

## ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING SEMITENDINOSUS AND GRACILIS TENDON GRAFT

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**ABSTRACT: BACKGROUND AND OBJECTIVE:** Incidence of ACL injuries are increasing due to motor sports and recreational activities involving high physical activity. Ligament injury accounts for nearly 40% of all knee injury problems and isolated anterior cruciate ligament injury constitutes nearly 50% of all knee ligament injuries.

**METHODS:** 27 patients with ACL injuries were selected who were admitted in the S.V.R.R.G.G. Hospital, Tirupati between November 2013 and august 2015. Patients were treated with arthroscopic anterior cruciate ligament reconstruction using single bundle quadruple semitendinosus and gracilis tendon graft and followed up till functional recovery and assessed clinically.

**RESULTS:** The study comprises of 25 male and 2 female patients aged from 15 to 50 years with mean age of 33 years. The follow up ranged from 6 to 14 months and results assessed using the Lysholm knee scoring system.

**INTERPRETATION AND CONCLUSION:** arthroscopic anterior cruciate ligament reconstruction using single bundle quadruple semitendinosus and gracilis tendon graft has good results.

**KEYWORDS:** ACL injuries. Arthroscopy, Single bundle quadruple semitendinosus and gracilis tendon graft.

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**INTRODUCTION:** In the present world of professional athletics, motor sports and recreational activities involving high physical activity such as skiing, knee is the second most commonly injured joint next only to ankle.<sup>1</sup> Ligament injury accounts for nearly 40% of all knee injury problems and isolated Anterior cruciate ligament injury constitutes nearly 50% of all knee ligament injuries.<sup>2</sup> Incidence of ligament injury is more in female athletes compared to males athletes.<sup>3</sup> Anterior cruciate ligament injury is more in white European American athletes compared to nonwhite. Better understanding of injury mechanisms lead to prevention strategies against anterior cruciate ligament injury with some effectiveness although, anterior cruciate ligament injury is still not fully preventable. Anterior cruciate ligament was considered of little importance for the long term function of the knee in the past. Studies have shown that there is greater risk of meniscal and articular injuries in short term follow up progressing to radiological and clinical changes of joint degeneration.<sup>4</sup> This is more in anterior cruciate ligament deficient patients compared to subjects with normal anterior cruciate ligament function.

Non operative management has not been proven to prevent or delay long term sequel of anterior cruciate ligament deficiency.<sup>5</sup> Early surgical methods such as primary repair of anterior cruciate ligament injury with or without augmentation showed a modest improvement over non-operative management in terms of subjective and functional outcome of symptomatic knee instability. Reconstruction of anterior cruciate ligament is by far has better edge over all other methods of management with failure rate around 10%. Varieties of graft materials available for surgeons' choice are autografts, allografts and synthetic graft materials. Success rates of ligament reconstruction using autografts are higher than when either allograft or synthetic graft materials were used.<sup>6</sup> Success of anterior cruciate ligament reconstruction depends also on methods of graft fixation. Arthroscopic reconstruction of anterior cruciate ligament has definite advantages over open reconstruction methods.

By far, one of the well accepted methods of reconstruction is that involving autologous hamstring tendon graft.

In our study we want to study the functional outcomes of arthroscopic anterior cruciate ligament reconstruction using single bundle quadruple semitendinosus and gracilis tendon graft.

**AIM OF THE STUDY:** To study the short term result of arthroscopic anterior cruciate ligament reconstruction by hamstring tendon graft by means of preoperative and postoperative subjective and objective evaluation scores.

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**MATERIALS AND METHODS:**

**Design:** Prospective study.

**Subjects:** Patients presenting with chief complaint of the knee instability and pain presenting to S.V.R.R.G Hospital from 1-9-2011 to 4-2-2013 were diagnosed clinically by lachman's test, anterior drawer test, pivot shift test and confirmed by radiology. These patients were treated with anterior cruciate ligament reconstruction using autologous ipsilateral hamstring tendon graft.

**Inclusion Criteria:**

1. Age of patients ranging from 18 to 40 years.
2. Anterior cruciate ligament tear that occurred more than 3 weeks
3. No previous surgery performed on the affected knee.

**Exclusion Criteria:**

1. Patients with medial collateral ligament laxity.
2. Patients with lateral collateral ligament laxity.
3. Patients with posterior cruciate ligament laxity.
4. Evidence of osteoarthritis on plain radiographs.

**Preoperative Evaluation:** Consists of detailed history regarding the mechanism of injury, history of instability, climbing upstairs and going downhill, difficulty sitting in cross legged, squatting, sense of giving away and knee joint pain.

Clinical evaluation by lachman test, anterior drawer test, posterior drawer test, mcmurray's test, valgus stress test and varus stress test. Preoperative investigations like plain radiograph to know avulsion fractures and any associated fractures.

Magnetic resonance imaging of the knee gives substantial information regarding anterior cruciate ligament injuries and associated injuries like collateral ligament, medial meniscus, lateral meniscus and posterior cruciate ligament. Intra operatively through diagnostic arthroscopy we estimate the grade of anterior cruciate ligament injuries.

**Classification of ACL injuries:****Grade I Sprain:**

- The fibres of the ligament are stretched, but there is no tear.
- There is a little tenderness and swelling.
- The knee does not feel unstable or give out during activity.

**Grade II Sprain:**

- The fibres of the ligament are partially torn.
- There is a little tenderness and moderate swelling.
- The joint may feel unstable or give out during activity.

**Grade III Sprain:**

- The fibres of the ligament are completely torn; the ligament itself has torn completely into two parts.

- There is tenderness (but not a lot of pain, especially when compared to the seriousness of the injury). There may be a little swelling or a lot of swelling.
- The ligament cannot control knee movements. The knee feels unstable or gives out at certain times.

**SURGICAL STEPS IN ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION WITH QUADRAPLED HAMSTRING TENDON GRAFT:**

**Graft Harvestation:** A 3cms medial incision made midway between tibial tuberosity and medial most aspect of upper tibia. The tendons were palpated and the Sartorius fascia was incised parallel to the fibers of the fascia just above the thicker and more distally inserted hamstring tendons.

After the vinculae had been cut under visual control, the distal end of tendons is cut and graft is harvested with a semiblunt, open tendon stripper.

**Graft Preparation:** The tendon was prepared on master board stripping the muscle fibers with a blunt scissors. The minimum suture is used for preparation of proximal and distal ends of the graft by whip stitch method. Two No.5 non-absorbable Ethibond sutures were used as the lead sutures at the distal and proximal ends. After the tendons sutured at two ends, graft is quadrupled by folding at the centre with an endobutton.

**Femoral Tunnel Preparation:** After arthroscopic examination and shaving of knee joint is done through an accessory anteromedial portal guide wire is placed in 10'o clock position over lateral femoral condyle inner aspect 2mm from posterior most corner of cortex and femoral tunnel drilled with appropriate size ACL reamer upto appropriate depth (25-30mm) over the beath guide wire placed at the femoral foot print of ACL with knee in 100 to 110 degrees of flexion. Rest of the cortex drilled with no. 4.5 mm cannulated drill bit for endobutton passage.

**Tibial Tunnel Preparation:** Through tibial ACL jig assembled at 55-60 degrees angle, tip of the guide placed at the tibial attachment of ACL i.e., medial to attachment of anterior horn of lateral meniscus. Tunnel drilled to appropriate size over the guide wire.

**Graft Passage and Fixation:** Graft passed all along the path by leading suture passing through the tibial and femoral tunnel after laying the cephalad end of the graft to the suture. Flipping of endobutton done with two leading different suture materials. After the femoral endobutton anchorage had been achieved twenty cycles of knee flexion and extension to remove the slackness in the graft. Knee is kept in 30 degrees of flexion with an assistant applying posteriorly directed force to the proximal tibia. Guide wire passed in the tibial tunnel over which appropriate size interference screw inserted. Wound closed in layers. R-J compression bandage applied post operatively.

**POST OPERATIVE EVALUATION:** Includes intraoperative arthroscopic findings, international knee documentation committee subjective assessment score, lysholm score and international knee documentation committee objective evaluation and postoperative complications.

**POST OPERATIVE PROTOCOL:** First 1-3 weeks wound care and swelling control with RJ Compression bandage is applied for every patient.

Post-operative radiograph taken in both anteroposterior and lateral views. Knee is immobilized in a knee brace. Suture removal done on 10<sup>th</sup> postoperative day.

Isometric exercises for Quadriceps and hip abduction strengthening are carried out.

Knee is kept in full extension with pillows kept under heel and knee presses against bed carried out to achieve full extension.

Knee may be allowed to bend up to 90 degrees as pain permits. Weight bearing permitted as pain permits with or without elbow crutches.

**Rehabilitation Protocol:** Goals of rehabilitation are pain and swelling control, maintaining range of motion, protection of anterior cruciate ligament graft, building hamstring and quadriceps muscles and regaining near normal strength and return to pre-injury level of injury.

3-6 weeks ice packs may be applied for 4-5 times a day for swelling control as required.

Isometric quadriceps exercises are continued and hamstring strengthening exercises are started with 2kgs of weight and gradually increasing at increments of 1kg per week till 6 weeks. Static cycling exercises are started.

Active exercises to improve range of motion continued 7-12 weeks. Quadriceps strengthening exercises started with 1kg weight gradually increased weekly upto 4kgs of weight and Hamstring strengthening exercises until 12kgs of weight is reached. Static cycling exercise is continued increasing resistance for 13 weeks – 6 months.

Quadriceps strengthening exercises at 4-6kgs and hamstring strengthening at 12kgs is continued daily along with static cycling exercises till 6 months.

Proprioceptive training exercises and running in straight line can be encouraged. Squatting, cutting and pivoting are avoided for 6 months.

Gradually depending on satisfactory completion of rehabilitation program patient may be allowed initially to return to noncontact or limited contact sports followed by gradual return to contact sports with caution and further injury prevention and avoidance training.

**OBSERVATIONS:** The following are made in 27 patients treated with ACLR using hamstring tendon graft using endobutton on femoral side and interference screw fixation on tibial side.

**STABILITY:** The reconstruction was considered to have failed if the Lachman and pivot shift tests were at least 2+.

All the patients were stable at 6 months and 1 year followup.

**DISCUSSION:** The goal of treatment of Anterior cruciate ligament deficient knee is to provide stable and flexible knee which prevents secondary injury to knee and potential early onset of osteoarthritis associated with Anterior cruciate ligament deficient knee.

The most accepted method of surgical management at present for Anterior cruciate ligament deficient knee is anterior cruciate ligament reconstruction using autologous bone patellar tendon bone or quadrupled hamstring tendon graft depending on operation surgeon's preference.

In our study we selected our patients according to their order of attendance in outpatient department at our institute for postoperative follow up 1 year after surgery.

Our aim of the study was to compare the results obtained to the international standard values depending upon subjective and objective outcomes. The procedure was performed by a single surgeon proficient in the method or reconstruction mentioned in this study.

We used ipsilateral semitendinosus and gracilis tendon graft with endobutton suspensory fixation on femoral side and interference screw fixation on tibial side for Anterior cruciate ligament reconstruction.

Post-operative evaluations including ligament laxity tests were done by single observer and were documented.

In our study overall post-operative results are satisfactory in terms of international knee documentation committee subjective scores. Lysholm score and activities of daily living by visual analog scale when compared to preoperative scores.<sup>7</sup>

Advantages of hamstring tendon graft are lesser future risk of osteoarthritis (80, 81, 82), paradoxical lesser laxity (Possibly due to remodeling process) in the long term (81) and lesser kneeling pain.

**Selection of Patients:** Patients are selected for Anterior cruciate ligament reconstruction strictly by the following criteria.

1. Patients main problem is pain and instability.
2. Clinically positive pivot shift test and significant anterior shift on lachmanstest(+2 to +3).
3. Moderate to high demand on their knees (sports men, police, military personnel etc.,)
4. Age between 18 – 40 years.
5. Complete anterior cruciate ligament tears on diagnostic MRI.
6. No degenerative changes on arthroscopy.
7. Well motivated patients.

If degenerative changes were present conservative line of treatment is planned as significant relief of symptoms of pain cannot be obtained in them.

The anterior cruciate ligament reconstruction will be a failure if done in an unmotivated individual as physiotherapy is an inherent part of the programme and is

to be followed strictly. Before surgery most of the patients graded their subjective knee function as fair or poor on a visual analog and subjective score. At 1 year follow-up all the patients said that they had excellent function with complete relief from pain, swelling and no episodes of instability.

We used Lysholm scoring system for all the patients. It included.

We used Lysholm scoring system for all the patients. It included.

Patients in our study group scored 86.16% average Lysholm score at the initial six months of the follow up, that is at six months as they were advised not to squat or sit cross legged.

At 1 year follow up mean Lysholm score improved to 95.08% as they were allowed to increase their activity. This comes under the excellent grade.

**CONCLUSION:** Arthroscopic anterior cruciate ligament reconstruction by hamstring tendon graft gives satisfactory results in short term follow up in terms of patient satisfaction, activities of daily living and return to near normal activity than before surgery.

Large scale study with long term follow up is required to corroborate findings of the study and to find out long term functional results. We found by our study arthroscopic anterior cruciate ligament reconstruction by hamstring tendon graft has following advantages:-Simple technique, Early postoperative mobilization, Minimal or no

complications, Lysholm score comparable to preoperative activity level, Early preoperative activity level, No need of open surgery, Cost effective surgery, Cosmetically more acceptable and Easy follow up.

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Limp		:	
	None	:	5
	Slight and/or periodical	:	3
Severe and/or constant support			
	None	:	5
	Stick or crutch	:	2
	Weight bearing impossible	:	0
Locking			
	No locking and no catching sensation	:	15
	Catching sensation but no locking	:	10
	Locking occasionally	:	6
	Frequently	:	2
	Locked joint on examination	:	0
Instability			
	No giving away	:	25
	Rarely using athletics or other heavy exertion	:	20
	Frequently during athletics or other heavy exertion	:	15
Occasionally during daily			
	Activities	:	10
	Often in daily activities	:	5
	At every step	:	0
Pain			
	None	:	25

	Inconstant and slight using heavy exertion	:	20
	Marked during heavy exertion	:	15
	Marked on or after walking more than 2kms	:	5
	Constant	:	0
Swelling			
	None	:	10
	On heavy exertion	:	6
	On normal exertion	:	2
	Constant	:	0
Stair climbing			
	No problems	:	10
	Slightly impaired	:	6
	One step at a time	:	2
	Impossible	:	0
Squatting			
	No problems	:	5
	Slightly impaired	:	4
	Not beyond 90 degrees	:	2
	Impossible	:	0
<b>Lysholm Knee Score</b>			

	<b>15-20</b>	<b>20-25</b>	<b>25-30</b>	<b>30-35</b>
NO. OF CASES	2	9	14	2
PERCENTAGE	7.40%	33.33%	51.85%	7.40%
<b>TABLE 1: AGE INCIDENCE</b>				

<b>SEX</b>	<b>MALES</b>	<b>FEMALES</b>
NO. OF CASES	25	2
PERCENTAGE	92.59%	7.40%
<b>TABLE 2: SEX INCIDENCE</b>		

<b>SIDE</b>	<b>RIGHT</b>	<b>LEFT</b>
NO. OF CASES	11	16
PERCENTAGE	40.74%	59.25%
<b>TABLE 3: SIDE INCIDENCE</b>		

<b>NATURE OF INJURY</b>	<b>SPORTS</b>	<b>RTA</b>	<b>OTHERS</b>
NO. OF CASES	8	18	1
PERCENTAGE	29.62%	66.66%	3.70%
<b>TABLE 4: NATURE OF INJURY</b>			

<b>MENISCUS</b>	<b>NO. OF CASES</b>	<b>PERCENTAGE</b>
MEDIAL	14	51.85%
LATERAL	12	44.44%
BOTH MEDIAL AND LATERAL	1	3.70%
<b>TABLE 5: MENISCAL LESIONS ON ARTHROSCOPY</b>		

RANGE OF MOTION	NUMBER OF PATIENTS	PERCENTAGE
FULL	26	96.30%
EXTENSION LAG	1	3.70%
DECREASED RANGE OF MOTION	0	0%
<b>TOTAL</b>	<b>27</b>	<b>100%</b>
<b>TABLE 6: RANGE OF MOTION</b>		

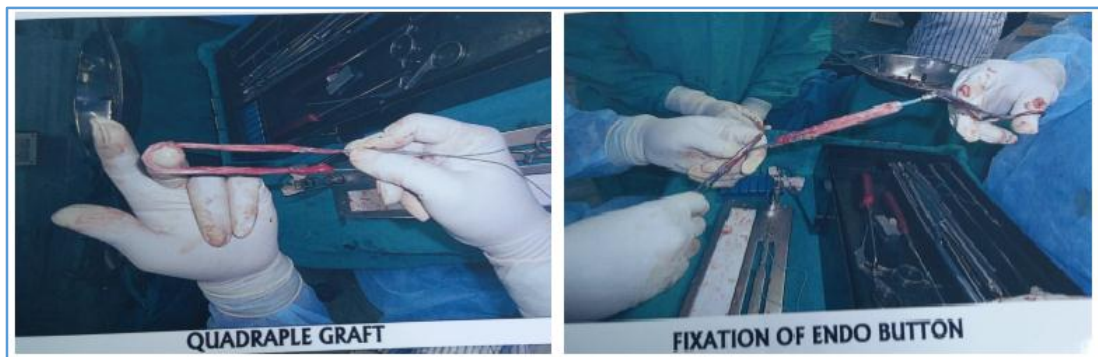
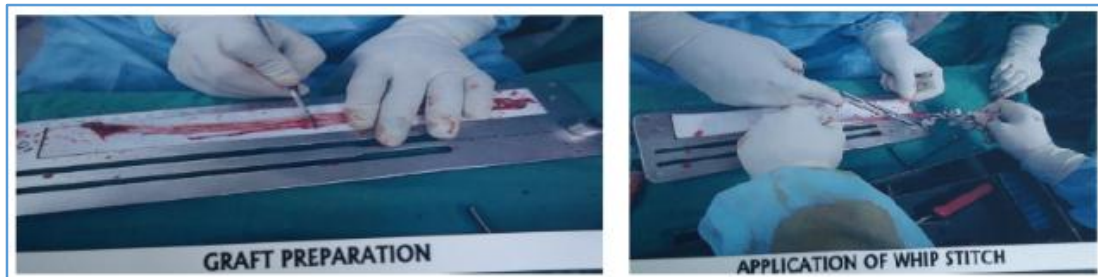
MONTHS	WASTING
6	27 PATIENTS (100%) WASTING UPTO 1CM
12	27 PATIENTS (100%) WASTING LESS THAN 1 CM
<b>TABLE 7: THIGH ATROPHY</b>	

GRAFT SITE TENDERSNESS	NUMBER OF PATIENTS	PERCENTAGE
NO TENDERSNESS	24	88.88%
MILD TO MODERATE TENDERSNESS	3	11.11%
SEVERE TENDERSNESS	0	0%
<b>TOTAL</b>	<b>27</b>	<b>100%</b>
<b>TABLE 8: GRAFT SITE TENDERSNESS</b>		

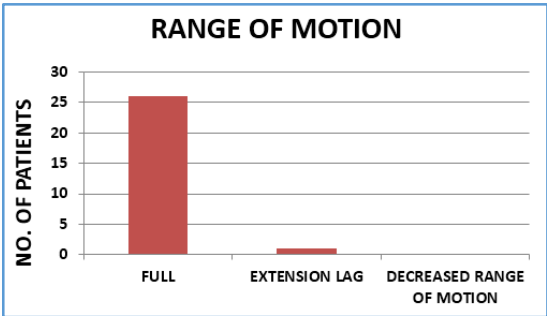
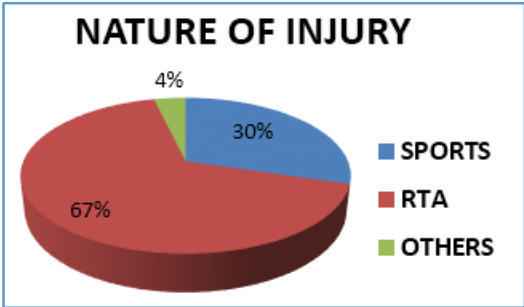
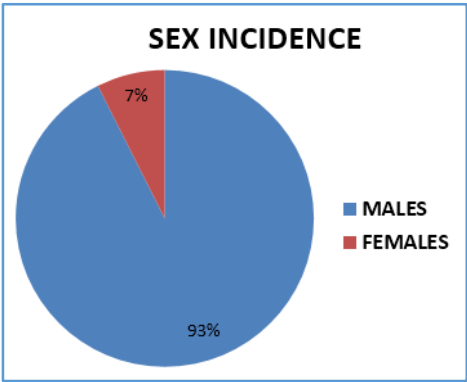
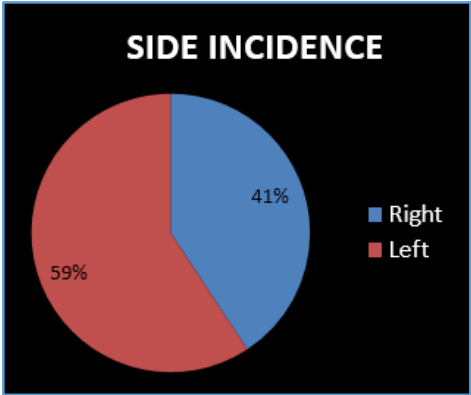
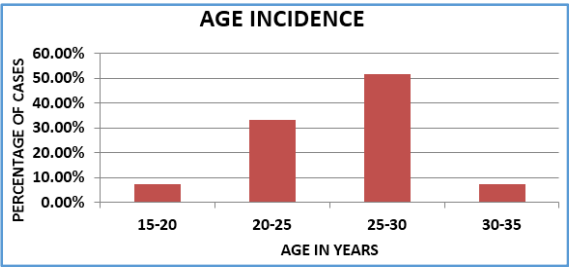
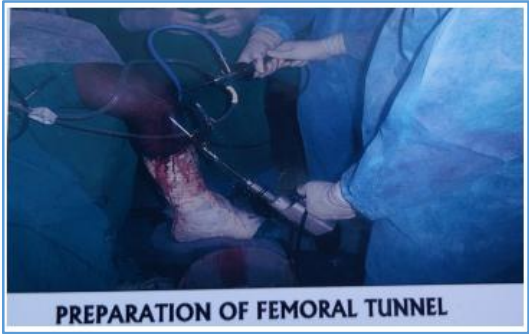
GRADING	SCORING
POOR	LESSTHAN 68
FAIR	68 TO 76
GOOD	77 TO 90
EXCELLENT	MORE THAN 90
<b>GRADING OF LYSHOLM SCORING</b>	

	OUR STUDY	JM WEB ET AL
MEAN AGE	26	26
AVERAGE LYSHOLM SCORE		
6 MONTHS	86.16	90
12 MONTHS	95.08	94
ROM		
FULL	88.88%	97%
EXTENSION LAG	3.70%	3%
DECREASED RANGE OF MOTION	7.40%	0%
GRAFT SITE TENDERSNESS		
NO SYMPTOMS	88.88%	56%
MILD TENDERSNESS	11.11%	44%
THIGH ATROPHY		
12 MONTHS	100% <1 CM	94% <1 CM
<b>COMPARATIVE STUDY</b>		

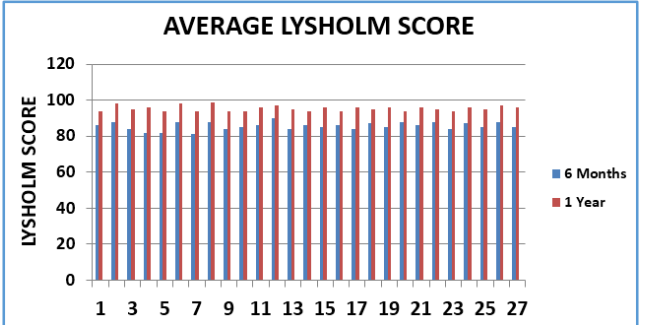
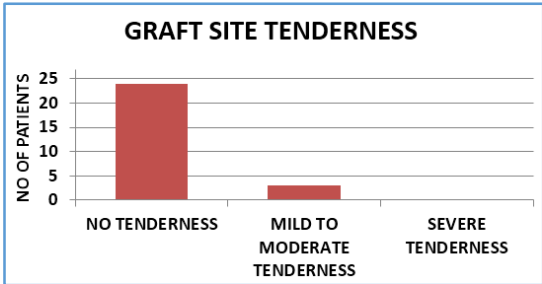
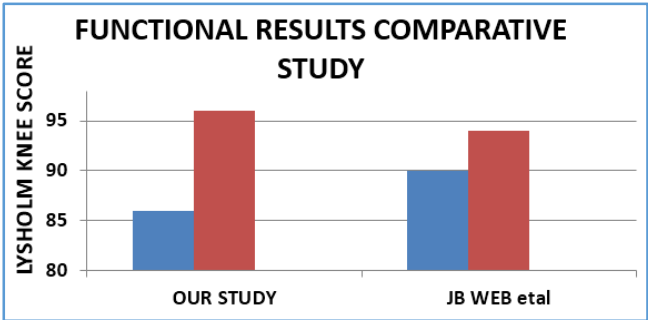
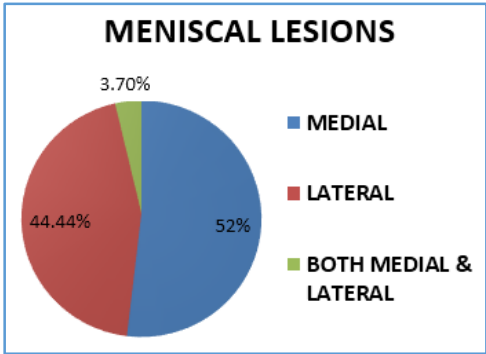












Cases:

1. AASHIQ: Scopy Images

RT ACL TEAR

LATERAL MENISCAL TEAR

POST OP X RAY

ACL GRAFT

PARTIAL MENISECTOMY

POST OP CLINICAL PHOTO ROM



4. Chandrababu: Scopy images

