ORIGINAL RESEARCH PAPER

Volume-6 | Issue-9 | September-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

FUNCTIONAL RESULTS OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION TO STABILISE THE KNEE: MINIMUM THREE YEARS FOLLOW-UP.

Orthopaedics

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ABSTRACT

Stability of the knee depends on the integrity of many structures, anterior cruciate ligament (ACL) being one of the most important of them. For young active individual, a symptomatic ACL deficient knee can cause significant problem in high-stress activities of the knee. In those, ACL reconstruction (ACLR) is the treatment of choice. This study assesses the functional result of 39 cases of ACLR. In the period between January 2011 to March 2014, a total of 46 knees in as many patients were treated by soft-tissue ACLR using autogenous, ipsilateral, free semitendinosus and gracilis (ST-G) tendon grafts. 39 could be followed up for at least 3 years (3yrs 1 month to 5 years 3 months). The results at the latest available followup of these patients were analysed to know the functional outcome of the surgery. Overall, excellent to good results were obtained in 92% of the patients at that point of time. Therefore, it can be inferred that ACLR is an effective treatment of the unstable ACL deficient knees. The published literature also supports this finding.

KEYWORDS

Arthroscopy, ACL deficient knee, ACL reconstruction, Semitendinosus-Gracilis, Endobutton

INTRODUCTION:

The human knee has very little stability from its non-congruous bony interfaces. Yet, this joint performs amazing tasks in locomotion and recreational/professional sports. This is possible from a well-developed and co-ordinated system of static and dynamic stabilisers…. the ligaments, capsule, myotendinous units connected to the brain.

ACL (anterior cruciate ligament) is one of the most important stabiliser. It prevents abnormal anterior translation of the tibia on the femur[1,2]. It also prevents abnormal rotation[3,4,5]. Unfortunately, ACL is the most frequently, totally-disrupted ligament inthe knee[6]. Its rupture can be very disabling to the patients who have to place much strain on the joint, mostly young, active and earning individuals[7,8,9]. In such cases, ACLreconstruction (ACLR) is the treatment of choice.

A plethora of surgical methods exist. Commonly used grafts are Bone-patellar tendon-bone (BPTB) and semitendinosus-gracilis (ST-G). Several studies point that in the long run there is hardly any statistical difference in terms of stability and function, however, ST-G harvest provides less donor site morbidity and less incidence of degenerative arthritis[10,11,12,13,14,15].

(Another point of debate is single versus double bundle. DB is suitable only for large femurs (uncommon in our population), has more complications and surgery time and expenses, though it mimics the native ACL bundles more closely. Long term benefit over single-bundle ACLR has not been clearly established.[16,17,18,19,20,21,22,23,24].

The femoral tunnel placement and orientation is also debated between transtibial versus anatomical-transportal. Anatomical reconstruction provides more rotational stability than transtibial(which places the graft in more vertical orientation[25,26,27,28,29,30,31])

Of course, the pre-operative and post-operative rehabilitationis vital to get into normalcy.

This prospective study aims to evaluate the functional outcome of ACLR in minimum three years followup.

MATERIALS AND METHODS:

Between January 2011 to March 2014, a total of 46 knees in 46 patients were treated by arthroscopic assisted ACLR. Out of them, 39 could be tracedfor a minimum period of 3 years or more,to be included in this study. This is a retrospective analysis of a prospectively maintained database.

ACL deficiency was diagnosed from

(a) History : loaded twisting fall – in sports or from motorcycle, or stuck by sea waves, sometimes a "pop" sound inside the knee followed by symptoms of instability like fear of (apprehension) or actually giving way of the knee;
(b) Positive Lachman test with no/mushy endpoints (this has sensitivity and specificity of 95% 32;
(c) Positive pivot shift test and supplemented by MRI findings when afforded (FIG.1).

FIG. 1. MRI shows ACL rupture (white arrow). PCL is intact (arrowhead)

The findings were put into the International Knee Documentation Committee (IKDC) form 2000 to get the preoperative scores. Pre-injury level of activities were noted according to the Tegner33 scale. Both are briefly described later.

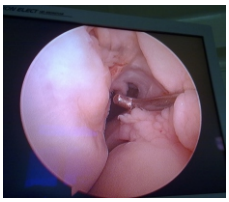
Chief Indication for surgery was symptomatically unstable knee from ACL deficiency. Multi-ligament injuries, injuries with fractures around the knee or any major fracture that could affect the rehabilitation were excluded. Seven cases were lost to follow-up within three years of surgery, they were also excluded.

(Preoperatively the patients were counselled about the nature of the injury, the indication for surgery, any alternative methods, importance of pre and post-operative physical therapy and exercise protocol, probability and expected time to return to preinjury level of activities, cost involved and the possible complications. An informed consent about this was offered. Consenting patients were prepared for elective surgery in the usual manner. Ethical committee approval was obtained for the study.)

After (usually spinal) anaesthesia, a pneumatic tourniquet around proximal thigh was applied. After standard prepping and draping in supine position, the limb was exsanguinated and the tourniquet was inflated. Diagnostic arthroscopicroundup of the knee was performed in

a standard way and the tear of the ACL was confirmed(FIG 2).

FIG 2. Arthroscopy shows ACL rupture and "empty lateral wall" sign indicated by the probe)



The stumps, where seen,were conservatively debrided with a motorised shaver to keep the footprints visible. Through a curvilinear incision about 3 cm posteromedial to the tibial tubercle, the Sartorius fascia was split and the semitendinosus – gracilis tendons were harvested with a stripper, after careful sectioning of the ST bands to medial head of gastrocnemius(FIG 3).

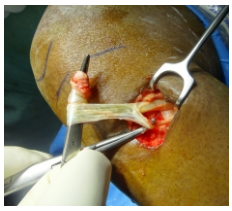


FIG 3. Strand from SemiT to medial gastrocnemius identified (arrow) before sectioning

These were stripped off muscle-fibres and measured. If the quadrupled grafts measured less than 8 mm dia., the tendons were folded into total six strands. Tibial tunnel and femoral (transportal) socket were prepared in 'anatomical' location and the depths measured. Closed-loop Endobutton ® or equivalent of proper size was used (that keeps a minimum of 25 mm of graft in femoral socket) for fixing in femur. Soft-threaded titanium interference screw was used to fix the graft to the tibia pushed back(like a PCL test), after tensioning cycle. FIG 4 shows the graft in place.

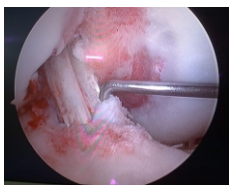


FIG 4. ACL reconstructed, the graft is in place

The wound of donor site was closed in layers including careful apposition of the Sartorius fascia. The arthroscopic portals were not sutured for drainage.

Postoperatively, a customised rehab protocol and pain control measures were used. Ice packs were applied 15 minutes four times a day. Static quads and hams ('spider killer') exercises were started early. Non-weightbearing ambulation was started the next day Usually patients were sent home by 3rd day, with instructions. Periodic checkup was done at the OPD. Stitches were taken off in the 2nd week. Follow-up continued as per a standard schedule and then, beyond two years, once a year.In each followup, thorough examination were carried out and the findings noted as per the study proforma, including the International Knee Documentation Committee (IKDC) knee form 2000 and Tegner Activity Score (described below in brief) . These were analysed to get the results.

IKDChas two parts, subjective and objective.

A. SUBJECTIVE:

1. Highest level of activity that you can perform without significant knee pain

4= Very strenuous activities like jumping or pivoting
3= Strenuous activities like heavy physical work, skiing
2= Moderate activities like moderate physical work, running or jogging
1 = Light activities like walking, housework or yard work
0 =Unable to perform any of the above activities due to knee pain
2. How often have you had pain?
3. If yes, how severe is it?
4. How stiff or swollen was your knee?
4 =Not at all to 0= extremely
5. Highest level of activity without significant swelling
4 to 0 like in point number 1

6. Knee locking/catching
0= Yes
1= No
7. Highest level of activity without significant giving way
4 to 0 like in point number 1
8. What is the highest level of activity you can participate in on a regular basis?
4 to 0 like in point number 1
9. How does your knee affect your ability to:

	Not difficult at all	Minimally difficult	Moderately difficult	Extremely difficult	Unable to do
	4	3	2	1	0
a. Go up stairs					
b. Go down stairs					
c. Kneel					
d. Squat					
e. Sit with your knee bent					
f. Rise from a chair					
g. Run straight ahead					
h.Jump and land on your involved leg					
I. Stop and start quickly					

10. How would you rate the function of your knee on a scale of 0 to 10 with 10 being normal, excellent function and 0 being the inability to perform any of your usual daily activities which may include sports?

To calculate the **final subjective IKDC** score the score of all items are added, divided by the maximum possible score 87, expressed as percentage.

OBJECTIVE

	Grades				Group grade*
GROUPS	**A (normal)**	**B (nearly normal)**	**C (abnormal)**	**D (severely abnormal)**	
1. Effusion	None	Mild (<25cc)	Moderate (25-60cc)	Severe (tense knee)	
2. Lachman	-1 to 2mm	3 to 5mm(1+)	6 to 10mm (2+)	>10mm (3+)	
3. Motion defect a. Lack of extension b. Lack of flexion	<3 0 to 5	3 to 5 6 to 15	6 to 10 16 to 25	>10 >25	

*Group grade: The lowest grade within a group determines the group grade.

TEGNER ACTIVITY SCORE:

10- Competitive sports: Soccer- international and national elite
9- Competitive sports: Soccer- lower divisions, ice hockey, Wrestling and/or Gymnastics.
8- Competitive sports: Badminton, Athletics (jump)
7- Competitive sports: Tennis, Athletics (Running), Basketball OR Recreational sports: Soccer, Ice hockey, Squash, Athletics (Jumping etc.) and/or Cross-country track.
6- Recreational sports: Tennis/Badminton, Handball, Basketball, Jogging atleast 5 times a week
5- Work: Heavy labor (e.g., Building, Forestry) OR Competitive

sports: Cycling or Cross-country skiing OR Recreational sports: Jogging on uneven ground at least twice weekly
4- Work: Moderately heavy labor (e.g., Truck driving, Heavy domestic work) OR Recreational sports: Cycling, Cross-country skiing, and/or Jogging on even ground at least twice weekly
3- Work: Light labor (e.g., Nursing) OR Competitive and Recreational Swimming OR Walking in forest possible
2- Work: Light labor OR Walking on uneven ground possible but impossible to walk in forest
1- Work: Sedentary work OR Walking on even ground possible
0- Work: Sick leave or disability because of knee problems

Results (*n* = 39 knees in 39 patients)
Gender : 37 male, 2 female.
Age : 19 to 46 (mean : 26.9)
Athletic injury : 28, traffic accidents 09, others 02
Twisting, loaded injury : 33, couldn't exactly recall :4
Subjective IKDC score preoperative :mean 44.29
Subjective IKDC score at the last followup : mean 89.4

Objective IKDC grade (preoperative and postoperative followup)

Grade	Preoperative (n)	Followup (n)
0 (Normal)	0	20
1 (Near normal)	6	16
2 (Abnormal)	24	05
3 (Severe abnormal)	09	00

Indicated that most of the patients really benefited from the surgery.
Tegner activity scale score before injury and after operation

	Range	Mean
Tegner activity before injury	5-9	7.1
Tegner activity after operation	3-9	6.9

This indicates that some of the high-demand athletes/ defence personnel may not attend the same strenuous level of activities at 3rd year after operation.

Complications.
Generally, this surgery proved to be safe. Complications occurred, though infrequently.

Complications	No. of patients
Knee pain (at rest/ on prolonged strain)	0/5
Incomplete ROM	4, See below
Superficial infection	2
Tibial Implant removal for persistent discharge	1
Objective laxity (Lachman 2+ with mushy endpoint at latest F/U	3
Subjective laxity (apprehension/ instability as before surgery)	1

No (0) patients have septic arthritis.

ROM (latest followup)	No flexion contracture*	Flexion contracture present**
Full flexion possible***	= Full ROM : 35	2
Full flexion not possible**	1	1

FIG 5. Early knee flexion, 7th postop day

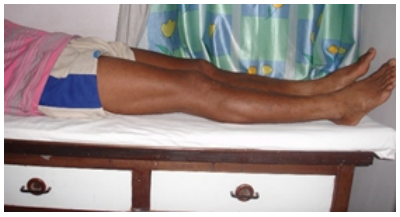
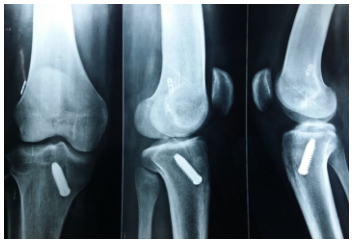


FIG 6. ROM at 4 weeks postop



DISCUSSION

Arthroscopic ACLR is the accepted treatment of symptomatic ACL deficient knee in active individuals. Various methods are in practice (graft choice, tunnel placement, number of bundles, fixation methods, rehab protocol). This study measures the outcome at minimum three years after anatomical transportal SemiT-G graft in 39 knees. Overall, there was a significant improvement of IKDC score from 44.29% preop to 89.4%. No serious complications occurred. Two superficial infections were successfully managed conservatively. In one knee, persistent discharge from the tibial site (culture showed no growth thrice) forced us to take out the distal screw and debride. The wound healed in two weeks. He was one of the patient who had objective and subjective laxity. One girl had generalised joint laxity (FIG 8) and ruptured her left ACL, but at the last followup, she had no symptomatic instability.

FIG 8. A girl with generalised joints laxity with symptomatic ACL rupture (left)

Tegner level shows that most patients could attain the same level of pre-injury activities, and some have to scale down. This is in accordance with most published literature.

CONCLUSION

The present study of 39 ACLRs followed up for a minimum of three years indicate that the surgical technique applied here is a safe and effective way to restore stability and function to the ACL-deficient, symptomatically unstable knees. Most of the patients could attain their respective pre-injury level of activities.

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