

TOTAL ARTHROSCOPIC RECONSTRUCTION OF THE ANTERIOR CRUCIATE LIGAMENT

RECONSTRUÇÃO ARTROSCÓPICA TOTAL DO LIGAMENTO CRUZADO ANTERIOR

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ABSTRACT

Introduction: Total internal arthroscopic anterior cruciate ligament reconstruction is one of the new technologies in recent years. The main advantage is the need for only one tendon for the surgical procedure. **Objective:** Compare the clinical effects of total internal and traditional anterior cruciate ligament reconstruction techniques. **Methods:** From January 2019 to January 2022, the clinical data of 45 patients with anterior cruciate ligament reconstruction were retrospectively analyzed, including 32 males and 13 females aged 18-33 years, mean of 24.2 ± 3.3 years. Total internal reconstruction was performed in 22 cases (total internal group) and traditional reconstruction in 23 cases (traditional group). The two groups recorded and compared the time of injury, duration of surgical procedure, postoperative VAS score, and recovery of knee function. The International Knee Literature Committee (IKDC) and the Lysholm scoring system were used to evaluate clinical efficacy. **Results:** 45 patients were followed for 14 to 18 months, mean (15.4 ± 1.3) months. There were no significant differences between the two groups in time between operation and injury, duration of operation, IKDC, and Lysholm score of the affected knee at the last follow-up. However, there were significant differences in the VAS score on day one, day three, day seven, two weeks, and one month after the operation ($P < 0.05$), with no significant difference at three months, six months, and one year after the operation. **Conclusion:** The effect of total internal reconstruction of the anterior cruciate ligament is equivalent to that of traditional methods, with less postoperative pain, making it the ideal choice for this treatment. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Anterior Cruciate Ligament; Arthroscopy; Reconstructive Surgical Procedures; Treatment Outcome.

RESUMO

Introdução: A reconstrução artroscópica interna total do ligamento cruzado anterior é uma das novas tecnologias dos últimos anos. A principal vantagem é a necessidade de apenas um tendão para o procedimento cirúrgico. **Objetivo:** Comparar os efeitos clínicos da técnica interna total e da técnica tradicional na reconstrução do ligamento cruzado anterior. **Métodos:** Entre janeiro de 2019 a janeiro de 2022, os dados clínicos de 45 pacientes com reconstrução do ligamento cruzado anterior foram analisados retrospectivamente, incluindo 32 homens e 13 mulheres, com idades entre 18-33 anos, média de $24,2 \pm 3,3$ anos. A reconstrução interna total foi realizada em 22 casos (grupo interno total) e a reconstrução tradicional em 23 casos (grupo tradicional). O tempo da lesão, duração do procedimento cirúrgico, escore de VAS pós-operatório e recuperação da função do joelho dos dois grupos foram registrados e comparados. O Comitê Internacional de Literatura de Joelho (IKDC) e o sistema de pontuação de Lysholm foram utilizados para avaliar a eficácia clínica. **Resultados:** 45 pacientes foram acompanhados durante 14 a 18 meses, média de ($15,4 \pm 1,3$) meses. Não houve diferença significativa entre os dois grupos no tempo entre a operação e a lesão, a duração da operação, a pontuação do IKDC e Lysholm do joelho afetado no último acompanhamento. Porém, houveram diferenças significativas na pontuação do VAS no primeiro dia, terceiro dia, sétimo dia, duas semanas e um mês após a operação ($P < 0,05$), sem diferença significativa em três meses, seis meses e um ano após a operação. **Conclusão:** O efeito da reconstrução interna total do ligamento cruzado anterior é equivalente ao dos métodos tradicionais, com menor dor pós-operatória, sendo a escolha ideal para esse tratamento. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Ligamento Cruzado Anterior; Artroscopia; Procedimentos Cirúrgicos Reconstructivos; Resultado do Tratamento.

RESUMEN

Introducción: La reconstrucción artroscópica interna total del ligamento cruzado anterior es una de las nuevas tecnologías de los últimos años. La principal ventaja es la necesidad de un solo tendón para el procedimiento quirúrgico. **Objetivo:** Comparar los efectos clínicos de la técnica interna total y la técnica tradicional en la reconstrucción del ligamento cruzado anterior. **Métodos:** Desde enero de 2019 hasta enero de 2022, se analizaron retrospectivamente los datos clínicos de 45 pacientes con reconstrucción del ligamento cruzado anterior, incluidos 32 hombres y 13 mujeres, de entre 18 y 33 años, con una media de $24,2 \pm 3,3$ años. Se realizó una reconstrucción interna total en 22 casos (grupo interno total) y una reconstrucción tradicional en 23 casos (grupo tradicional). Se registraron y compararon el momento de la lesión, la duración del procedimiento quirúrgico, la puntuación postoperatoria de la VAS y la recuperación de la



función de la rodilla de los dos grupos. Se utilizaron el Comité Internacional de Literatura sobre la Rodilla (IKDC) y el sistema de puntuación de Lysholm para evaluar la eficacia clínica. Resultados: 45 pacientes fueron seguidos durante 14 a 18 meses, con una media de $(15,4 \pm 1,3)$ meses. No hubo diferencias significativas entre los dos grupos en cuanto al tiempo transcurrido entre la operación y la lesión, la duración de la operación, la puntuación IKDC y Lysholm de la rodilla afectada en el último seguimiento. Sin embargo, hubo diferencias significativas en la puntuación de la VAS al primer día, al tercer día, al séptimo día, a las dos semanas y al mes después de la operación ($p < 0,05$), sin que hubiera diferencias significativas a los tres meses, a los seis meses y al año después de la operación. Conclusión: El efecto de la reconstrucción interna total del ligamento cruzado anterior es equivalente al de los métodos tradicionales, con menos dolor postoperatorio, lo que la convierte en la opción ideal para este tratamiento. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptores: Ligamento Cruzado Anterior; Artroscopía; Procedimientos Quirúrgicos Reconstructivos; Resultado del Tratamiento.

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INTRODUCTION

Anterior cruciate ligament (ACL) is one of the important structures that maintain the stability of the knee joint and can be divided into anteromedial bundle and posterolateral bundle according to its anatomical structure. A foreign epidemiological study showed that the annual incidence of ACL injuries is 35/100,000 in all age groups, with a higher incidence in athletes and young adults with high sports activity.¹⁻² Rupture of the anterior cruciate ligament is a common sports injury, and most young patients often require surgical treatment.³ Arthroscopic knee surgery has the advantages of less trauma and reliable efficacy, and arthroscopic ACL reconstruction is currently the main modality for treating ACL rupture, and it is also a hot spot in sports medicine research. There are more studies on femoral tunneling techniques and fixation modalities, but relatively few studies on tibial tunneling techniques and fixation modalities, and the all-inside technique is one of the new techniques that have emerged in recent years.⁴ In this study, we retrospectively analyzed 35 patients with anterior cruciate ligament rupture admitted to our hospital from 01-2018 to 01-2021, and the results are reported below.

MATERIALS AND METHODS

Clinical Information

Retrospectively analyzing the data of 35 patients with ACL rupture admitted to our hospital from 01-2018 to 01-2021, of which 25 were male and 10 were female, age 16-38 years, mean (26.6 ± 6.6) years, time from injury to surgery 7d-380d, 17 cases of anterior cruciate ligament reconstruction using traditional technique (traditional group), and the anterior cruciate ligament was reconstructed using the all-internal technique (all-inside technique group) in 18 cases. There were no statistically significant differences between the two groups in terms of gender composition, age and time from surgery to injury ($P > 0.05$) (Table 1), and the two groups were comparable.

The study is purely observational studies which no need to registry ID of ICMJE, and all the participants were reviewed and approved by Ethics Committee of XianNing Central hospital, China (NO. 2021031)

Table 1. Comparison of general information of patients with ACL rupture in the traditional technique group and the all-inside technique group ($\bar{x} \pm s$).

Group	Cases	Gender (male/female)	Age(years)	Injury to surgery time(days)
Traditional technique Group	18	13/5	26.6±6.0	71.2±91.2
All-inside technique Group	17	12/5	26.7±7.0	67.9±67.6

Inclusion and exclusion criteria

Inclusion criteria: rupture of the anterior cruciate ligament of the knee and undergoing reconstructive surgery by taking the ipsilateral hamstring tendon.

Exclusion criteria: 1. Patients with posterior cruciate ligament and medial and lateral collateral ligament reconstruction surgery. 2. Patients with internal and external knee deformity. 3. Patients with combined cartilage injury.

Surgical approach

The procedure is performed under lumbar or epidural anesthesia, and multimodal analgesia is used during the perioperative period. In the traditional group, the ipsilateral semitendinosus tendon and the thin femoral tendon were cut, and the ends of the tendons were braided for 2-3 cm each with Acuvue (Johnson) 2 wire, folded into 4- or 6-fold grafts, and pre-distractionated. The tibial tunnel was positioned with a point-to-point sight (Schluter) to locate the tibial stop, and the femoral tunnel was created with an anteromedial approach through the knee. The femoral side was fixed with an Endobutton plate (Ziehl-Abegg), the graft tendon was tensioned in a 120° flexion position, and the tibial tunnel was fixed with an extrusion nail (Ziehl-Abegg) screwed into the tibial tunnel under posterior thrust stress.

All-inside technique group: the ipsilateral semitendinosus tendon was cut during surgery, and the ends of the tendon were braided for 2-3 cm at each end with Aegis Bond (Johnson) 2 wire, folded into a 4-fold graft, pre-distraction treatment, and fixed to an adjustable collar splint (Schluter) after the 4-fold, and the "0" absorbable suture line was used to anastomose the severed ends, and the tendon was braided at 2cm at both ends of the tendon. The femoral and tibial tunnel lengths were calculated from the measured graft lengths. A 4.0 mm inverted drill bit with the same diameter as the diameter of the braided tendon was used to locate the hook at the tibial stop, and a 4.0 mm inverted drill bit was used to drill through the bone tunnel in a downward direction, followed by reversing the drill bit and drilling the bone tunnel with the same diameter as the graft, preserving at least 5 mm of bone cortex, and creating the femoral tunnel in the same way. Two traction wires were led from the tibial and femoral tunnels through the anteromedial incision, respectively, and the graft was led into the femoral tunnel and tibial tunnel successively, and then the lateral femoral and lateral tibial adjustable tabbed splints were tightened simultaneously under 30° of posterior tibial push stress in flexion.

After surgery, the affected limbs of both groups were fixed with adjustable knee braces and discharged from the hospital 1 week after surgery, with regular outpatient review and guidance on functional exercises. The quadriceps and hamstring exercises and straight leg

raising exercises were started the day after surgery. The passive knee flexion and extension exercises were started in the second week after surgery, increasing by 30° per week and exceeding 120° in 6 weeks after surgery; weight-bearing was gradually performed under the protection of a brace, and full weight-bearing was possible in 6 weeks after surgery. Daily life was resumed 4 months after surgery, and sports were allowed to resume 9 months after surgery.

Observed indicators

Observation and recording the time of surgery, graft diameter, pain VAS score at 1 day, 3 days, 7 days and 2 weeks after surgery, International Knee Documentation Committee (IKDC) score and Lysholm score of the affected knee at the last follow-up were observed and recorded in both groups.

Statistical treatment

All data were analyzed using SPSS 20.0 statistical software, and independent samples t-test was performed for measurement data and χ^2 test was used for count data. $P < 0.05$ indicates that the difference is statistically significant.

RESULTS

All patients were followed up for 12 to 24 months with a mean of (15.2±1.6) months. the results of the observed indicators in the two groups are as follows.

2.1 Comparison of operative time and graft diameter. There was no statistically significant difference in operative time and graft diameter between the two groups ($P > 0.05$), as detailed in Table 2.

2.2 Comparison of pain VAS scores at 1, 3, 7 days and 2 weeks after surgery

The differences in pain VAS scores between the two groups on postoperative days 1 and 3 were not statistically significant ($P > 0.05$), and the differences in pain VAS scores at 7 days and 2 weeks were statistically significant ($P < 0.05$). There was no statistically significant difference in the IKDC score and Lysholm score of the knee 1 year after surgery between the two groups, as detailed in Table 3.

2.3 The knee function scores at 1 year postoperatively were compared, as detailed in Table 4.

There was no statistically significant difference in the IKDC score and Lysholm score of the knee at 1 year after surgery between the two groups ($P > 0.05$).

2.4 Complications in the two groups. No complications such as ligament re-rupture or infection occurred during the follow-up period in either group. Typical cases are shown in Figures 1 and 2.

Table 2. Comparison of operative time and graft diameter in patients with anterior cruciate ligament rupture between the Traditional Technical Group and the All-inside Technical Group ($\bar{x} \pm s$).

Groups	Number of cases	Duration of surgery (min)	Graft diameter (mm)
Traditional Technical Group	18	97.2±5.6	8.2±0.6
All-inside Technical Group	17	100.9±5.1	7.9±0.5

Table 3. Patients with anterior cruciate ligament rupture in the Traditional Technical Group and the All-inside Technical Group comparison of postoperative pain and knee function scores ($\bar{x} \pm s$).

Groups	Number of cases	VAS score 1 day after surgery	VAS score 3 days after surgery	VAS score 7 days after surgery	VAS score 2 weeks after surgery
Traditional Technical Group	18	7.7±0.6	5.2±0.8	3.6±0.8	1.9±0.9
All-inside Technical Group	17	7.5±0.5	5.1±0.7	2.9±0.6	0.7±0.7

Table 4. Comparison of knee function scores 1 year after anterior cruciate ligament rupture in the Traditional Technical Group and the All-inside Technical ($\bar{x} \pm s$).

Groups	Number of cases	IKDC score	Lysholm score
Traditional Technical Group	18	77.9±5.4	90.7±2.4
All-inside Technical Group	17	76.4±4.3	91.1±2.1

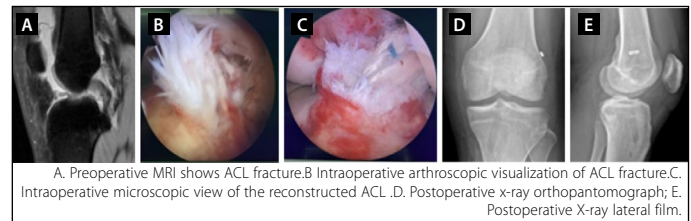


Figure 1. Patient Male, 24 years old. Anterior cruciate ligament reconstruction by traditional tunnel technique.

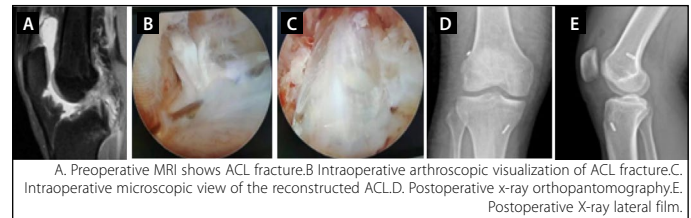


Figure 2. Patient Male, 18 years old. Total internal tunneling technique to reconstruct the anterior cruciate ligament.

DISCUSSION

ACL rupture is a common knee sports injury, and arthroscopic reconstruction of the ACL has been shown to have good results. It has been shown⁵ that the absence of the popliteal tendon of the knee will result in a 5% to 10% reduction in the flexion internal rotation strength of the knee. It has also been shown⁶ that preservation of the gracilis is important for postoperative rehabilitation, especially in patients with frequent knee flexion movements. Since Morgan first proposed the total internal technique for ACL reconstruction,⁷ the total internal technique for ACL reconstruction has also received more and more attention. In this study, we are adopting the all-internal technique to reconstruct the ACL and taking only the semitendinosus tendon as the graft, which reduces the impact on the popliteal tendon and is important for the patient's postoperative rehabilitation. At the same time, the bone tunnel of the total internal tibia is drilled from the inside out, which can effectively preserve the tibial bone cortex and reduce the risk of fracture, and because the tunnel with the outside world is smaller, it can significantly reduce the leakage of intra-articular fluid and reduce the risk of infection.⁸ Reconstruction of the ACL with the all-inside technique offers advantages in establishing the bone tract. It has been suggested⁹ that there is a correlation between the angle of the grafted tendon and tendon bone healing, and that the all-inside technique uses an inverted drill for drilling the bone tunnel, which makes it easier to control the angle intraoperatively, thereby reducing graft tendon flexion. In this study, there was no significant difference in pain VAS scores at 1 and 3 days postoperatively in the All-inside Technical Group compared with the Traditional Technical Group, and the analysis may be related to the rapid recovery concept of over-the-top analgesia and postoperative multimodal analgesia; however, pain was significantly reduced and statistically significant at 7 days and 2 weeks postoperatively. The use of multimodal analgesia had been discontinued at this time, indicating that the All-inside Technical had certain advantages in terms of late pain relief, which facilitated the patient's early functional knee exercises and prevented complications such as knee stiffness. The main reasons for this are the following: 1. The diameter at the tibial tunnel cortex in the

all-inside technical group was 3.5 mm, much smaller than 8 mm in the traditional technical group.² In the all-inside technical group, only the semitendinosus muscle is taken as a graft, which causes less damage to the surrounding soft tissues. Some research scholars believe¹⁰ that the pain at the site of graft excision is obvious for a short period of time after surgery, and only one tendon is taken to reduce postoperative pain.

In conclusion, the efficacy of the all-inside technique for ACL reconstruction is comparable to that of the conventional technique, but its faster recovery from postoperative pain compared with the conventional technique and its benefit to early functional knee exercise and prevention of postoperative knee stiffness make the technique worth promoting. In addition, the all-inside technique is valuable in reconstructive surgery

for multiple ligament ruptures in the knee and in revision surgery after ACL reconstruction due to its minimal destruction of the proximal tibial bone cortex. In recent years, it has also been suggested¹¹ that there may be a potential relatively high rate of ligamentous failure with all-inside technique reconstruction of ACL, but due to the small number of cases in this study and the short follow-up period, no such phenomenon was found for the time being. In our future work, we will continue to follow up patients postoperatively while increasing the number of cases and conducting more in-depth studies.

All authors declare no potential conflict of interest related to this article

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