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ORIGINAL ARTICLE

EXCELLENT KNEE STABILITY, AND EARLY RETURN TO SPORTS AFTER ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING HAMSTRING AUTOGRAFT WITH SUTURE TAPE AUGMENTATION

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ABSTRACT

Background: ACL injuries are amongst the frequently occurring injuries of knee which usually affect athletes. In this study, we sought to assess outcomes of the suture tape augmentation of arthroscopic ACL reconstruction, in respect to knee stability, post-surgery rehabilitation, return to sports and complications rate

Materials & Methods: This case series study was conducted from Jan 2020 to July 2023 in MTI, LRH Peshawar. A total of 100 patients were included. Clinical outcomes were assessed by knee stability tests, return to sports and preinjury activity level and Patient reported outcome measures (IKDC, Tegner scores) Statistics were compared with paired t-tests and chi square test where applicable in the analysis of the results, keeping the level of $p < 0.05$ Statistically significant

Results: The results showed excellent knee stability at each follow up. The mean Lysholum scores increased from 52.76 pre operation to 90.80 post operation ($p < 0.001$), and IKDC score from preop 48.34 to post op 85.54 ($p<0.001$). Complications rate was 7% in the form infection (5%) and stiffness (2%). The average time taken to return to full activities was 6 months on average

Conclusion: Suture tape augmentation of the ACL reconstruction yields promising outcome in term of knee stability, quicker rehabilitation, early return to sports and decreased complications

KEY WORDS: ACL reconstruction; hamstring autograft; knee stability; internal brace; suture tap augmentation.

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INTRODUCTION

ACL knee injuries are common injuries, and affect a large number of athletes and sportsmen as well as those involved in high physically demanding tasks. Annually, 100,000 to 150,000 ACL injuries take place in USA alone.[1] ACL injuries are routinely caused by trauma to knee joint in pivoting spots. like soccer, baseball, cricket, kabaddi, in falls with landing in awkward position, road traffic accidents.[2,3]

The most common surgical technique of treating ACL injuries is called Arthroscopic Anterior Cruciate Ligament reconstruction commonly referred to as ACL reconstruction or ACCLR. This surgery may require either a substitution of the lost or injured ligament by the fresh tissue, either isolated from a patient's body (autograft) or from the other person's body (allograft). Another option is to repair the torn and avulsed ligament from femoral side by stitching it back to its origin.[4] Despite the high success rates, some patients however end up with residual instability, graft elongation or failure especially in the initial phases of the post-operative rehabilitation.[5] To this end, the recent advancement is suture tape augmentation, which can be helpful to improve the graft reinforcement, working as an internal seat belt mechanism, thus protecting the graft from trauma and load during the early reha-

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bilitation period. This procedure is known as suture tape augmentation in which a strong non-absorbable suture tape is used together with the ACL graft to provide a form of internal support. This reinforcement also provides additional support to the graft during the initial crucial period when chances of elongation or failure of the graft is very much possible.[4-7] This suture tape offers initial stability hence, early mobilization that may help patients to undergo rehabilitation faster and with minimal chances of graft failures.[7] Invitro studies and biomechanics researches indicate that the use of suture tape augmentation enhances the tendon graft stiffness and tensile strength, and help minimize the graft's elongation during activities.[8] Furthermore, using the suture tape may further reduce forces placed on the ACL graft during rehabilitation and exercise, thus enhancing both the short and the long-term outcomes. A number of clinical studies addressed the value of suture tape augmentation in the course of ACLR. Smith et al., mentioned in their research that suture tape augmentation in conjunction with ACLR improved the stability of the healing ligament and reduced risk of re-injury as compared to ACLR alone.[9] Objectives of this study are therefore to determine the functional and clinical results of ACL reconstruction using suture tape augmentation. As a way to assess whether suture tape augmentation provides quantifiable benefits, the choice of assessment criteria will focus on knee stability, functional performance and patient satisfaction.

MATERIALS AND METHODS

This Prospective case series study was conducted from Jan 2020 to July 2023 in MTI, LRH Peshawar. Ethical Approval was taken from the ethical review board, MTI, LRH All the patients were admitted through OPD and selection was done by purposive sampling technique. An informed consent was taken from each and every patient and consent were also taken from every patient regarding their participation in the study. A total of 100 patients, with 95(95%) males and 5 (5%) females who had ACL reconstruction with suture tape augmentation were included. Age was form16-46 (28.5±5) years. Detailed history, clinical examination and investigation including mri knee were done for every patient. After optimization for anesthesia and surgery, all patients then underwent arthroscopic ACL reconstruction as per standard protocol.

Data was collected preoperatively, and then postoperatively at each follow up; follow ups visits for data collection purpose were planned at 4th week, 8th weeks, 3rd month, 6th month 12 month.

Stability was assessed by Lachman and anterior drawer tests. Patient reported outcome measures were assessed using Lysholum, Tegner and IKDC scores; Return to sports were noted at 6th month. In addition, the occurrence of complications such as infection, graft re-rupture or development of stiffness after surgery was noted.

Statistical analysis was done by the help of the software SPSS version 22. 0. Continuous variables were described using statistical measures such as means and standard deviations. Paired T test was used to compare and evaluate the mean difference in continuous data scores preoperatively, with post operative results at each follow up and then at final follow up. Categoric variables were described using frequency and percentages. Scores regarding the return to sports and complication rates were quantified and measured using chi square test. For statistical significance, P value < 0.05 was considered significant

RESULTS

In this study total of 100 patients, with 95(95%) males and 5 (5%) females, mean age was 28. 5± 5. 0 years. Out of total 100 patients, 95(95%) were male, while 5(5%) were female In the follow up examination which was done after 12 months, 95% of the patient had negative Lachman and pivot shift test meaning that the knees were stable after surgery ($p < 0.01$). The mean value of the preoperative Lysholum knee score of 52.76, and IKDC scores of 48.34 were increased to 90.80 and 85.54 respectively in the postoperative period ($p < 0.001$), clearly demonstrating substantial gains in the patients' knee function. In addition, 85 percent of the patient population who participated in the study was engaged in physical activity prior to their surgery and 85%percent of them were able to regain their baseline activity level within 6 months after the surgery. In the complication rate in this study, we had infection in 5 cases; 3 case were superficial tibial side infection which responded to DD and antibiotic as per culture and sensitivity; In the remaining two cases, Arthroscopic wash of the knee joint was done , ACL graft was found intact; tibial screw and tap were removed , and graft retained and then antibiotic was administered and that responded and got ok. 2 cases (2%) developed stiffens and that was treated with aggressive physiotherapy The incidence of serious complications, such as graft re-rupture or severe infection that needs removal of the graft were nil.

Table 1: Demographics

Mean Age	28.5 years
Gender (Male)	95%
Gender (Female)	5%
Mean BMI	24.6 kg/m^2
RTA	30%
Soccer	20%
Cricket	30%
Kabaddi	8%
Others	12%
Left knee	40%
Right knee	60%

Table 2: Preoperative Knee Stability

Test	Percentage of Patients (%)
Lachman Positive	100
Anterior Drawer positive	80
Pivot Shift Positive	30

Table 3: Postoperative Knee Stability (at 12 months)

Test	Percentage of Patients (%)
Lachman Positive	5
Anterior drawer	3
Pivot Shift Positive	0

Table 4: Complication Rates

Complication	Percentage of Patients (%)
Minor superficial infection	3
Deep infection	2
Graft Re-rupture	0
Knee stiffness	2
No complication	95%

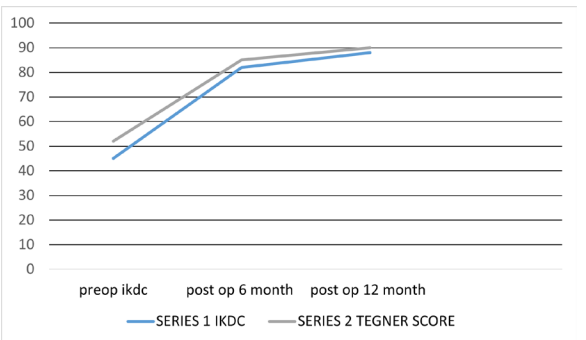

Figure: Functional knee score graphical presentation

DISCUSSION

The findings of this work show the effectiveness of using suture tape for enhancing ACL reconstruction's clinical and functional results, describing increased knee stability, shorter rehabilitation and early return to sports. These findings corroborate with the current literature on suture tape augmentation in which a number of advantages are identified in improving the ACL graft construct and minimizing the risk factors in the early period after surgery. Of the many advantages of the technique, it would seem to form a major part of increasing the stability of ACL graft during the initial stage of healing and equally important to prevent graft from stretching or failing during rehabilitation activities. Possibly the most significant observation made in this study was postoperative knee stability evidenced by Arthrometer findings, negative Lachman, anterior drawer and pivot shift tests in 92 patients at 12 months. These results are in parallel with the research study conducted by Murray et al where similar results were seen for knee stability with the help of bio-enhanced ACL reconstruction. [9] Enhancement of graft strength has also been enhanced by means of mechanical support from the suture tape augmentation during early mobilization to minimize the risk of strain put on the graft. This is further supported by the work done by Smith et al, in which the author noted that suture tape augmentation offers further shield to the ACL graft, most especially during the initial period of its healing stage when it is most exposed to trauma and so failure.[10] In this way, the suture tape acts as an internal support and force is distributed throughout the tissue more evenly avoiding graft rupture or it's elongation.

Our current study reflects the success of the surgery by comparing the pre- and post-operative mean Lysholum scores and IKDC scores which increased from 52.76 to 90.80, and 48.34 to 85.54 respectively. This is in concurrence with Grassi et al, who did identify similar functional improvements in patients, who underwent ACL reconstruction with suture tape reinforcement. [11] A recent study by Grassi also reported improved rehabilitation profile and more rapidity

Patient reported Outcome Measurements

Tool	Score	Mean difference	P Value
IKDC score			
Pre-op	48.34±5.57		
6th month	82.40±4.19	35.06 (preop -6th month)	0.002
12th month	85.54±3.19	2.14(6th mont-12th month	0.04
Tegner Lysholm Score			
Preop	52.76±2.99		
6th month	83.98±4.50	27.69(Preop -6th month)	0.003
12th month	90.80±5.50	5.80(6th month -12 month)	0.03

in the return to the previous level of activity and early return to sports at an average of 6 months, which was ascribed to the greater degree of mechanical fixity conferred by the suture tape.[12] Similarly Mackay et al and Hopper et al have concluded that suture tape augmentation enables an early aggressive rehabilitation protocol for the graft without deleterious effect on the graft, which results in improved functional outcome and better rehabilitation times.[13,14] Additionally, patients in our study had good return-to-sport rate of 85% of patients who were able to return to their pre-injury sports activity level within 6 months of the surgery. The early return to sports and pre injury activity level has also been supported in the study conducted by van Eck et al, where they also found out that athletes who have been treated with ACL reconstruction with suture tape augmentation took shorter time in their recovery period.[15] There are however extra benefits that can help most patients especially athletes who find themselves with injuries that require time off from their vigorous activities as they get to return to their sports activities level much faster. Suture tape augmentation enhances the stability which in turn minimizes chances of reinjury during the early days of rehabilitation hence ensures quick return to sports. In regard to the complications, which were described in this study, 5% of patients were encountered to experienced complications, and none of them showed the graft re-rupture. This is consistent with earlier studies including that by Sun demo et al.in their study they noted that suture tape augmentation led to reduced failure rates of graft as compared to the conventional ACL reconstruction.[16]

It is assumed that the low complication rate can be explained by the fact that a suture tape increases the stability of the graft and reduces its stress due to early postoperative activity. Crucial to this is the fact that in their works, Hopper et al have established that there was reduction in graft elongation and revision using suture tape in ACL reconstruction hence the possibility of suture tape to enhance clinical results. As with the previous studies, several other authors have supported the usability of suture tape augmentation for ACL reconstruction. To illustrate, research by Macarenas et al reveals that those that underwent suture tape augmentation suffered reduced complications and shorter periods of convalescence than an ACL reconstruction only.[17] Moreover, Burnham et al in systematic review indicated that the use of suture tape augmentation decreases the risk of graft failure and improve the knee joint function in the long term.[18] These findings, coupled with the result of this study, indicates that suture tape augmentation can be developed as a potential method to optimize ACL reconstruction by enhancing early graft stability and reduce complications. Summative, it can be said that the findings of this study are in concordance with the science in favor of suture tape augmentation as an additive to ACL reconstruction. In this context this technique seems to enhance early stability after knee surgery, decrease the chance of graft failure and hasten the period of rehabilitation. Thus, the long-term follow-up research, and the larger- scale based randomized controlled trials are needed to determine the sustained effectiveness of the suture tape augmentation in the ACL reconstruction.

CONCLUSION

ACL reconstruction combined with suture tape augmentation gives good clinical and functional outcomes and reduced complications and reduced time to return to the pre-injury activity levels and sports. Suture tape augmentation therefore seems to add extra support to the graft particularly during the early days after surgery thus decreasing chances of graft failure and time taken to regain normal pace of knee joint.

Limitations: In the present study, there are small patient population and short-term follow-up, thereby excluding the evaluation of graft changes and patients' functional status in the mid- and long-term period. Also, this was a descriptive study; hence we would recommend for double blinded randomized control trial with long follow up.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	JI, NU
Acquisition, Analysis or Interpretation of Data:	JI, NU, AK, SUR, FAS
Manuscript Writing & Approval:	JI, NU, AK, SUR, MAA

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.