed that “good” for scores of 84–94, it can be inferred that the patients in this study improved to similar levels compared to previous studies with longer follow-up. However, Lysholm scale mainly focuses on the patient’s perception of function in those activities of daily living and at various intensities of athletic activity, without evaluating high-performance knee stability or physical examination⁽¹³⁾. Therefore, low-demand patients tend to score high in the item of instability especially when they avoid those activities causing instability. Future study blending measures assessing patient’s activity level in working and sporting such as Tegner activity scale⁽¹⁴⁾ is needed to avoid this potential bias.

The IKDC score not only assesses knee symptoms and function based on the level of sports activity, but also identifies inconvenience in daily activities and psychological anxiety⁽¹⁵⁾. It may be inferred that the younger group had a higher level of functional demand in daily activity than the older group; for this reason, they experienced more anxiety about discomfort, which invaded the preoperative IKDC scale. Moreover, after surgery, younger patients can experience more the advantage of surgery after proper training than older patients. Previous studies also reported that younger patients had better IKDC scores than older patients although statistical difference was not significant. Similar to the finding of the present study, the study by Osti⁽⁸⁾ further showed that the younger group had a higher preinjury IKDC level than the older group, and most of them can return to the preinjury level after surgery. Although not as good as the younger patients, patients older than 50 years can still have good knee functional improvements postoperatively. Therefore, ACL reconstruction should be considered in patients in their 50 s who didn’t existing physical contraindications to enable recovery of previous activity levels and to improve the quality of life.

One of most important factors to analyze is that despite all patients of older than 50 years group return to sport activity, only 56% returned to pre-injury level; this result seems to be lower especially if compared to previous study⁽¹⁶⁾. The patients who

did not return to sport activity had associated injuries, especially meniscal tears and cartilage damages. As simultaneous ACL reconstruction and meniscectomies give better outcomes than meniscectomies performed in unstable knees⁽¹⁷⁾, almost all the patients with meniscal tears were arthroscopically managed.

At a mean follow-up of five years, Wolfson et al.⁽¹⁸⁾ reported a high incidence of residual instability (19%) and reoperation (38%) in 32 patients with a mean age of 58.4 years at the time of operation. They concluded that the degree of patellofemoral arthritis, graded with the Outerbridge classification⁽¹⁹⁾, may be associated with poor outcomes and should be considered in making a decision for operative treatment.

Steadman et al.⁽²⁰⁾ showed long-term decreased pain and improved function in 95% of patients younger than 45 years in progress microfracture technique followed by careful rehabilitation; however, chondral changes have a negative effect on the results of ACL surgery. The pre-operative mild degeneration at imaging in 8 patients (40%) older than 50 years is a cause for concern. Although long-term symptomatic pain relief and stability are get by patients (mean age 30 years) in progress isolated ACL reconstruction for chronic instability with pre-operatively radiographic evidence of degenerative osteoarthritis⁽²¹⁾, ACL or meniscal injuries change the static and dynamic loadings of the knee, with increased deleterious forces on the cartilage and other joint structures⁽²²⁾. Other authors⁽²³⁾ have supported for ACL reconstruction to prevent meniscal and cartilage injuries in chronically unstable knees, both are associated with poor function and rapid progression of knee degenerative changes. Another concern in the elderly population is bone quality and the healing response, which can affect graft incorporation and healing process⁽²⁴⁾.

The present study recognize the benefit of ACL reconstruction over clinical improvements and functional restoration in patients older than 50 years. Osti et al.⁽⁸⁾ analyzed the outcomes of ACL reconstruction comparing patients older than 50 years with patients younger than 30 years. Their study showed no difference between the two groups in the arthrometric evaluation. In contrast to this study in which no difference was found between the age groups in the arthrometric evaluation, our results showed an equal stability in patients of younger group compared to older than 50 years group. Conteduca et al.⁽²⁵⁾ hypothesized that the increased stiffness in older patients could be due to a variety of physiological and pathological factors, such as different scar tissue formations, initial degenerative joint changes, different hormonal patterns (especially in women), and loss of elasticity of tissue. In the literature, it has reported that tendons and myotendinous junctions are modified with aging

by changes in the structure and mechanical properties becoming progressively stiffer.

This study has a few limitations. It was a retrospective study, so there was potential for selection bias. In some cases, detailed information was not available; in those cases, we recorded total clinical scores rather than scores for individual factors. The size of the study was small; for a power of the test > 80%, we should have included 38 patients in each group. We may not be able to concluded the results of this study. Finally, the follow-up period of two years may be too short to draw conclusions about long-term outcomes.

Conclusions

Anterior cruciate ligament reconstruction in younger patient is more effective comparable to patients older than 50 years in the treatment of anterior cruciate ligament tears.

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การศึกษาเปรียบเทียบระหว่างผู้ป่วยอายุมากกว่า 50 ปีและผู้ป่วยอายุน้อยกว่าในการรักษาผู้ป่วยที่มีเอ็นไขว้หน้าข้อเข่าขาด

สมบูรณ์ วุฒิพิริยะอังกูร, พบ

วัตถุประสงค์: เพื่อศึกษาเปรียบเทียบผลการรักษาระหว่างผู้ป่วยอายุมากกว่า 50 ปีและผู้ป่วยอายุน้อยกว่าในการรักษาผู้ป่วยที่มีเอ็นไขว้หน้าข้อเข่าขาด

วิธีการศึกษา: ผู้ป่วยจำนวน 41 ราย แบ่งเป็น 2 กลุ่ม ได้แก่กลุ่มอายุมากกว่า 50 ปี จำนวน 20 รายและกลุ่มอายุน้อยกว่าจำนวน 21 ราย เป็นการศึกษาวิจัยแบบย้อนหลังโดยดูองศาการเคลื่อนไหวของข้อเข่า, ระดับความเจ็บปวดหลังการผ่าตัด, Lysholm score, International Knee Documentation Committee knee evaluation form score, ผลการตรวจ anterior drawer test, Lachman test และ pivot-shift test

ผลการศึกษา: ผลการศึกษาไม่แตกต่างกันอย่างมีนัยสำคัญในองศาการเคลื่อนไหวของข้อเข่า, ระดับความเจ็บปวดหลังการผ่าตัด, ผลการตรวจ anterior drawer test, Lachman test และ pivot-shift test กลุ่มอายุน้อยกว่ามีผลการตรวจ Lysholm score, International Knee Documentation Committee knee evaluation form score หลังการผ่าตัดที่ดีกว่าอย่างมีนัยสำคัญ

สรุป: การรักษาผู้ป่วยกลุ่มอายุน้อยกว่าที่มีเอ็นไขว้หน้าข้อเข่าขาดมีประสิทธิภาพดีกว่ากลุ่มที่มีอายุมากกว่า 50 ปี
