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Relationship Between Tibial Interference Screw Position and Post-Operative Range of Movement of Knee in Arthroscopic Anterior Cruciate Ligament Reconstruction.

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ABSTRACT

Management of the Anterior Cruciate Ligament injury in demanding adults is a common problem to orthopaedic surgeons. Current practice is of Arthroscopic Anterior Cruciate Ligament Reconstruction using autologous Hamstring tendon graft fixed with interference screws and endo button. Presence of the tibial interference screw closer to the anterior tibial cortex is a concern for orthopaedic surgeons. There are few works in this regard. The present series is of 13 cases of Anterior Cruciate Ligament injury that underwent Arthroscopic Anterior Cruciate Ligament Reconstruction. Sports injuries especially kabbadi predominated the aetiology. The age group was 22- 38 years. Cases with bilateral lesions, avulsion injuries of Anterior Cruciate Ligament and associated Posterior Cruciate Ligament lesions were excluded. There were ten cases associated with other problems like meniscal injuries. These conditions were also addressed arthroscopically. Arthroscopic Anterior Cruciate Ligament Reconstruction was done. These patients were assessed post -operatively for the knee range of movement and the distance between the tip of the tibial interference screw and the anterior cortex was measured in all the cases. This distance varied from 10.2 mm to 33.3 mm. The relationship between these two parameters was discussed.

Keywords: Arthroscopic, Anterior Cruciate Ligament, Reconstruction. tibial interference screw anterior tibial cortex, range of movement

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INTRODUCTION

Arthroscopic Anterior Cruciate Ligament Reconstruction (AACL) is a very common orthopaedic procedure and frequently used to treat sports injuries resulting in deficient Anterior Cruciate Ligament function. The earlier methods of extra articular and open intra articular methods have the disadvantages of increased operating time, operating site morbidity, infection, knee stiffness and delayed rehabilitation.

The current practice is of AACL using autologous tendon graft fixed with techniques like interference screws and endobutton. The presence of the tibial interference screw closer to the anterior tibial cortex in the post operative radiographs is a concern for orthopaedic surgeons. There are few work in this regard. The present work is aimed to find the relationship between the position of tibial interference screw and the post operative range of movement of the knee in Arthroscopic Anterior Cruciate Ligament Reconstruction.

MATERIALS AND METHODS

Between 2014 to 2017, 13 patients with ACL deficiency were selected and included in this study. Cases with bilateral knee involvement, (no control to compare), those with associated upper tibia fractures (could interfere with portal), those with associated PCL injury (could affect the outcome of a good range of movement and rehabilitation and avulsion injuries of Anterior Cruciate Ligament were excluded from the study. The age group ranged from 18 to 38 years. 11 patients were under 35 years of age- only 2 were over 35. Seven of them were due to sports injuries, three due to vehicular accidents and three had injury following a fall. All patients presented 2months and 6 months after injury. 35% cases presented with instability (knee giving way) , 15 % with locking (catch), 30% with knee pain and instability 30 % cases and only knee pain in 20% cases.



Figure 1: Preoperatively Anterior drawer test being done on a patient



Figure 2: Preoperative Lachmann's test

As shown in the above figures 1 and 2, the patients, underwent clinical examination and evaluation for different ligaments including the anterior drawer test Lachman's test,, Pivot shift test, Valgus, Mc Murray test, Posterior drawer test, Reverse pivot shift test. The preoperative range of movements are measured and recorded. All these patients had radiographs of knee to look specifically for associated fractures of upper tibia like the plateau fractures and the seagond's fracture. MRI was done for all these patients to confirm the lesion and to look for associated injuries (figure 3). Details of these patients is given in the [Table 1].While awaiting surgery these patients were taught static and dynamic quadriceps exercises and hamstring strengthening exercises.



Figure 3: MRI of right knee (sagittal section) showing torn ACL with hyperbuckling of PCL

After spinal anaesthesia, with a distension of the knee joint with normal saline, diagnostic arthroscopy was done. The supra patellar pouch, under surface of patella, medial and lateral gutters and the menisci were examined. The site of ACL injury and the remnants were noted, if intact it was probed for the normal tension. The menisci are probed for instability .The posterior cruciate ligament was inspected. Thus all the pathologies were recorded, now a second anteromedial portal (working portal) was made at the inferior pole of patella, just medial to patellar tendon. The associated pathologies were addressed appropriately like partial meniscectomy for a meniscal tear, shaving for chondral defects and removal of loose bodies.

The semitendinosus tendon was harvested without injuring the inferior patellar branch of the saphenous nerve graft and prepared with running baseball sutures in chinese finger trap configuration to make it compact. The ends are given double looped knots to enable application of traction (figure 4).



Figure 4: Graft preparation

One femoral and one tibial tunnel were created with centres corresponds with centre of ACL's femoral and tibial attachment sites. Femoral tunnel was prepared by using anteromedial portals independently in this technique in line with the anatomical native femoral footprint of ACL graft 10.30 position for the right knee and 1.30 position for the left knee. The tibial tunnel is made by tibial elbow instrument aimed from inside out under arthroscopic guidance at an angle of 55 degrees. The harvested prepared graft was fixed on the femoral side with one endobutton continuous loop (Smith and Nephew) and on the tibial side with one interference screw (Figure 5) . The interference screw was Smith and Nephew (commercially available as Soft silk tibial interference screw). The sizes of the interference screws of sizes 20-25mm in length and 7mm to 9 mm in diameter depends on the size and length of the graft. Endobutton has dimensions of 15mm 20 mm loop 0.1 to 0.4 cm in length and 15 mm or 20 mm loop .



Figure 5: Hamstring graft after reconstruction

Post operatively the knee was immobilized with a knee brace for two days. All the 13 cases were available for follow up and were followed up for a period of one and a half to two years (average 16 months). All wounds healed by two weeks. There was no discharge from the wounds. The results were analysed by clinical and radiological examination.



Figure 6: at four months follow up- full range of knee movement without extensor lag



Figure 7: Painless full range of knee movement without extensor lag during 4 months follow up

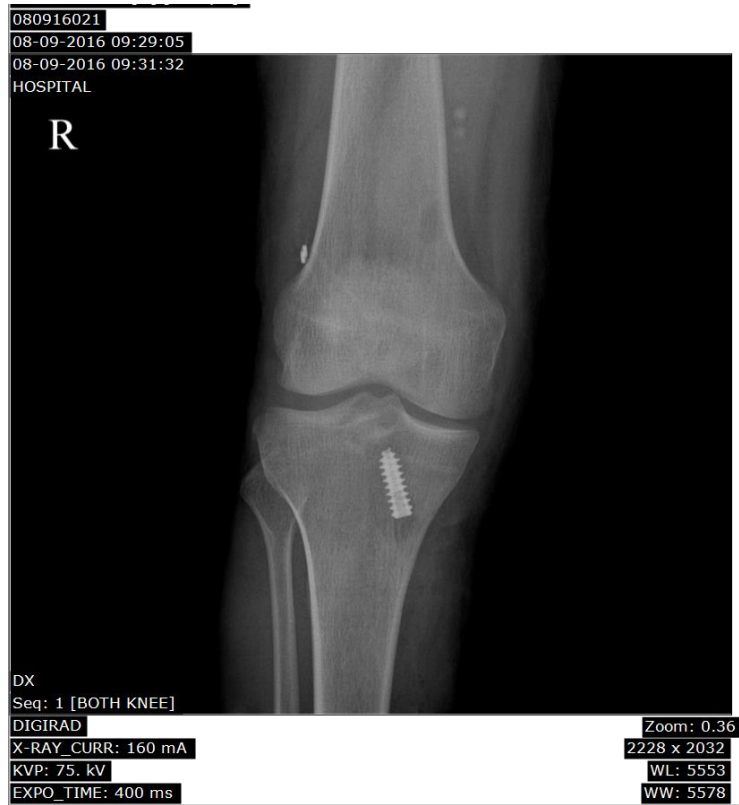


Figure 8: Post operative antero posterior radiographs of the knees during 4 month follow up showing proper positioning of endobutton and interference screw without loosening or pullout.

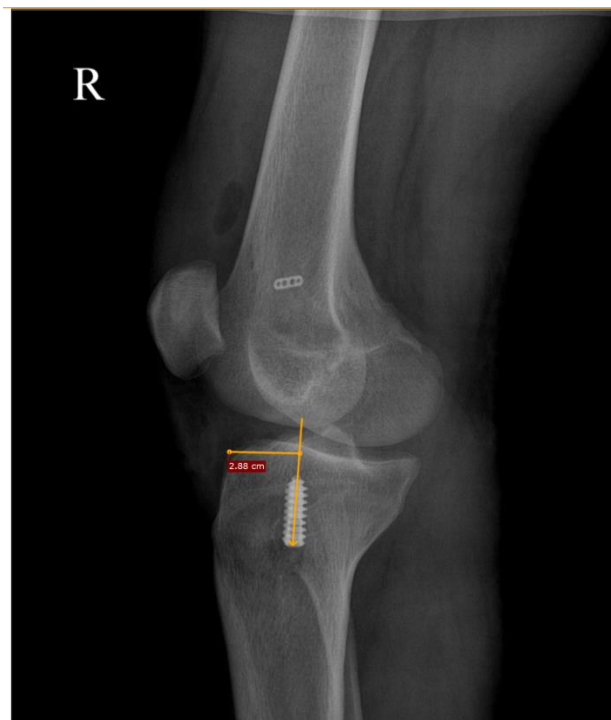


Figure 9: Post operative antero posterior radiographs of the knees during 4 month follow up showing proper positioning of endobutton and interference screw without loosening or pullout. The distance measured with radiological line tool and ruler is 2.88cms

- 1. Clinical evaluation:** The range of movement of the knee joint was checked at immediately after 12 days, at third, sixth and twelfth months.
- 2. Radiological Evaluation:** True AP and standing lateral digital radiographs were taken in the follow up- to look for the position of the tunnels, the position of the implants. The method is as described in methodology. The digital radiographs are done for each of the patients. Using the codes the images are opened. The lateral view of the operated side knee is opened on the screen Using the line and Angle, tool <http://digiteclecco.com/en/product/digirad> one line is drawn along the long axis of interference screw, another line is drawn along the anterior cortex of tibia .Using the ruler function, we determined the distance between the above two lines along the upper surface of tibia. Figure 9.

RESULTS

The range of movement of the knee joint is tabulated alongside the radiological measurements in table 1.

Table 1: The range of movement of the knee joint and the radiological measurements of all patients

| S.no | Distance from the anterior cortex to upper tip of the interference screw | Post operative range of motion of knee joint |
|------|--------------------------------------------------------------------------|----------------------------------------------|
| 1. | 27.0mm | 0-130° |
| 2. | 10.2mm | 0-130° |
| 3. | 18.7mm | 20-90 |
| 4. | 22.8mm | 0-130° |
| 5. | 26.8mm | 0-130° |
| 6. | 16.9mm | 0-130° |
| 7. | 29.0mm | 0-120° |
| 8. | 33.3mm | 0-130° |
| 9. | 28.8mm | 0-130° |
| 10. | 27.8mm | 0-130° |
| 11. | 30.6mm | 0-130° |
| 12. | 11.0mm | 0-130° |
| 13. | 19.9mm | 0-130° |

One patient who had very small distance of 10.2mm still had a good range of movement of 0-130 degree. Figure 10



Figure 10: Post operative radiographs of right knee of our second patient (both AP and Lateral view) showing Endo button and interference screw and position of tibial tunnel after ACL reconstruction . in the lateral view the distance measured was 10.2 mm and the range of movement was 0 -130degrees.

Another patient (3rd in the above table 1) had a good range of movement except that there was restriction of final degrees of extension and also reduced flexion. His post operative MRI showed Cyclops lesion. He however had no impingement and graft position was good in MRI. From the above table grossly it was found that the patients who had smaller distance had no specific reduction in extension or flexion. Statistically the relationship between the distances were done.

Table 2: Results of one-sample 't'-test and mean Position of Tibial Interference Screw in Arthroscopic Anterior Cruciate Ligament Reconstruction.

| N | Mean | S.D. | Std. Error Mean | 't' | Df | M.D. | 95% Confidence Interval of the Difference | |
|----|-------|------|-----------------|----------|----|--------|-------------------------------------------|-------|
| | | | | | | | Lower | Upper |
| 13 | 23.29 | 7.41 | 2.06 | 11.332** | 12 | 23.292 | 18.81 | 27.77 |

** - Significant difference at the 0.01 level

Table 2 shows the result of mean position of Tibial Interference Screw in Arthroscopic Anterior Cruciate Ligament Reconstruction. The mean position was found to be 23.29mm (with standard deviation 7.41mm); the lower limit and upper limit were found to be 18.81mm and 27.77mm, respectively. The result of t'-test was found to be ('t' = 11.332; p < 0.01) significant difference in the mean position of Tibial Interference Screw. The mean Post Operative Range of Movement of the Knee Joint was also found to be 130°.

Table 3: Results of Pearson Correlation between the Position of Tibial Interference Screw and the Post Operative Range of movement of the Knee in Arthroscopic Anterior Cruciate Ligament Reconstruction.

| | | Position of Tibial Interference Screw | Post Operative Range of movement of the Knee |
|----------------------------------------------|---------------------|---------------------------------------|----------------------------------------------|
| Position of Tibial Interference Screw | Pearson Correlation | 1 | 0.127 |
| | Sig. (2-tailed) | - | 0.679 |
| | N | 13 | 13 |
| Post Operative Range of movement of the Knee | Pearson Correlation | 0.127 | 1 |
| | Sig. (2-tailed) | 0.679 | - |
| | N | 13 | 13 |

Table 3 shows the results of pearson correlation between position of tibial interference screw and the post operative range of movement of the knee in Arthroscopic Anterior Cruciate Ligament Reconstruction. It was observed that there was no significant relationship since the obtained correlation coefficient r = 0.127 with p = 0.679.

DISCUSSION

To fix the tendon graft to bones in knee joint endobuttons and interference screws are used. The placement of the tunnels of the interference screws are usually done under arthroscopic control. The position of the tibial interference screws specially is of concern for orthopaedic surgeon [1, 2] Interference screws are common implants. They are as effective as they are when being used for bone tendon bone graft anchorage. The healing is achieved by growth of the tissue or incorporation of tissue into bone. [3] The direction of the tunnels are also very important so that the exact direction of the native ACL is. [2] Radiographs were taken with prevention of rotation as described by Amis et al

True Antero Posterior and standing lateral radiographs were taken at follow-up. The use of fluoroscopy helped eliminate rotation and allowed digital enhancement of the images. Clinical outcome measures. [5]

Precise graft placement is vital for a good anterior cruciate ligament reconstruction. An earlier radiographic measurements of bone tunnel position following ACL reconstruction found that placement and orientation of the tunnel varied to accommodate technique and fixation. Also the clinical results similar in bone tendon bone and semitendinosus graft [6]

MRI was found to be accurate to evaluate post arthroscopic reconstruction especially to assess the tibial tunnel angulation and graft direction . It can also helps to predict post ACL reconstruction complications like graft impingement, graft disruption, graft stretching, arthrofibrosis and ganglion cyst , abnormal graft signal without disruption, tunnel malposition [7] We had a case of arthrofibrosis in our case. The major concern in tendon graft is the incorporation of the tendon graft within the bone tunnel. Bone morphogenetic protein-2 was reported to be useful in animal models. For graft incorporation periosteal enveloping of the tendon graft was found to improve the healing response of the tendon graft within the bone tunnel. Mechanical stimulation by cyclic stretching may also help. [3] The tendon graft-to-bone healing is a slow incorporation achieved possibly with dense fibrous tissue. [8]

In all our cases a good knee function was obtained after six to eight weeks. The sole case of Cyclops had poor result but this patient did not consent for another surgery to address this problem. Cyclops is a reported complication of arthroscopic ACLR. [5] Thus the results did not depend on whether the screw was closer to the anterior tibial cortex or not. It depends on whether the patient was very active and if he understands the physiotherapy regimen or development of other complications. The radiological position of the tibial interference screws did not correlate well with the clinical results of the patient e.g. a patient with less distance from interference screw to anterior cortex still had a good range of movement clinically.

CONCLUSION

Even with a small sample size, in this study it was found that the radiological distance between the tip of the tibial interference screw and the anterior tibial cortex had no statistically significant relationship with the post operative range of movement of the operated knee. This can be considered and reassurance is useful when there is no morbidity or post- operative stiffness.

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