



ISSN NO. 2320-5407

Journal homepage: <http://www.journalijar.com>

INTERNATIONAL JOURNAL  
OF ADVANCED RESEARCH

## RESEARCH ARTICLE

### TO INVESTIGATE THE CLINICAL AND RADIOLOGICAL OUTCOMES OF ACL RECONSTRUCTION WITH QUADRUPLE HAMSTRING AUTO-TENDON GRAFTS USING FEMORAL TRANSFIX SCREW.

Dr Manish Barot<sup>1,2</sup>, Dr Aditya K. Agrawal<sup>1</sup>, Dr Gurunath BV<sup>2</sup>

1. Sumandeep Vidyapeeth University, Piparia, Vadodara, Gujarat, India.
2. Sri Sathya Sai Institute of Higher Medical Sciences (SSSIHMS), Anantpur, Andra Pradesh, India.

#### Manuscript Info

##### Manuscript History:

Received: xxxxxxxx  
Final Accepted: xxxxxxxxxxxxxx  
Published Online: xxxxxxxxxxxxxx

##### Key words:

##### \*Corresponding Author

Dr Manish Barot.

#### Abstract

**Introduction:** An anterior cruciate ligament (ACL) injury of the knee is one of the most common sports/road accidents injuries. Surgery confirms a stable and a fully functional knee, preventing possible future complications such as repeated knee injuries and possible arthritis.

**Aims and objectives:** The current study is done to measure the outcome of arthroscopic ACL reconstruction with quadruple hamstring auto-tendon grafts fixed with metal transfix screw on the femoral side and metal interference screw on tibial side of the graft.

**Materials and method:** The study includes fifty patients with complete chronic ACL tear between the age group of 20-40 years. This study was conducted at Department of Orthopaedics, SSSIHMS. The study period had being from June 2007 to June 2010. This is a retrospective study of patients from a prospectively maintained database for a minimum period of 2 yrs. All patients underwent arthroscopic assisted ACL reconstruction with quadruple hamstring auto tendon graft fixed with titanium transfix screw on the femoral side and titanium interference screw on the tibial side. All patients underwent surgery performed by the same surgeon. The outcome of the study was statistically assessed using the Mann-Whitney test and Wilcoxon signed rank tests.

**Results:** At the end of the two years of the follow up, 36 patients (72%) out of 50 were noted to have IKDC subjective assessment score between 85-95% and 6 patients (12%) were found to have the score between 95-100 %. Only 4 (8%) patients had score less than 80. All the patients were also assessed with Lysohlm score and were found to have improved post operatively. 40 patients (80%) were noted to have score between 80 to 95%.

**Discussion:** Most common mode of ACL injury was noted to be sports injuries, while in our country, road traffic accidents also take significant share. Patients with good pre-operative muscle bulk were having good functional outcome. Associated intra-particle pathologies were also shown to alter the outcomes of the surgery, as evident by the lower outcome scores. Good compliance with the accelerated ACL rehabilitation protocol showed good outcomes of the surgery with respect to their progressive increase in functional scores at every follow up. Proper bone tunnel placement in femur and tibia were found to be playing key role in achieving excellent results. In spite of having grade 1 laxity post operatively, the functional outcomes were noted to be satisfactory.

**Conclusion:** Performed under ideal conditions, we maintain ACL reconstruction with quadruple hamstring auto-tendon grafts using a femoral transfix screw fixation is a safe & effective approach in indicated patients.

Copy Right, IJAR, 2016,. All rights reserved.

## Introduction

An anterior cruciate ligament (ACL) injury of the knee is one of the most common sports/road accidents injuries. It often leads to instability of the knee especially during strenuous activities or routine activities like running/jumping/climbing stairs often necessitating reconstruction. Arthroscopic assisted ACL reconstruction is a common procedure performed during the recent times (1). The most commonly used harvested auto grafts are bone - patellar tendon - bone and hamstring tendon graft.

Surgery confirms a stable and a fully functional knee, preventing possible future complications such as repeated knee injuries and possible arthritis. Untreated ACL injury might lead to chronic instability, muscle weakness, and post-traumatic osteoarthritis. During the last 25 years, ACL has been one of the most studied structures in musculoskeletal system (2). In many of the studies, it was noted that the ACL is weaker of the two cruciate ligaments, hence, apparently more vulnerable for injuries. Daniel et al (3) proposed the "ACL injury cascade" a series of events that may follow an ACL injury. ACL deficiency leads to instability, instability leads to secondary meniscal injury, which may in turn result in degeneration of the joint. Chronic ACL tear increased incidence of premature osteoarthritis of the knee; another compelling reason for ACL reconstruction is by Anderson et al (3) study which showed ACL reconstruction lowered secondary meniscal tear rate from 27% to 3%. Recent advances in arthroscopic instrumentation and surgical techniques incorporating autologous graft and also with advances in both graft fixation and rehabilitation has improved the functional recovery of the patients (4).

The current study is done to measure the outcome of Arthroscopic ACL reconstruction with quadruple hamstring auto-tendon grafts fixed with metal transfix screw on the femoral side and metal interference screw on tibial side of the graft.

### Aims and objectives:-

1. To investigate the clinical and radiological outcomes of ACL reconstruction with quadruple hamstring auto-tendon grafts using femoral transfix screw. 2. To study surgical factors that give the optimal outcome in relation to fixation. 3. To study the pattern of associated injuries to the intra-articular structures along with ACL

### Materials and methods:-

The study includes fifty patients with complete chronic ACL tear between the age group of 20-40yrs. This study was conducted at Department of Orthopaedics, SSSIHMS –PG. The study period being from June 2007 to June 2010. All fifty patients were males. All these patients underwent a complete clinical and radiological evaluation by a senior consultant. Patients with a clear history of knee instability and clinically demonstrable anterior knee instability confirmed with radiological evaluation were selected for the study. Mean age of patient who underwent ACL Reconstruction in our study was 29.22 years. Minimum follow up period was 24 months post operatively. Inclusion criteria included young adults (20 – 40 years) with chronic ACL injury, ACL Injury associated with stable meniscal injuries. Exclusion criteria included acutely injured knee in patients with age more than 40 years with previous history of knee surgeries, infection of the knee joint, degenerative joint disease of the knee, osteo-chondral defects of femoral, tibial or patellar articular surfaces, multi-planar knee instability, stiff knee with deformities. The data was collected by obtaining the relevant history and clinical findings from case papers, clinical examination of the patients & radiological evaluation, periodic post op evaluation and reviewing the hospital records of the patients from the electronic hospital Information system (EHIS). This is a retrospective study of patients from a prospectively maintained database for a minimum period of 2 yrs. All such patients with relevant history of knee instability following an injury were primarily assessed with respect to strict inclusion criteria. Further clinical evaluation was carried out by a senior consultant. Such selected patients underwent appropriate radiological investigations. Radiological evaluation included standing antero-posterior, lateral and skyline views of knee joint. Particular attention was paid to note the evidence of osteo chondral fractures or Segond's fractures. MRI was carried out in patients with associated intra articular lesions to specifically rule out unstable and complex meniscal tears and possible intra-articular injuries. Appropriate pre-operative laboratory Investigations were carried out. Further, patients underwent appropriate rehabilitation protocol. Most of our Patients presented to us with a history of instability of his/her Knee following an injury. The injury mechanism was either sudden deceleration activity with rebound of the knee, or direct hit on the outside of the knee, moving knee with stuck foot, jump from height and landed with jerk in the knee, twist injury during sporting activities, road traffic accident or hyperextended knee. Patient, in many of the instances, complains of popping sound of the knee with instability. In cases with chronic tear, patients complain of giving way sensation or locking episodes also. Patient complains of difficulty in walking downhill, wet slopes, cannot stop suddenly, difficulty in running or jogging, getting up from sitting position.

Before examining the injured knee, the uninjured knee was examined to provide a baseline for comparison and to look for generalized joint laxity. It also helps in reducing apprehension. Complete Knee Examination was carried out and signs of ACL injury and injury to any other associated intra-articular structures were documented. Patients were counseled for the surgery and emphasis was made for pre-operative and post-operative rehabilitation program. Quadriceps and hamstrings strengthening exercise are started, as soon as, the patient was diagnosed to have an ACL deficient knee, for a period of 4-6 weeks. After thorough examination of the knee clinically and radio logically, the patient was subjected for the scoring of the knee using IKDC FORM & Lysohlm Scoring system. We confirmed our diagnosis and dealt with associated meniscal injuries with arthroscopy, before ACL reconstruction. Surgery was done under the appropriate departmental antibiotic prophylaxis. All patients underwent arthroscopic assisted ACL reconstruction with quadruple hamstring auto tendon graft fixed with titanium transfix screw on the femoral side and titanium interference screw on the tibial side. All patients underwent surgery performed by the same surgeon.

Statistical software SPSS 17.0 (Statistical Package for Social Sciences) was used for analysis of data and Microsoft Word and Excel was used to generate tables and charts. Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean value (Min-Max) and results on categorical measurements are presented in Number (%). The outcome of the study was statistically assessed using the Mann-Whitney test and Wilcoxon signed rank tests.

### **Results:-**

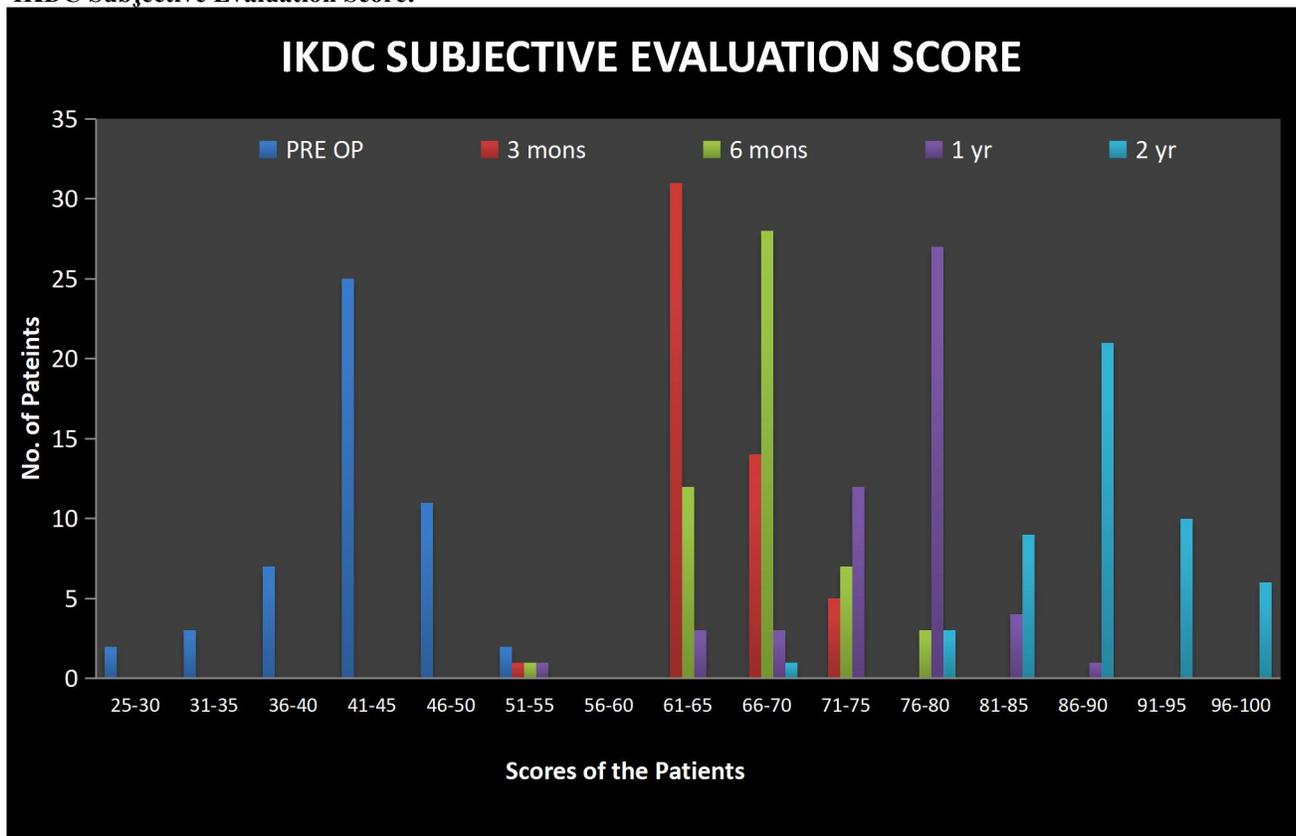
Our study includes only young active patients between the age group of 20 to 40 years, who are actively involved in high demanding activities. All patients in our study were males, who were actively involved in high demanding works. Most of our patients were to be injured in their right knee, mainly observed in patients with sporting injury being the common cause.

Domestic falls were also noted to cause complete ACL tear in about seven patients from rural background. Other main causes of the ACL tear being different types of road traffic accidents. Most of the patients with complete ACL tear due to different causes presented to us before two years since the time of the injury. Twelve patients (24%) had medial meniscal injury, four patients (8%) had lateral meniscal injury and four patients (8%) had combined medial and lateral meniscal injury. One patient (2%) was found to have medial femoral osteo-chondral defect in the non-articular region, which was found incidentally during our routine arthroscopic evaluation of the knee. All the patients were followed up at regular intervals of 2 weeks (for suture removal), 6 weeks, 3 months, 6 months, 1 year & 2 years with prospectively data. All the patients were examined thoroughly both subjectively and objectively using most appropriate scores (IKDC & Lysohlm scores) & with appropriate radiographs. On clinical examination of the patients at the end of the 2 years of follow up, decreased thigh muscle girth was improved significantly. 32 patients (64%) were noted to have thigh muscle atrophy of >3cms preoperatively. Post operatively, only 3 patients (6%) were noted. More than 70 % of patients were significantly improved with regular and supervised physiotherapy in our physiotherapy department, on out-patient basis. Anterior drawer test and Lachmann test were performed on all patients as a part of the post-operative follow up assessment in all visits. About 13 patients (26%) were noted with nil Lachman and 58% of patient were noted to have Grade 1 Lachmann. Negative Anterior Drawer test was noted in 38 (72%) of the patients. 84% of patients were noted have full painless range of movements of the Knee by the end of 2 weeks. One patient with history of post-operative refill, was noted to have fixed flexion of the knee of 10 degrees and another patient due to unknown reason was noted to have fixed flexion deformity of knee, probably due to non-compliance to the rehabilitation protocol. 8 patients (16%) were noted to have terminal extension deficit of <10 degrees at the end of the 2 years of follow up. None of the patients are noted to have extension deficit more than 10 degrees.

### **Ikdc score assesment:-**

#### **Subjective Assessment:-**

At the end of the two years of the follow up, 36 patients (72%) out of 50 were noted to have IKDC subjective assesment score between 85-95% and 6 patients (12%) were found to have the score between 95-100 %. Only 4 (8%) patients had score less than 80.

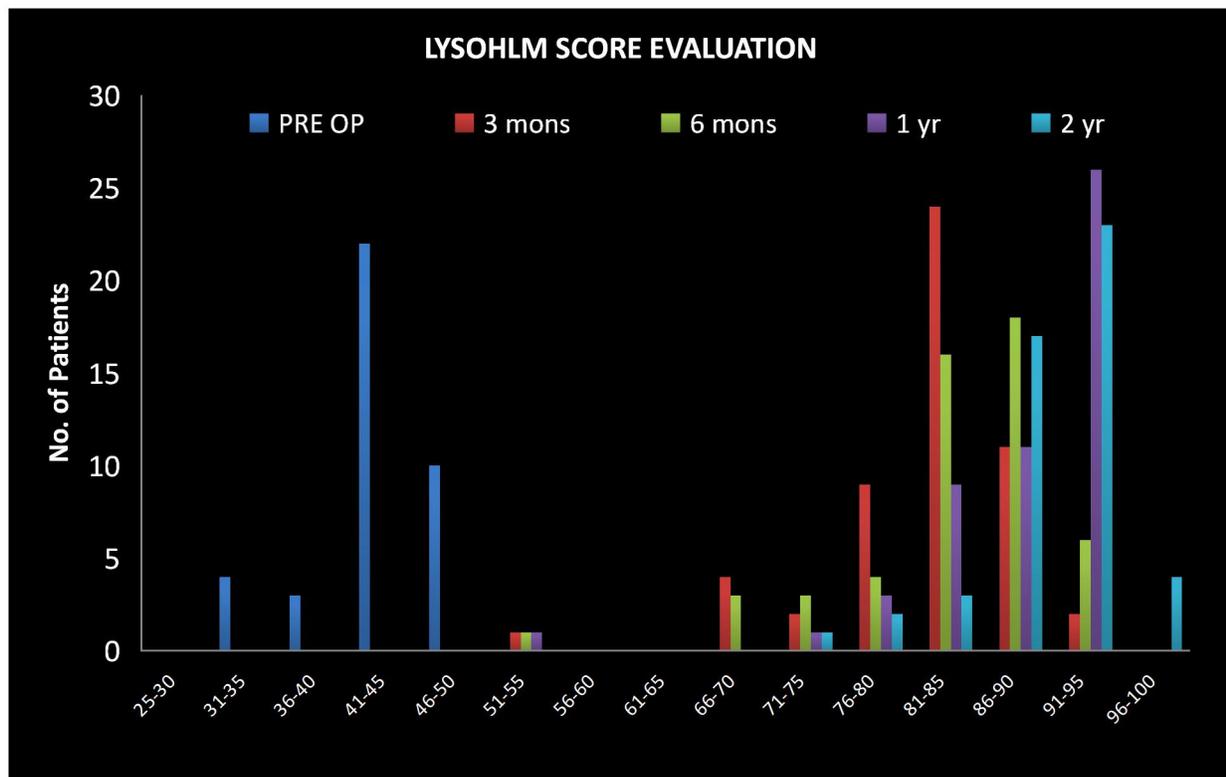
**IKDC Subjective Evaluation Score:-**

Large volume of patients were distributed between IKDC Subjective score of 41-45 pre-operatively, which was noted to be between 61-65 at 3 months post op follow up, between 66-70 at 6 months, 76-80 at 1 year follow up and between 86-90 at 2 years of post op follow up.

**Lysohlm scoring system:-**

All the patients were also assessed with Lysohlm Score and were found to be improved post operatively. 40 patients (80%) were noted to have score between 80 to 95%. 4 patients (8 %) with > 95%.

**Lysohlm Score Evaluation:-**



Large volume of patients were distributed between Lysohlm score of 41-45 pre-operatively, which was noted to be between 61-65 at 3 months post op follow up, between 66-70 at 6 months, 76-80 at 1 year follow up and between 86-90 at 2 years of post op follow up.

**Table : Lysohlm score:-**

	Mean	Std. Deviation	Paired t test
Pre op Lysohlm Score	46.12	5.085	t = 40.79, p=0.000, HS
Lysohlm Scoring	89.78	5.296	

**Transfix Screw Size:**

45mm sized transfix screw were used in 22 patients and 40mm sized Transfix screws

**COMPLICATIONS:**

3 cases were noted have numbness over the medial aspect of the leg. One patient had wound gaping at the harvest site who improved significantly with re-debridement & physiotherapy. Three cases were found to have aseptic synovitis, managed conservatively, found to be relieved from symptoms. One case with incomplete penetration of the transfix screw in to opposite cortex, which was readjusted during the immediate post-operative period were used in 28 patients, depending on the physic of the patients. Most of patients were observed to have isolated ACL tear (60%). This observation may be due to less vigorous nature of the force and also based on the fact that most of our patients are not professional sports persons and hence could have given up sports activities. However, we also observed in 40 % of patients associated intra articular lesions like meniscal tears, medial femoral osteo-chondral defects. It has been observed that majority of these patients are professional sports persons involved in high contact sports. Therefore, the injury could have happened due to high velocity force.

Ligament Injured	No. Of patients in Traumatic Group (Non sporting injuries)	No. Of patients in Sports Injuries group
Medial Meniscus	2	10
Lateral Meniscus	0	4
Combined injuries	0	4
Medial femoral OCD	1	0
Isolated ACL Tear	16	14

#### Time of Presentation:-

We have observed that the patients who sustained an complete ACL tear due to injuries sustained due to non-sporting causes like RTA and domestic fall, presented earlier (44% presented with 6 months) when compared to those due to sporting and pivoting injuries (43% presented between 1 to 2 years since injury).

Injury Nature	< 6 months	6mons-12 months	>1yr- <2yrs	> 2yrs
Sporting Injuries	5 (16%)	8 (25%)	14 (43%)	5 (16%)
Non sporting injuries	18 (44%)	5 (28%)	1 (5%)	4 (23%)

The Mean IKDC Subjective score and the Mean Lysohlm scores at different levels of follow up showed a gradual improvement. This improvement can be attributed to the patient compliance to the immediate post-operative rehabilitation protocol. After 1 year of post op follow up, study shows that there was only marginal improvement in the functional scores.

Duration	Mean IKDC Subj score	Mean Lysohlm Score
Pre op	42.61	45.94
<b>Post op Follow Assessment Scores</b>		
3 months	56.11	59.81
6 months	75.23	78.24
1 year	82.12	85.11
2 years	89.23	90.13

#### Conclusion:-

Most common mode of ACL injury was noted to be sports injuries, while in our country, road traffic accidents also take significant share. Patients with ACL tear due to sports injuries cause were noted to have more associated injuries. Patients with ACL tear due to non-sports injury early presentation for the treatment than those with sports injury. Patients with good pre-operative muscle bulk were having good functional outcome. Associated intra-articular pathologies were also shown to alter the outcomes of the surgery, as evident by the lower outcome scores. Good compliance with the accelerated ACL rehabilitation protocol showed good outcomes of the surgery with respect to their progressive increase in functional scores at every follow up. Proper bone tunnel placement in femur and tibia were found to be playing key role in achieving excellent results. In spite of having Grade 1 laxity post operatively, the functional outcomes were noted to be satisfactory. Performed under ideal conditions, we maintain ACL Reconstruction with Quadruple hamstring auto-tendon grafts using a femoral transfix screw fixation, is a safe & effective approach in indicated patients.

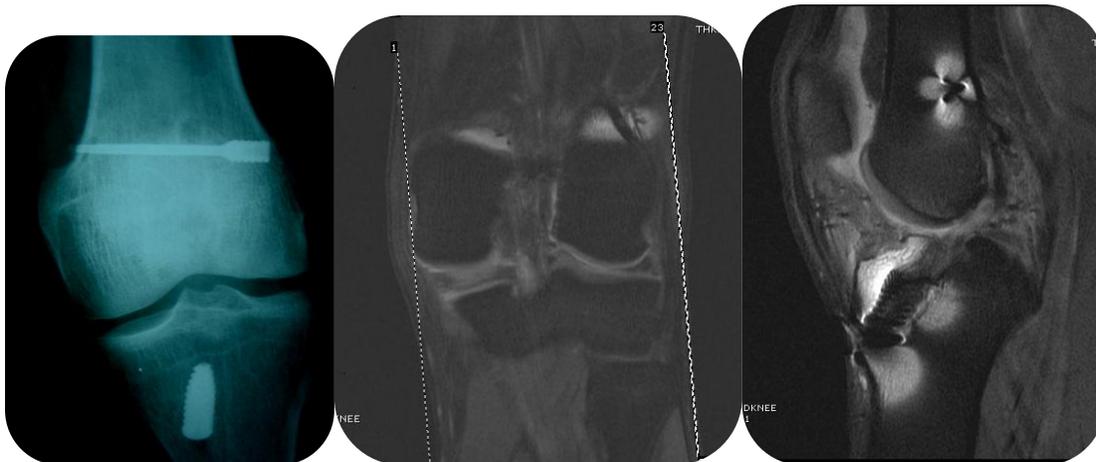
**Case:-**

24 yrs old male with Post Traumatic Complete ACL Tear Left Knee with no other Associated Injuries

	Pre op	Post op
Thigh Muscle wasting	>3cms	1 cm
Extension Deficit	<10 degree	Nil
Anterior Drawer test	5- 10 mm	Negative
Lachmann test	2 +	Negative
IKDC Subj Score	39	97
IKDC Obj Score	C	A
Lysohlm Score	41	98

- No Harvest site Morbidity
- One leg Hop Index showed: 100 % to that of the normal leg 2 year post op

Patient joined as a physical trainer for high sporting activities in a teaching institute and is performing well in his career.

**Immediate Post op x-ray****2 years Post op Follow up MRI****Immediate Post op ACL****2 years post op follow up**



### References:-

- 1) Anatomic endoscopic anterior cruciate ligament reconstruction with patella tendon autograft. E. Lyle Cain, Jr,MD, William G. Clancy,Jr,MD. OCNA 33(2002) 717-725.
- 2) Anatomy and biomechanics of ACL. Michael Dienst, MD, Robert T. Burks, MD, Patrick E.Greis,MD. OCNA 33 (2002) 605-620.
- 3) Fate of the anterior cruciate ligament – injured knee. Donald C. Fithian, MD, Liz W.Paxton, MA, David H.Goltz,MD. OCNA 33 (2002) 621-636.
- 4) Anterior cruciate ligament Reconstruction with Patellar Autograft Tendon. Jeff A.Fox, MD; David D. Nedeff, MD; Bernard R.Bach, Jr., MD; and Kurt P. Spindler,MD. CORR No. 402, pp.53-63.
- 5) Reiman PRE, Jackson DW. Anatomy of the anterior cruciate ligament&The anterior cruciate deficient knee.St.Louis: CV Mosby and co; 1987.p.17-26.
- 6) Tena-Arregui J, Barrio-Asensio C, Viejo-Tirado F, Puerta-Fonnolla J,Murillo-Gonzalez J. Arthroscopic study of the knee joint in fetuses.Arthroscopy, 2003;19: P862-868.
- 7) Strochii R, The Human ACL, histological and ultrastructural observations. J. Anatomy 1992; 180. 515- 9
- 8) Danylchuk KD : Microstructural Organisation of Human and Bovine Cruciate Ligaments. Clinic Orthop 131: 294-8.
- 9) Odensten m, Gillquist J : A Modified technique for ACL surgery using a new drill guide for Isometric positioning of the ACL. Clinic Orthop 213: 154-158.
- 10)Duthon Vb et al : Anatomy of the ACL. Knee Surg Sport traumatol Arthrosc 14 : 204-213
- 11) Girgis et al, The Cruciate Ligaments of Knee, Anatomy, Functional & Experimental Analysis Clin Orthopn 1975, 106, 216- 31
- 12) Smith BA Livery, biology and Biomechanics of ACL. Clinic Sports med 199, 12:637-70
- 13) Amoczky Anatomy of ACL; Clinic Orthop1983; 172; 19-25
- 14) ) Litner DM, Radiographic evaluation of Native ACL attachment and graft placement for ACL reconstruction- A cadaver study. Am J sports Med 1996; 24:72-8
- 15) Odensten M, Gilquist. Functional Anatomy of the ACL and rationale for the Reconstruction. JBJS 1985; 67 A: 257-62.
- 16) Amis AA,Dawkins. Functional Anatomy of the ACL Fibre actions related to ligament replacements and injuries JBJS 1991; 73B 260-7
- 17) Teitz CC. Symmetry of the Femoral notch width index. Am J Sports med 1987; 25: 687-90
- 18) Ellison AE, Berg EG: Embryology, anatomy and function of anterior cruciate ligament. Orthop Clin NA 1985; 16:3-14.