

Dr. Fabrizio Di Feo
Orthopaedic Surgeon at the
CTO Hospital in Rome,
1st Division
(Head Physician A. Passa)

femoral + tibial 

RIGIDFIX[®]

TRANSVERSAL FIXATION FOR ACL RECONSTRUCTION WITH SEMITENDINEOUS TRIPLE GRAFT

according to
Dr. Di Feo's
Technique

- Graft bone with 360° contact
- Safe pins fixation
- Easy execution
- Absorbable grafts
- Improved biomechanics

NEW:
Fixation with
reabsorbable
tibial rigidfix

 **DePuy Mitek**
a Johnson & Johnson company

[Endoscopic Reconstruction with semitendinous triple graft and RigidFix fixation]

■ *Rationale for use*

Minimizing surgical trauma

• *The use of semitendinous tendon*

In the Anterior Cruciate Ligament (ACL) reconstruction, as in all kind of techniques, it is extremely important to decrease the immediate damaging impact of the intervention, especially being this an auto-graft foreseeing a double surgical damage first due to the removal and then to the implant of the used tendon.

As already highlighted by Rosenberg for what concerns the quadruple semitendinous graft and by Staehelin and Morgan for the triple ones, from this point of view the use of only the semitendinous graft guarantees sturdiness, considering that the single semitendinous graft has a resistance equal to the 70% of the original ACL.

The tendon removal generates a graft long between 21 and 32-33 cm, according to the patient's height, the ability of the surgeon and an imponderable variable bound to the height of the cut of the tendon stripper on the teno-muscular junction. The so-obtained tendon can be tripled with a graft total length between 7 and 10 cm, medially around 9-9.5 cm; quadrupling tendon could create grafts short and too stiff.

Compressed on a circular section the graft diameter varies between 7.5 and 9 mm. if considered in its central section; comparing it again with the quadruple tendon, this last one has a diameter usually larger than 9 mm increasing the difficulties related to the tendon central section gluing. The two ends of the triple semitendinous

graft can be created with a lower or higher diameter according to requirements.

These geometrical and mechanical characteristics make the semitendinous tendon equal to other used tendons such as the quadriceps tendon and the Achille's one, and make it definitely superior to the patella tendon, also implying a less significant trauma for the patient. Several studies confirmed the possibility for the tendon of growing again from the muscle and within the sheath/path of the tendon itself; this event takes place in 70% to 80% of patients.

The ACL reconstruction with uni-tunnel technique has to be carried out with a 3 cm incision in the medial superior region of the leg at level with the anserine tendon along the Langer's lines; this has an excellent cicatricial and aesthetic result.

• *Rigidfix*

The use of Rigidfix fixation system at a tibial and femoral level allows fixing the graft in the epiphyseal and cortical area at the lateral femoral condyle and the internal tibial plateau level using reabsorbable "pins" not in contact with the endo-articular environment. These pins guarantee an excellent resistance to the tractions and rotations to which the graft is subject.

The use of a "U-guide" allows the positioning of pins in the centre of the graft assuring an excellent repeatability of the surgical action at the fixation level.

■ *Surgical Technique*

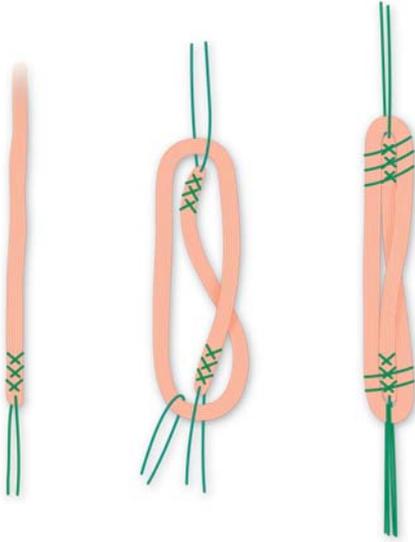
Tendon removal

It is advised to make an oblique incision of almost 3 cm starting 2 cm medially and 2 cm distally from tibial tuberosity following the course of the anserine tendon at 30° in supine decubitus. Gently move down in the underlying levels making an accurate haemostasis with electro-scalpel at the minimum speed to prevent deforming the anserine tendon level that is immediately underneath. Once the sartorius tendon is identified incise it following the fibres' lines and avoiding damaging it, then open it out showing semitendinous and gracilis tendons and their common intersection. The semitendinous distally presents 3 reflexions which are advisable to charge cistically in order to exert a tension on the tendon including the reflexions. This allows exerting a homogeneous traction on the tendons' fibres; it is particularly important to identify the most proximal reflexion - almost 10-12 cm from the tibial bone intersection - to avoid a blockage of the ascending tendon-stripper. Once the tendon stripper is inserted on the tendon, go up proximally in line with the tendon, cutting once over passing 28 cm length; anyway as from 23 cm length it is already a useful area.

Tendon preparation (Pic. 1)

With a robust thread execute a Roman Sandal like structure on both ends of the tendon for almost 3 cm.

Construction of the tendon (Pic. 1)



Strongly tension the tendon with suture threads; then, execute a plain loop contacting the tendon's end on the end that will be located in the proximal hole. The tendon is thus tripled putting it on a narrow S shaped plain; the 2 tendon's bends are then to be put in the 2 suture threads coming out of each tendon's end, and then all has to be tensioned. In this way we obtain a transplant in which the traction on threads exerts a tension on the three tendinous parts that will have the same length. The end with the plain loop will be put in the graft's part destined to be inserted in the femoral hole; the two threads of that end pass overlapping the other 2 and thus allowing a homogeneous tension of the three parts. In the graft's part destined to be positioned on the tibia, we will put another thread overlapping the loop, being accurate in assuring that the sutured end is slightly shorter (5 mm) than the remaining tendon passing through the threads coming from the sutured end. In this way we will have the chance to tension this part of the graft: one end through the sutured thread on the tendon and the remaining 2 parts through the thread overlapping the loop. The two ends of the graft are then sutured using a reabsorbable thread in order to make them more compact and applying

circular stitches, each for a length of 3 cm.

Tibial hole

The tibial hole will have a diameter inferior to 0.5 mm to that of the portion of the hosted tendon: obviously, the operator will take care of obtaining a graft part destined to the tibial positioning having a diameter never inferior to the femoral one. Averagely, the hole will be centred in the central portion of the ACL tibial stump, of which if possible residuals are maintained. The operator will try to obtain an hole inclination equal to 50-60° on a sagittal level and to 60-70° on a femoral level; the hole will start medially and slightly higher to the anserine tendon (not in the collateral ligament!).

Femoral half-tunnel

It will be carried out according to the Rosenberg's dictates from the tibial hole with knee flexed to 90°, 5-6 mm embossed guide according to the diameter of the necessary hole. The advised depth for the hole is of 30 mm for a graft long 9 cm, and 25 mm for shorter grafts; it is not advisable to carry out shorter holes since these may invalidate the RigidFix's pins hold.

RigidFix proximal cannulas positioning (Pic. 2)

First set the femoral RigidFix U-guide inside the tibial hole and then inside the femoral one, choosing a cannulated stem with adequate diameter; introduction in the femoral half-tunnel can sometimes result difficult, in such a case, one may try by extending the knee of almost 70° and then flex it once inside, exerting at the same time a posterior drawer.

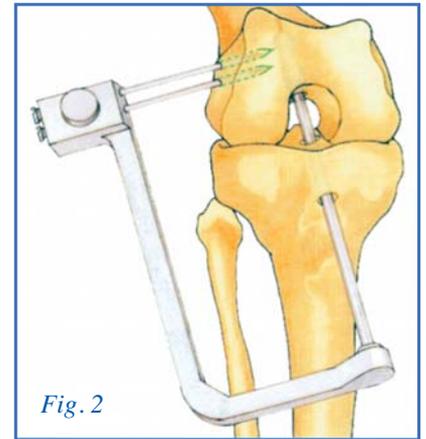


Fig. 2

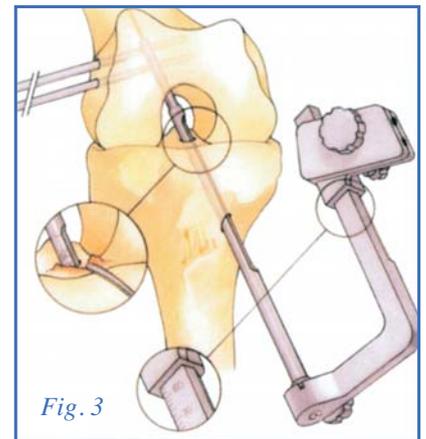


Fig. 3

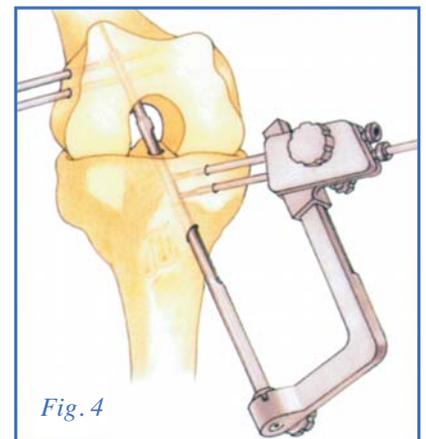


Fig. 4

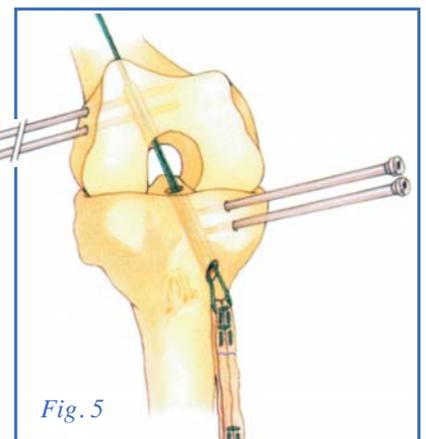


Fig. 5

The femoral position has to get in contact with the roof of the half-tunnel, thus from the outside, the 2 cannulas are positioned with the trocar end inserting the distal one at first. The cannulas angle must be perpendicular to the lateral femoral condyle.

RigidFix tibial cannulas positioning (Fig. 3-4)

A tibial guide of adequate diameter will be used, passing it through the tibial hole and then through the femoral one, then, after reading the distance from the half-tunnel roof to the tibial plate, set the same distance on the tibial cannulas external guide. The intersection point of the proximal cannula will often be high and in some cases the front medial arthroscopic portal can be used; among the instruments to be used it is foreseen a bone palpator, allowing to try the hole positioning. Cannula's positioning is at about 30° anterior to the femoral cannulas.

Graft positioning (Fig. 5)

Graft will be dragged with a thread from the tibial hole towards the femoral hole, keeping the knee bent at 90°. It is necessary to have certain strength since the graft will have a good press-fit that is the guarantee of a correct holes measuring and a future good integration.

Femoral fixation (Fig. 6)

The assistant will maintain the graft under slight tension through the threads coming out of the tibia and the femur, and being careful in keeping it lay on the roof inside the femoral half-tunnel with a higher proximal tension. First the distal pin will be inserted, then the proximal one, so to obtain a dystro-proximal

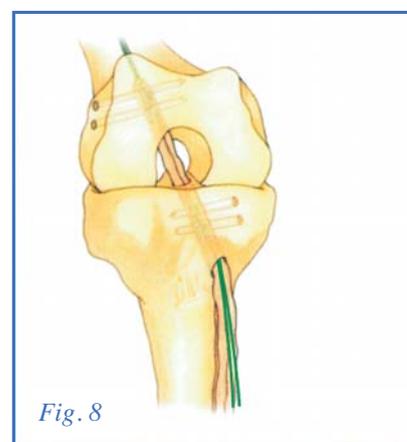
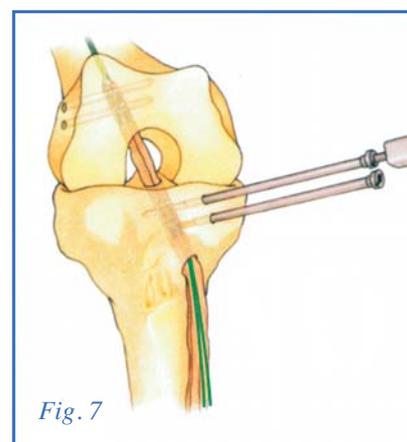
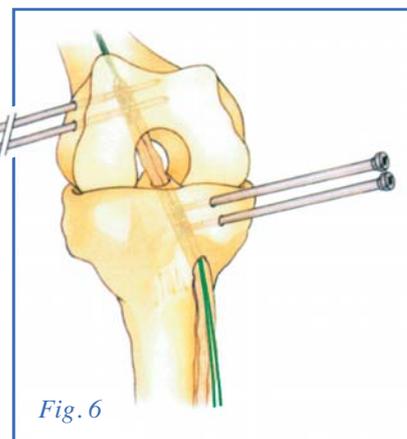
tension in the hole, partly similar to a screw's action. Pins have to be inserted in the positioning cannula with the conic end towards the inside and paying attention not to make them fall. Beat them with the proper positioner till the end of their path without using particular violence in order to avoid a further impact on the cannula while using it. Then tension it with the maximum strength for two minutes through the threads coming out of the tibial tunnel.

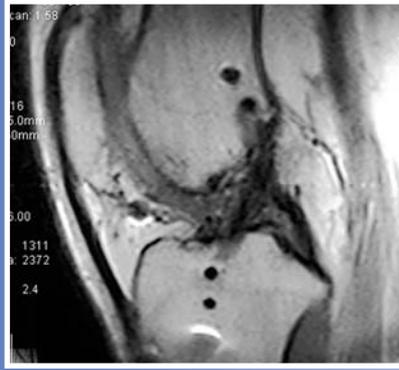
Tibial fixation (Fig. 7)

Maintaining the graft in tension, first position the proximal pin and then the distal one with the same modality of the femoral one; tension on the threads coming out of the tibial holes must be maximal and homogenous; 2 threads keep an end under tension, while the other two, tensioning the remaining graft while overlapping it, can give a more elastic response. It is convenient to maintain united the 2 cannulas in the positioning guide since the distal one can often be poorly stable.

Final Control (Fig. 8)

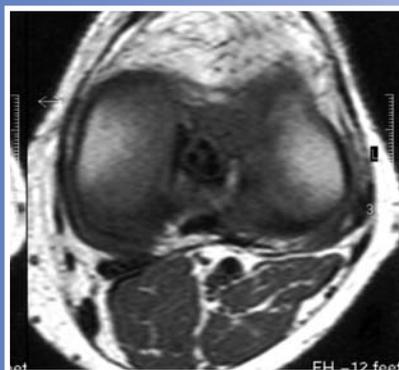
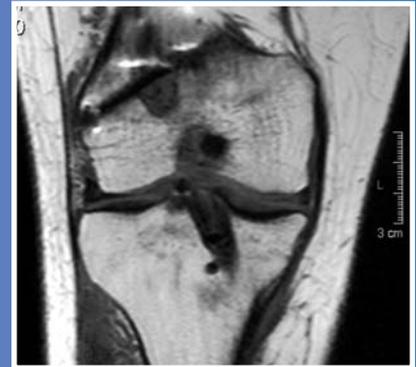
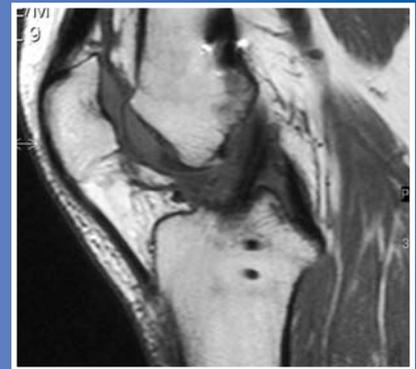
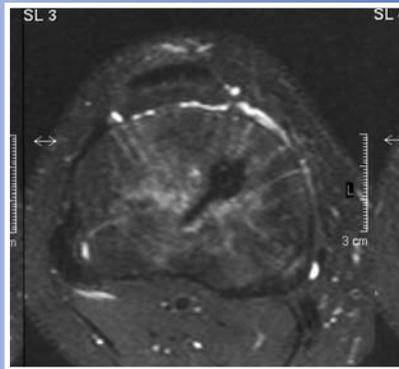
Control the graft with arthroscopy and assess its tension using a palpator, then remove the cannulas with the proper instrument controlling that they don't have pins inside (this can happen if cannulas are bent during intervention). In case the graft results to be not in tension, try its tension level by tractioning the tibial threads. Re-control the graft after a couple of dozens of flexions and extensions; the eventual failure in reaching total extension, with a slight deficit of about 5°, is well common in hard tensioned ligaments but it tends to recover during rehabilitation.





C.S.
One month
after intervention.

M.M.
Four months
after intervention.



B.M
Eight months
after intervention.



Special thanks to
Doc. Cerone CTO

