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THE AUGMENTATION VERSUS THE STANDARD TECHNIQUE FOR ANATOMIC RECONSTRUCTION OF ANTERIOR CRUCIATE LIGAMENT TEARS – PRELIMINARY POSTOPERATIVE RESULTS

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The aim of this study was to compare the augmentation technique with standard ACL reconstruction in the treatment of partial ACL lesions. The study included 53 patients, who underwent ACL reconstruction, with a minimum follow-up period of one year. The study group included 26 patients (ACL augmentation technique), whereas the control group included 27 patients (standard ACL reconstruction technique). The International Knee Documentation Committee (IKDC) scores, Lysholm score, knee stability tests (Lachman test, pivot shift test, Rolimeter differential laxity test) and range of motion were used to assess the outcomes both preoperatively and at the last examination. Widening of tibial tunnel was evaluated on standard lateral X-ray views of the knee. Symptomatic ACL cyclops lesion were registered in both groups. Postoperative stability as tested with the Rolimeter (p=0.008), Lachman test (p=0.04) and pivot shift test (p=0.03) was statistically significant superior in the study group. Widening of tibial tunnel was statistically significant less important in the study group (p=0.007). The short term results in patients with ACL augmentation were superior compared to the standard procedure in terms of knee stability. By preserving the ACL stump the widening of the tibial tunnel is decreased, which can be helpful in ACL revision surgery.

Keywords: ACL reconstruction; partial lesion; augmentation; remnant preservation

INTRODUCTION

Anterior cruciate ligament (ACL) reconstruction is currently the most frequently performed procedure for knee ligament injuries[1, 2]. Due to increased physical demands in the young active population and improved knowledge concerning ACL anatomy, selective bundle reconstruction in partial tears has become an important option for the treatment of this particular type of injury.
Although most patients have reasonable function and a stable knee 5 years after a partial ACL tear, this is possible with the price of a marked decrease in the level of physical activity[3]. Almost 50% of partial ACL tears progress to complete tears[4]. The augmentation technique with preservation of the remaining bundle may be an important surgical option for these patients with partial ACL tears. Such reconstruction is technically difficult due to the possibility of reduced arthroscopic vision and increased risk of tunnel malpositioning. Preserving the remnant by using the ACL augmentation technique ensures vascular support for graft healing, maintains proprioceptive innervation, ensures superior mechanical strength in the immediate postoperative period for the reconstructed ACL and provides guidance for tunnel positioning[5-9].
The aim of this study was to compare the augmentation technique with standard ACL reconstruction in the treatment of partial ACL tears.
The hypothesis was that the ACL augmentation technique may produce improved clinical results compared to standard ACL reconstruction technique.

MATERIAL AND METHODS

This retrospective study included 53 patients, who underwent ACL reconstruction in the Foisor Orthopaedics Hospital, with a minimum follow-up period of one year. The study group included 26 patients (mean age 27 years old, 17 men and 9 women), for whom the ACL augmentation technique was performed, whereas the control group included 27 patients with similar characteristics (mean age 27 years old, 19 men and 8 women), for whom the standard ACL reconstruction was performed (Figure 1). The Objective and Subjective International Knee Documentation Committee (IKDC), Lysholm score, knee stability tests (Lachman test, pivot shift test, Rolimeter differential laxity test) and range of motion were used to assess the outcomes both preoperatively and at the last examination. Widening of tibial tunnel was evaluated on standard lateral view X-rays of the knee. Symptomatic ACL cyclops lesions were registered in both groups.

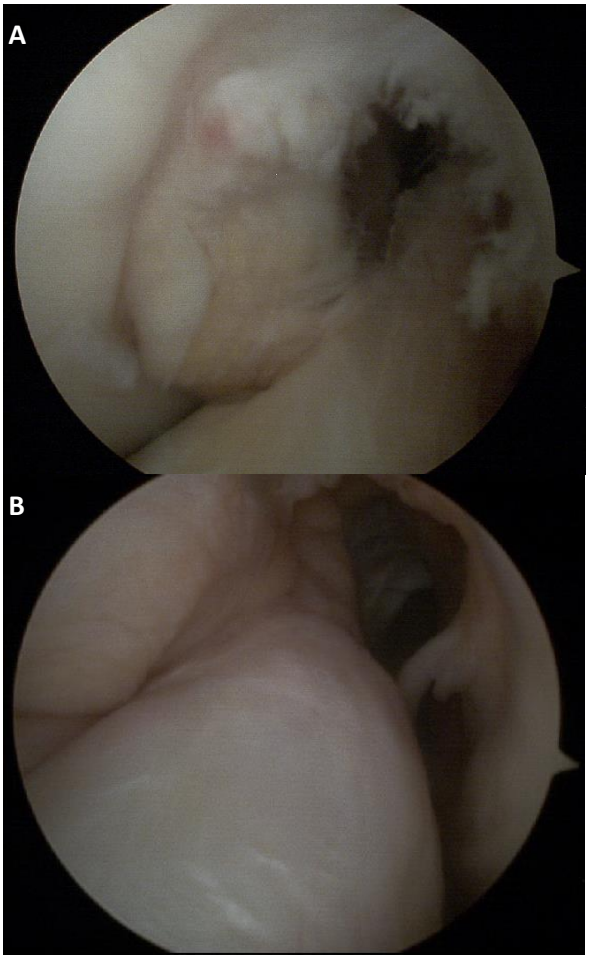

Figure 1. Arthroscopic view of a partial (A) and complete (B) ACL tear

Surgical Technique The patient was placed in the supine position with a lateral post in the proximal third of the thigh, level with the tourniquet, and with a foot roll to keep the knee flexion at 90^{o}. With the knee at 30^{o} of flexion, the tibial ACL remnant was inspected. An outside-in femoral guide was introduced through the anteromedial portal and positioned at the femoral footprint of the ACL. After guide pin placement, the femoral tunnel was drilled. The tibial guide was introduced through the anteromedial portal and positioned within the center of the ACL tibial stump. In the study group the drill remained strictly within the ACL remnant to conserve residual tissue, a shaver was passed through the tibial tunnel, into the ACL remnant preparing the passage of the graft and finally the interior of the synovial sleeve was debrided to avoid anterior impingement and extension deficit (Figure 2A). In the control group, the entire ACL remnant was removed before drilling the tibial tunnel (Figure 2B). A quadrupled semitendinous/gracilis ACL graft was prepared in situ keeping intact the tibial insertion. Passage of the graft was performed through the tibia and the femur and interference screws were used to secure the graft both in the tibial and in the femoral tunnel.

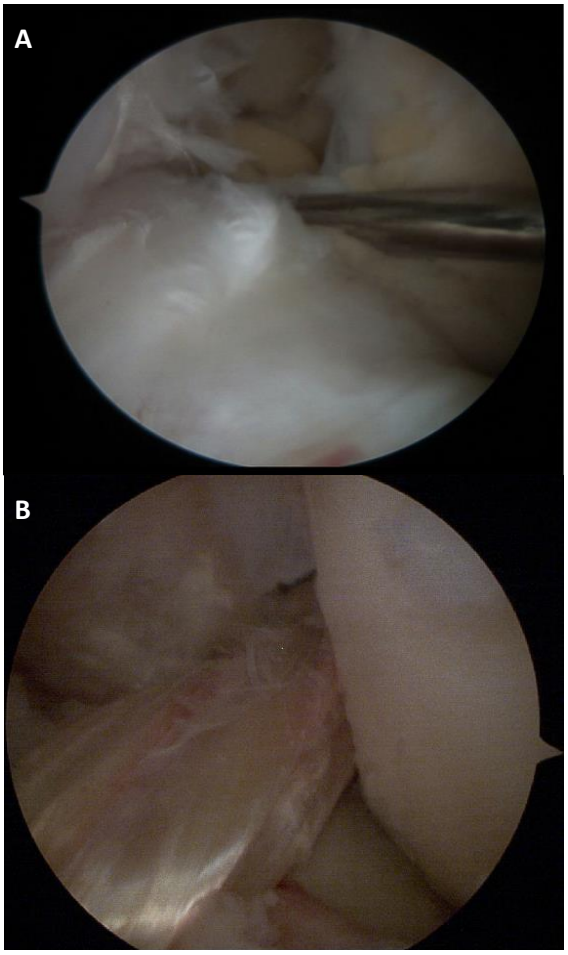

Figure 2. Postoperative aspect of the reconstructed ACL after the augmentation technique (A) and after standard anatomical reconstruction (B)

Postoperative rehabilitation All patients followed the same rehabilitation protocol using 2 crutches and no brace, with full weight-bearing and progressive range of motion exercises. Gradual return to sports activity was allowed starting at 3 months for running and cycling, at 6 months for noncontact pivot sports, and at 8 months for contact pivot sports.

Statistical analysis The independent sample t-test and Chi-square tests were used for statistical analyses. $p<0.05$ was considered statistically significant.

RESULTS AND DISCUSSIONS

There was no statistically significant difference between postoperative IKDC subjective and objective scores, Lysholm score, range of motion and cyclops lesion incidence in the two groups ($p>0.05$) (Table 1).

Postoperative stability as tested with the Rolimeter ($p=0.008$), Lachman test ($p=0.04$) and pivot shift test ($p=0.03$) was statistically significant superior in the study group. Widening of tibial tunnel was statistically significant less important in the study group ($p=0.007$) (Table 2).

	STUDY GROUP	CONTROL GROUP	p-value
OBJECTIVE IKDC			p=0.39
A	21	21	
B	5	6	
C	0	0	
D	0	0	
SUBJECTIVE IKDC	94.6	93	p=0.08
LYSHOLM SCORE	95.7	94.2	p=0.06
ROM	142.1°	144.1°	p=0.07
CYCLOPS	2/26	1/27	p=0.26

Table 1. Results regarding knee scores, range of motion (ROM) and symptomatic cyclops lesion

	STUDY GROUP	CONTROL GROUP	p-value
ROLIMETER	0,9±0,7 mm		p=0.008
LACHMAN TEST			p=0.04
0	24	20	
I	2	7	
II	0	0	
III	0	0	
PIVOT SHIFT TEST			p=0.03
0	23	18	
I	3	9	
II	0	0	
III	0	0	
TIBIAL TUNNEL	0.6±0.4 mm	1.2±0.5 mm	p=0.007

Table 2. Results regarding knee stability tests and widening of the tibial tunnel

The main finding of the current study is that short term results in patients with ACL augmentation were superior as compared to the standard procedure in terms of knee stability (Lachman test, pivot shift test, Rolimeter test). Moreover, by preserving the ACL stump the widening of the tibial tunnel is decreased.

There are four main arguments supporting the concept of preserving the ACL stump: mechanical protection of the graft during the early postoperative period, vascular supply for the new graft, preservation of proprioception and guidance for tunnel positiong. Crain et al.[9] demonstrated that resection of the ACL remnant scarred to the femur in a non-anatomical position determined an increase in anterior laxity of the tibia. Gohil et al[10] demonstrated that minimal debridement leads to earlier revascularisation within the mid-substance of the ACL graft at two months. Regarding proprioception preservation, Georgoulis et al.[6] demonstrated that mechanoreceptors exist even 3 years after injury in patients with an ACL remnant. Adachi et al.[8] showed that proprioceptive function of the ACL is related to the number of mechanoreceptors.

There are several literature reports concerning the ACL augmentation technique. While some of them found no advantage compared with standard ACL reconstruction technique[11-12], there are others that present superior clinical results in patients with ACL augmentation particularly concerning objective knee stability[13-16]. Pujol et al.[13] showed that selective antero-medial (AM) bundle reconstruction conserving the posterolateral bundle remnant provides clinical results comparable to the standard single bundle technique, with better control of anterior laxity. Sonnery-Cottet et al.[14-15] demonstrated that selective reconstruction of the AM bundle of the ACL with preservation of the PL bundle restores stability and function of the knee. ACL reconstruction did not significantly improve subjective and functional results in the short-term evaluation, but it significantly improved postoperative knee stability as shown by Kondo et al.[16].

Our results demonstrated that by preserving the ACL stump widening of the tibial tunnel is decreased. These are consistent with those published by Demirag et al.[11] and Zhang et al.[17].

The main limitations of the current study are represeted by the retrospective nature of the research and the limited follow-up time (presentation of preliminary results).

CONCLUSIONS

The present study shows that the short term results in patients with ACL augmentation were superior as compared to the standard procedure in terms of knee stability (Lachman test, pivot shift test, Rolimeter test). By preserving the ACL stump the widening of the tibial tunnel is decreased, which can be helpful in cases of ACL revision surgery.

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