ÖSSUR®
LIFE WITHOUT LIMITATIONS

REBOUND®

Injury Solutions

Introducing selected case studies from Key Opinion Leaders

FUNCTIONAL HEALING® BY ÖSSUR

FUNCTIONAL HEALING® CASE STUDIES FROM GLOBAL KEY OPINION LEADERS

LIST OF CONTENT

REBOUND® PCL

ÖSSUR REBOUND®
INJURY SOLUTIONS

The Rebound product family is built on decades of experience and designed to protect bone and soft tissue during healing. Through innovative technology, proven biomechanical approaches and partnerships with leading medical professionals, we strive to offer comprehensive and effective treatment options.

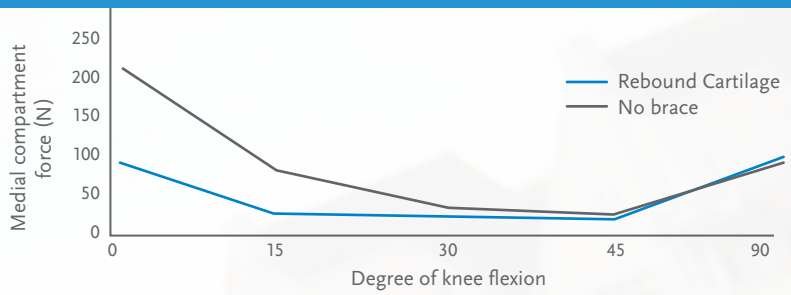
Within the Rebound family, we offer indication-specific products designed to optimise healing while maintaining function and mobility. These Functional Healing products incorporate Össur's proprietary technology and are backed up by clinically-relevant outcomes.

REBOUND® CARTILAGE

Rebound Cartilage is a protective functional solution designed to support regeneration of the knee cartilage after cartilage repair and meniscal repair/ transplantation. Rebound Cartilage is based on the clinically-proven 3-Points of Leverage System and patented Cartilage Protection Straps™.

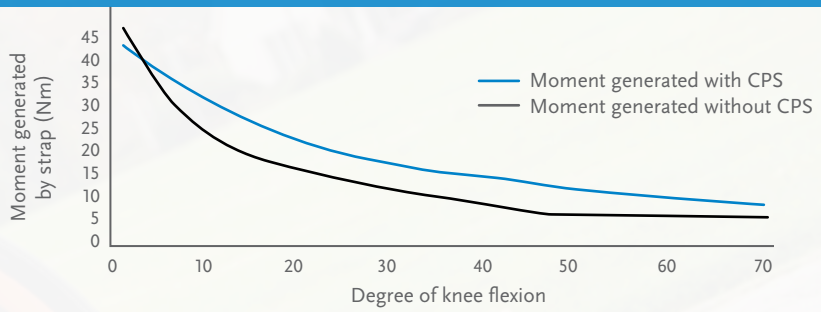
BIOMECHANICAL EVIDENCE

REDUCED COMPARTMENTAL FORCE



Rebound Cartilage effectively unloads the addressed knee compartment *

A WIDER RANGE OF PROTECTION



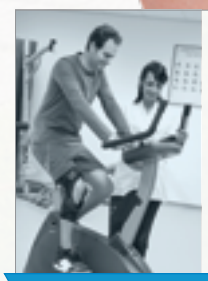
Cartilage Protection Straps (CPS) maintain greater strap tension over wider range of knee flexion *

Improve functional capacity to rebound more rapidly during rehabilitation.

PRE/REHABILITATION

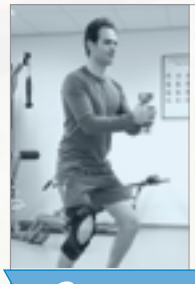
Partial weight bearing and possible restriction of range-of-motion.

1 POST-OP



Transition from partial weight bearing to full weight bearing.

2 INITIAL



Full weight bearing with moderate load. No running.

3 INTERMEDIATE

Full weight bearing, progressing to normal functional level.

4 FINAL

No Limitations

Normal life with various sports and activities. Prevent progression to OA.

5 RECOVERY

Articular cartilage needs up to 24 months to regenerate post repair procedures and includes 5 important phases for recovery.

*Biomechanical data from surrogate leg. (Össur File)

Cartilage Repair Case Study

Two patients with cartilage lesions treated with temporary unloading.

INDICATION

Patients with large cartilage lesions without any malalignment or patients with small to medium-sized defects but with a slight malalignment may need a temporary unloading of the lesion site area post-surgery and during the initial maturation time. I have here below two examples of patients being candidates for temporary unloading with a brace.

CASE EXAMPLES

One patient (patient 1) has been operated on before with carbon fiber implants, resulting in successful pain relief. A return of pain results in a new conventional weight bearing x-ray + an MRI.

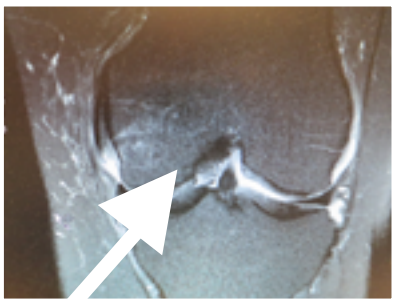
A lesion in the repaired area was found on the MR images (see arrow).

There was a slight narrowing of the joint space and a minor malalignment in varus (0.5 degrees). The patient rejected the suggested unloading osteotomy. Instead, an arthroscopy was performed and an injury of the repaired area was treated by an AMIC procedure with a hyaluronic acid membrane. Post-operatively the rehabilitation was combined with an unloading brace locked in extension for 2 weeks with full weigh bearing allowed. At the 3rd week the brace was opened and put into unloading position for another 4 weeks. For the rest of the post-operative year, the patient was advised to use the unloading brace as much as possible outdoors.

Patient 2 has a knee trauma. The weight bearing x-ray is normal but the MRI images show a large chondral lesion on the medial femoral condyle of the injured knee. At the arthroscopy examination, treatment with ACI was decided and a biopsy was taken.

8 weeks later, a trans-arthroscopic ACI was performed. The patient was immobilised in an unloading brace locked in extension for 2 weeks with full weight bearing allowed. At the 3rd week, the brace was opened and put into unloading position for another 4 weeks. For the rest of the post-operative year, the patient was advised to use the unloading brace as much as possible outdoors.

Figure 1. Patient 1's MRI.



Patient 2 arthroscopy (Figure 2) and MRI (Figure 3).

Mats Brittberg
MD, PhD
Professor, Region Halland Orthopedics
Kungsbacak Hospital, Sweden

TREATMENT GOAL / REHABILITATION

It is important to be patient when treating cartilage lesions as the healing time is very long. The maturation process seen in different types of cartilage repairs goes on for 2-3 years. Too much load may have negative effect on the repair tissue development. When there is a large malalignment, a definitive unloading with an osteotomy is needed. The amount of time needed post-operatively to protect a repaired area with an unloading brace is not known. However, one may follow the reduction of bone marrow edema seen below a cartilage defect repair as a sign of repair tissue maturation. If the bone marrow edema has disappeared at 1 year, less use of the unloading brace is needed and vice versa.

Goals are: 1) Motion Control, 2) Muscle Strengthening and 3) Balance and Coordination Training.

Post-operative physiotherapy programs following articular cartilage repair procedures vary much among patients and are individualised based on the nature of the lesion, the special characteristics of the patient, and the type and detail of each surgical procedure. The repair tissue development after surgery is slow. Theoretically there are several repair phases to which the rehabilitation could be adapted. Furthermore, the speed of rehabilitation is partly limited if there are other injuries repaired at the same time like meniscus and ligaments. Cartilage repair is the slowest tissue to repair and the rehabilitation is subsequently adapted primary to the cartilage repair mechanisms. Weight bearing as much as pain allows. Crutches 4-6 weeks.

PHASE 1: 1-12 WEEKS	PHASE 2: 3-6 MONTHS	PHASE 3: 6-24 MONTHS
Proliferative phase: After cell migration, proliferation and attachment, a fibrocartilaginous soft repair tissue forms.	Transition phase: Tissue integration into the surrounding tissue improves the structural composition of the repair cartilage.	Remodeling and maturation phase: On-going remodeling of matrix is seen with reorganisation of collagen.
Physiotherapy steps: protection and articular joint activation. • Active-assisted heel slide exercises progressing to gradual increase pain-free active knee ROM exercises. • Stationary cycle, minimal resistance once 100° of knee flexion are achieved. • Full active ROM exercises for ankle and hip. • Quadriceps setting exercises progressing to multi-angle isometric exercises. • Partial to full weight-bearing proprioceptive exercises. • Aqua therapy when surgical wound has healed. • Rowing ergometer, no resistance (no handle). • Introduce treadmill walking after full weight bearing. • Introduce forward lunges, forward step-ups, and lateral step-ups within safe range of knee flexion after full weight bearing.	Physiotherapy steps: progressive joint loading and functional restoration. • Progress knee exercises to light resistance within safe ranges, with no resistance over repaired area. • Progress from concentric to eccentric loading. • Progress from static to dynamic loading. • Proprioception/balance exercise progressions: stable to unstable surfaces, uniplanar to multiplanes, double- to single-limb. Strength exercises for the hip muscles in full WB positions. • Progress proprioception exercises to more challenging surfaces. • Introduce low-impact uniplanar aerobic activities and progress to moderate-impact uniplanar activities and then to multiplanes activities. • Introduce plyometrics in supine double-limb landing with gravity eliminated, progressing to single-limb landing with gravity eliminated and then to standing on foam surface. • Continue cycle and rowing ergometer with increasing duration and gradual increase in resistance. • Continue aquatic therapy for general endurance.	Activity restoration (sport-specific reconditioning/on-field rehabilitation): • Loading program individualised with progression to full resistance over repaired area in both closed-kinetic-chain and open-kinetic-chain activities. • Continue strengthening and flexibility exercises from phase 2. • Education and preparation for return to sport. • Sport-specific high load strength training (increase of intensity and duration). • Increase of dynamic training with implementation of functional sport-specific agility training.

CONCLUSION

Remember the T3 of cartilage repair: Time is long, Training is needed regularly, and Tolerance is crucial from both doctor and patient related to the first two T's. Cartilage repair is a biological process with a repair tissue under constant remodeling. Such a process needs adequate loading; not too little and not too much. Temporary support from an unloading brace may be benefical when treating large lesions without malaligment or the lesions in malaligned joints.

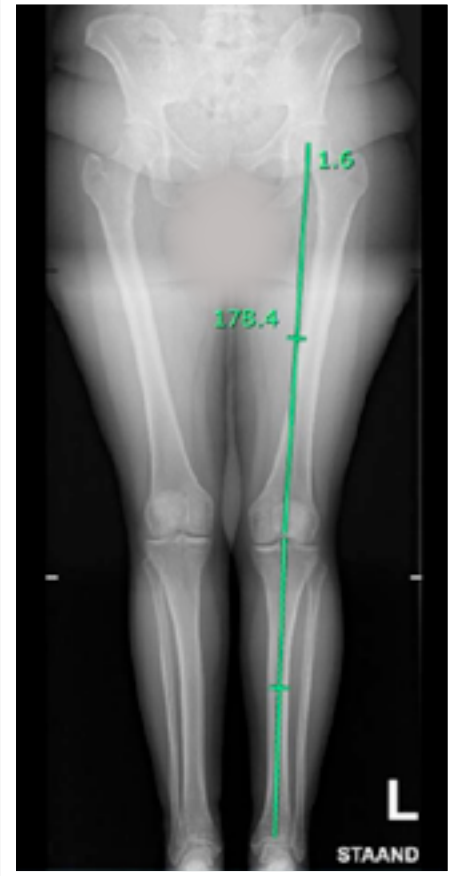
Rebound Cartilage Case Study

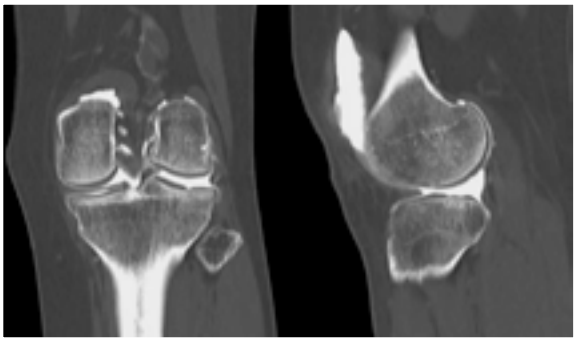
Female patient with chronic pain in left knee.

INDICATION

Female patient, presents chronic pain at the lateral tibiofemoral compartment of the left knee. She underwent a lateral subtotal meniscectomy 7 years ago. Clinical examination reveals slight valgus alignment of the knee. Tenderness is located at the lateral joint line, no ligament instability could be found using conventional laxity tests.

DIAGNOSTICS





Standing X-rays confirmed close to neutral alignment of the left knee (valgus angle of 1.6 degrees). Arthro-CT scans confirmed subtotal meniscal defect at the lateral side (34 mm on coronal plane, 29 mm on sagittal plane), with evidence of focal (ICRS grade III) chondral damage at the lateral tibiofemoral compartment.

TREATMENT OVERVIEW / TREATMENT GOAL

Initial rehabilitation is prescribed to maintain complete range of motion and improve quadriceps strength. Lateral unloader brace was used to reduce the bearing on the lateral compartment and improve knee function as a preoperative test. Lateral meniscal allograft transplantation procedure is planned on the basis of pre-operative condition. Aim is to achieve pain-free bearing, and satisfactory knee function.

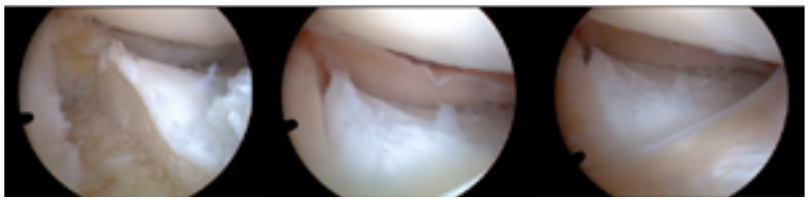
Peter Verdonk
MD, PhD

Antwerp Orthopaedic Center
Monica Hospitals

Department of Orthopaedic Surgery
Antwerp University Hospital (UZA)

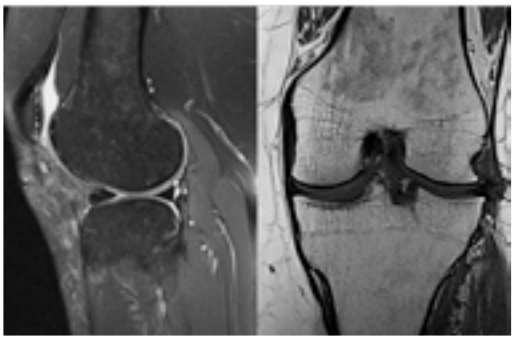
SURGICAL TREATMENT

A lateral meniscal allograft transplantation with bone trough was performed under arthroscopic guidance.



REHABILITATION

ITEM	PHASE 1 (0-1W)	PHASE 2 (1-3W)	PHASE 3 (3-6W)	PHASE 4 (>6W)
Rebound Cartilage	24 hours	No bracing	During ambulation	During ambulation
ROM	Locked in extension	0-45 week 1-3	Max 90 degrees	Progression to full flexion, avoid deep flexion until week 12
Weight Bearing	Not allowed	Not allowed	Progressive weight bearing	Full weight bearing with brace
Physical Therapy	RICE Isometric Contractions	RICE Closed chain Proprioception	Progress to open chain exercises	Strengthening Proprioception



REASONS TO USE THE REBOUND CARTILAGE BRACE

The brace fits optimally the needs to unload the treated compartment in the early healing phases, while allowing gradual increase of flexion during post-operative period. It also serves in the preoperative testing phase to identify mechanical overload as the main responsible factor of pain in the affected compartment.

CLINICAL OUTCOME

At 3 months of follow-up, the patient is pain free, she walks without crutches. Unrestricted activity was allowed at 6 months, but contact sports were delayed at 12 months of follow-up. MRI showed good status of the meniscal tissue, but still ongoing integration of the bone plug that otherwise appeared well integrated at X-Ray evaluation.

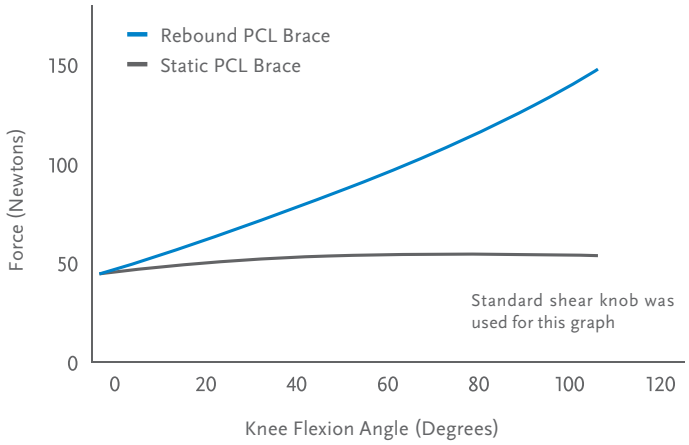
CONCLUSION

Use of the Rebound Cartilage brace helped unload the treated compartment during integration phases, at the same time allowing a safe recovery of flexion, thanks to the adjustable hinge and progression towards complete weight-bearing.

REBOUND® PCL

Rebound PCL is our first brace designed to apply a physiologically-correct, dynamic force, optimum for rehabilitation of PCL ruptures. For use during functional (non-surgical) treatment or post-surgical reconstruction.

Quantification of functional brace forces for posterior cruciate ligament injuries on the knee joint: an in vivo investigation.



Comparison of the posterior tibial load provided by a static PCL brace and the dynamic force of the Rebound PCL brace. Graph adapted from LaPrade et al.

2016 Orthopedics This Week Sports Medicine Awards

Rebound PCL – proven physiologic loading in knee extension and knee flexion.

The Rebound PCL brace applies significantly larger forces at higher knee flexion angles, where the posterior cruciate ligament (PCL) is maximally loaded in vivo, compared to a static PCL brace.

FUNCTIONAL HEALING® BY ÖSSUR

Rebound PCL Case Study

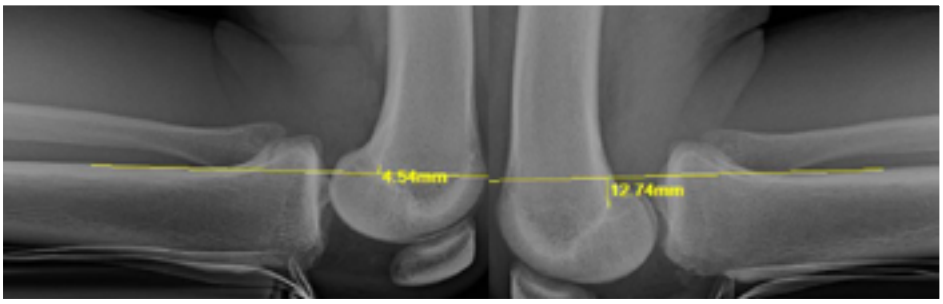
24 year old male, severe varus non-contact injury

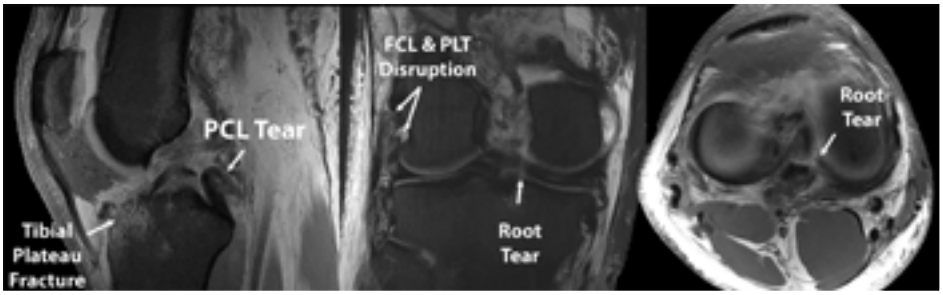
INDICATION

The patient was a 24 year old male injured during a tumbling landing. He sustained a severe varus non-contact injury.

DIAGNOSTICS

An MRI scan demonstrated a complete tear of his posterior cruciate ligament (PCL), a grade III complete posterolateral corner injury, a minimally displaced anterior tibial plateau fracture, and a medial meniscus root tear. PCL stress radiographs demonstrated a high grade PCL tear with 16 mm of increased posterior tibial translation.





TREATMENT OVERVIEW / TREATMENT GOAL

The goal of treatment was to restore his function to a high national level and to initiate knee motion on postoperative day one to ensure that he did not develop arthrofibrosis (knee stiffness). It was desired to operate within the first 2 weeks after injury because the results of acute treatment for multiple ligament injuries have the best outcomes.

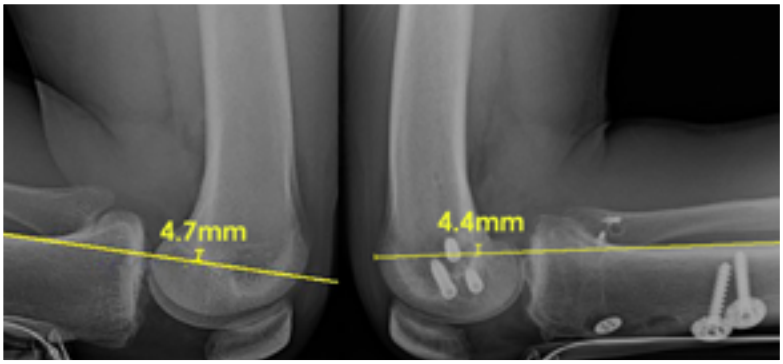
Robert F. LaPrade
MD, PhD

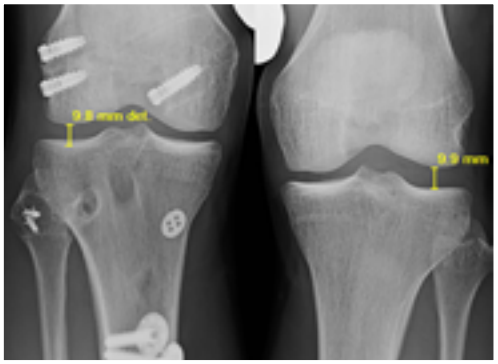
Complex Knee and Sports Medicine Surgeon

The Steadman Clinic
Vail, Colorado USA

SURGICAL TREATMENT

The surgical procedure consisted of a double bundle PCL reconstruction, a complete anatomic posterolateral corner knee reconstruction and a medial meniscus root repair.





POST-SURGICAL REHABILITATION

The patient initiated physical therapy on postoperative day one. Early prone knee flexion, to negate the effects of gravity, was initiated at 0-90° for the first two postoperative weeks and then increased as tolerated. In addition, the patient was non-weight bearing for the first 6 weeks. On postoperative day 3, the patient was placed into a Rebound PCL brace. After 6 weeks, the patient initiated a progressive weight bearing program.

REASONS TO USE THE REBOUND PCL BRACE

Historically, PCL reconstructions tended to stretch out over time due to the deleterious effects of gravity. The use of the Rebound PCL brace negates the negative effects of gravity by applying an anterior translation force at higher knee flexion angles theoretically protecting the PCL graft. Early postoperative application of the Rebound PCL brace facilitates an early improvement of knee motion.

CLINICAL OUTCOME

The patient had an excellent outcome. He had full restoration of knee motion and complete healing of his PCL and PCL reconstructions. He was able to return back to activities at 9 months and was able to return to a national level of competition at one year postoperatively.

CONCLUSION

Patients with serious multiple ligament knee injuries can be restored back to high levels of activity with modern anatomic-based reconstructions. The additional use of the Rebound PCL brace facilitates a safe initiation of knee motion in the early postoperative period.

Rebound PCL Case Study

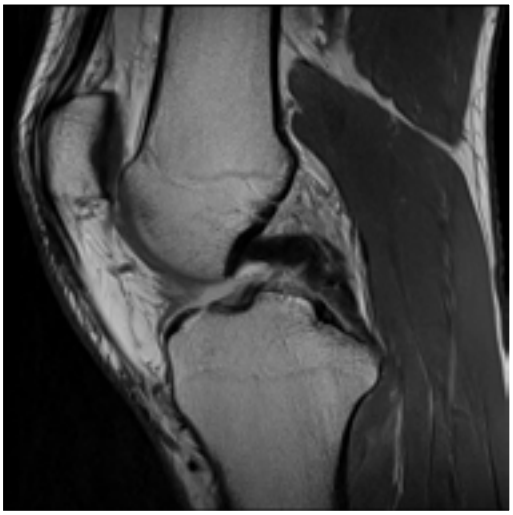
24 year old male, right knee isolated high grade PCL injury, non-surgical treatment

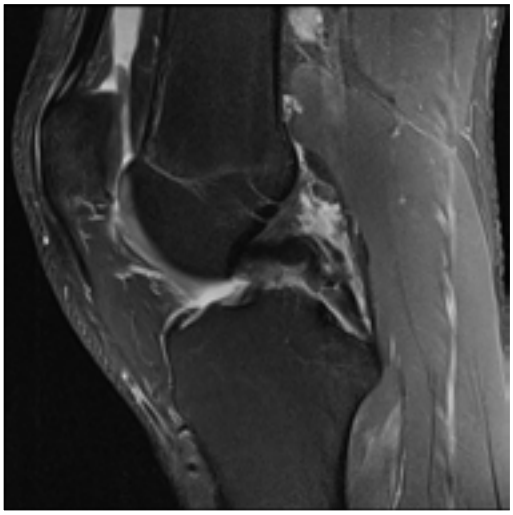
INDICATION

24 Male, High Level AFL footballer with right knee isolated high grade PCL injury after a fall onto anterior tibia on a flexed knee. Seen day 7 post injury with grade 3 PCL laxity (tibial station posterior to femoral condyle). No other clinical laxity. Past history 2 years prior of left knee high grade PCL injury, managed without bracing, with grade 2+ Posterior Draw with firm end point.

DIAGNOSTICS

No fractures on plain x-ray. MRI confirmed mid-substance PCL injury. No associated meniscal or chondral injury. Intact Posterolateral Corner, ACL and MCL.





TREATMENT OVERVIEW / TREATMENT GOAL

Patient reported mild dissatisfaction with residual laxity on left side. After discussion of options, patient elected to be managed with Hinged PCL Specific Brace, with the goal of reduced laxity when compared to previously injured left knee.

Christos Kondogiannis
FAOrthA FRACS

Royal Melbourne Hospital
St. Vincent's Private Hospitals

Melbourne, VIC Australia

NON-SURGICAL TREATMENT/REHABILITATION

ITEM	PHASE 1 (0-2W)	PHASE 2 (2-8W)	PHASE 3 (8-12W)	PHASE 4 (>12W)
Rebound PCL	24 hours	24 hours	Day only	No brace
ROM (Ext/Min Flex/Max Flex)	Locked in extension	0/0/45 week 2-4 0/0/90 week 4-6 0/0/max week 6-8	No limitation	
Weight Bearing	25% PWB	50% PWB week 2-4 WBAT > week 4	No limitation	
Physical Therapy	RICE Isometric Contractions	RICE Closed chain Hamstring exercise Proprioception	Graduated return to sport specific training/ agility	Return to sport

REASONS TO USE THE REBOUND PCL BRACE

Despite literature supporting functional rehabilitation without bracing for isolated high grade PCL injuries, in my experience, not uncommonly, patients note residual posterior laxity that is problematic. This patient in particular had experienced a similar injury of the contralateral knee, and whilst still functioning at a high level, noted residual symptoms. Previous satisfactory outcomes with the use of PCL braces lead me to offer bracing as a treatment option in this case. We were fortunate that the injury occurred at a time where the athlete felt comfortable taking time before returning to competition.

CLINICAL OUTCOME

The patient returned to high level competition approximately 4 months post injury, at the beginning of the next season. Examination of right knee at 6 months revealed grade 1 posterior draw, with firm end point. ROM equivalent to contralateral knee. Subjectively, the patient was much happier with his right knee stability than his left knee. As noted previously, despite subjective dissatisfaction with his left knee, athletic performance was not adversely affected.

CONCLUSION

In this isolated case, while using a PCL brace, PCL stability improved from baseline and resulted in subjective patient satisfaction.

Rebound PCL Case Study

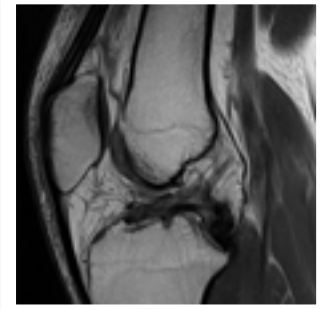
27 year old male, laborer, with ACL / PCL and MCL deficient left knee

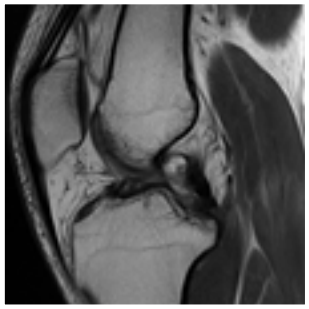
INDICATION

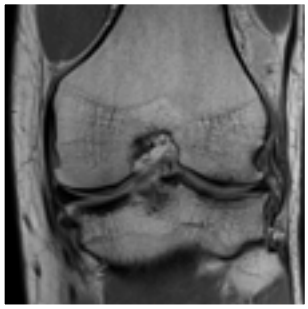
Presents 8 weeks after injury at work. Foot was caught between pallets with subsequent hyperextension valgus injury. Past history of probable MCL injury. Examination reveals 3+ laxity of PCL, 3+ laxity of ACL and 3+ laxity of MCL (0 & 30 degrees).

DIAGNOSTICS

No fractures on plain X-ray. Neutral Mechanical axis on alignment X-rays. MRI confirmed probable chronic ACL tear/acute PCL tear and tibial sided MCL injury. Meniscal tears and chondral damage medially and laterally.





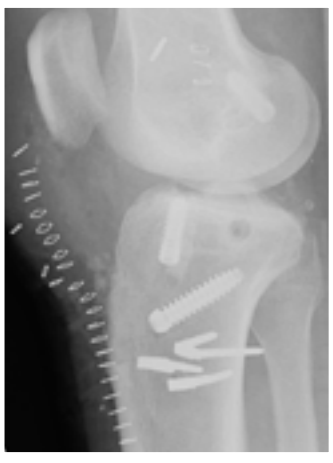


TREATMENT OVERVIEW / TREATMENT GOAL

Initial rehabilitation, protected in PCL brace aiming to achieve functional ROM. Planned multiligament reconstruction to improve baseline laxity and subjective stability.

SURGICAL TREATMENT

4 months post injury – Autologous Hamstring PCL Reconstruction / Autologous BPB ACL Reconstruction / Allograft LaPrade MCL Reconstruction.



Christos Kondogiannis
FAOrthA FRACS

Royal Melbourne Hospital
St. Vincent's Private Hospitals

Melbourne, VIC Australia

POST-SURGICAL REHABILITATION

ITEM	PHASE 1 (0-4W)	PHASE 2 (4-8W)	PHASE 3 (8-12W)	PHASE 4 (>12W)
Rebound PCL	24 hr (Grey Shear Knob)	24 hr (Grey Shear Knob)	24hr (White Shear Knob)	Wean Brace as tolerated
ROM (Ext / Min Flex / Max Flex)	Locked in Extension	0/0/45 week 4-6 0/0/90 week 6-8	No Limitation	
Weight Bearing	< 25% PWB	50% PWB week 4-8 WBAT > week 8	No Limitation	
Physical Therapy	RICE Isometric Contractions	RICE Closed Chain Proprioception	Progress to Open Chain Exercises	Ongoing Strengthening Proprioception

REASONS TO USE THE REBOUND PCL BRACE

Ideal to provide support for PCL Reconstruction during biological incorporation. Protection of coronal plane forces, with graduated increase in flexion range.

CLINICAL OUTCOME

The early post-operative period was complicated by swelling and fracture blisters, which took 4 weeks to resolve, fortunately without adverse consequence. MUA to assist flexion was planned, but at 3M post op, 110 degrees of flexion achieved with extension to 0 degrees. At 9 months, flexion to 125 degrees (135 degrees contralateral), 0 degrees extension (5 degrees contralateral). Residual quads weakness steadily improving. Return to work on light / sedentary duties. Knee stable subjectively.

Clinical Laxity: PCL Gd 0-1 Firm / ACL Gd 0-1 Firm / MCL Gd 2 @ 30 and Gd 1 in extension.

Aiming for return to normal duties within next 3 months with improved functional capacity. Occasional use of compression knee support to assist confidence.

CONCLUSION

Use of the Rebound PCL brace provides added confidence when commencing flexion post autologous PCL reconstruction. Adjustable hinge allows for graduated increase in flexion range. In this case, satisfactory stability achieved with improvement in clinical laxity maintained at 9 months post-surgery.

Rebound PCL Case Study

45 year old female, isolated PCL tear

Clemens Gwinner, MD & Tobias Jung, MD

INDICATION

A 45-year-old female patient reported to our outpatient clinic with a slight limp complaining of a right knee injury that had started after a bicycle injury three months ago. She reported landing on the anterior, proximal aspect of her right knee. She further stated that the initial pain quickly subsided to a vague, general soreness about her knee. Experiencing no relief of pain and having a recurrent feeling of instability over the next weeks, she attended our clinic and the diagnosis of an isolated PCL tear was established.

DIAGNOSTICS

A thorough physical exam of the knee was performed to evaluate any potential concomitant lesions. Patient's gait and weight bearing posture was assessed accurately as static and dynamic alignment can provide an indication of a suspected PCL or peripheral deficiency. Manual posterior drawer test and step-off test were used to assess posterior knee stability and the dial test ruled out an additional injury of the posterolateral corner. Long leg radiographs in standing anteroposterior and lateral knee radiographs were performed as part of our clinical routine. Moreover, the side-to-side difference (SSD) of the posterior tibial translation (PTT) was graded using a Telos Stress Device.

We have proceeded to solely perform stress radiographs in a chronic setting (at the earliest three month after trauma / PCL reconstruction) to avoid additional strain on the healing ligament.

TREATMENT OVERVIEW / TREATMENT GOAL

As the intrinsic healing ability of the PCL had ceased by time of admittance, a strict conservative treatment was ineligible. The patient subsequently underwent physical therapy to improve the impaired joint mobility and muscle performance. Finally, as the patient continued to have a recurrent feeling of instability and was not able to return to her pre-injury level of activity, we discussed PCL reconstruction using autologous hamstring tendons with the patient.

SURGICAL TREATMENT

The arthroscopic portals used were as follows: anteromedial (AM), anterolateral (AL) and posteromedial (PM). Subsequently to a routine arthroscopy to rule out accompanying meniscal or cartilaginous defects, the arthroscope was advanced posteriorly between the medial femoral condyle and the remnants of the PCL into the popliteal recess to create the PM portal. Femoral tunnel creation was done through a low AL portal in an inside-out fashion using dedicated drill guides centered at the anterolateral bundle of the PCL. Remnants of the PCL complex such as the meniscofemoral ligaments or the posteromedial bundle were preserved. Tibial tunnel creation was performed via direct arthroscopic visualization using the additional PM portal. The PCL graft consisted of autologous 5-fold semitendinosus- and gracilis tendons.

Tobias Jung, MD

Center for
Musculoskeletal Surgery

Charité-University
Medicine Berlin

Femoral and tibial fixation was performed in a hybrid manner using a biodegradable interference screw and an EndoPearl device on the femoral site and sutures tight over a bony bridge on the tibial site. Maximum manual pretension in approximately 90° of flexion was performed as our clinical routine.

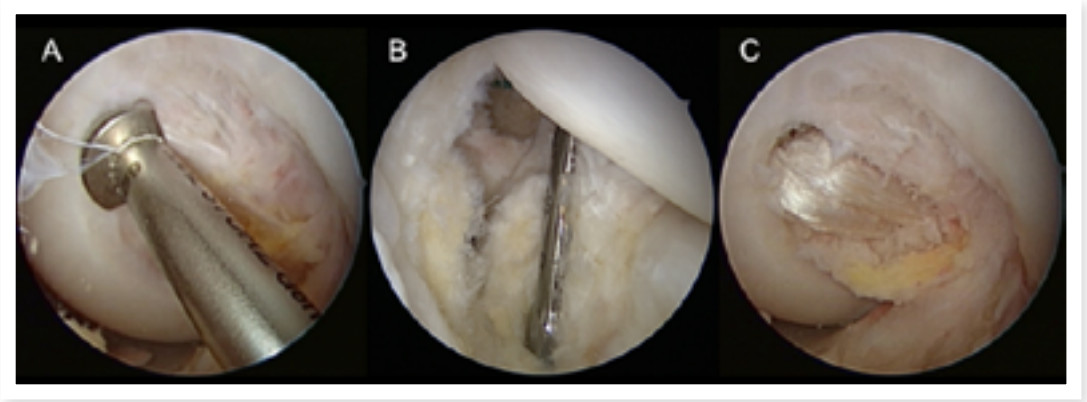


Figure 1: Femoral drilling, centered at the anterolateral bundle of the PCL (A). Tibial drilling (B). Remnant preserving PCL reconstruction, using autologous hamstring tendons (C).

POST-SURGICAL REHABILITATION

The rehabilitation protocol included immobilisation for six weeks in a straight knee immobiliser with posterior tibial support, which performed an anteriorly directed force on the proximal tibia in order to counteract posterior tibial translation. The patient was encouraged to start isometric contraction of the quadriceps immediately after surgery. Partial weight bearing and gradual passive mobilisation in prone position were performed during this period. After six weeks, the knee immobiliser with posterior pad was changed to the custom-made Rebound PCL and full weight bearing was gradually established. Gentle sporting activities, like jogging or swimming were permitted four months after surgery, because the patient already achieved the full range of motion and a near to normal quadriceps strength.

REASONS TO USE THE REBOUND PCL BRACE

The posterior cruciate ligament is composed of two bundles, the larger anterolateral and smaller posteromedial bundle. Both bundles function in a codominant and synergistic fashion as the primary restraint of posterior tibial translation during higher grades of knee flexion. Dr. Robert LaPrade and colleagues (LaPrade et al., *Knee Surg Sports Traumatol Arthrosc* (2015) 23:3070–3076) were able to demonstrate that the Rebound PCL brace applies increasing anterior forces to the proximal tibia at higher flexion angles, thus the physiological loading profile of the PCL is respected. Additionally, it has been advocated that a slow and rather conservative rehabilitation following PCL reconstruction is necessary for a successful clinical outcome.

Rebound PCL Case Study

45 year old female, isolated PCL tear

Clemens Gwinner, MD & Tobias Jung, MD

CLINICAL OUTCOME

Upon completion of the first year post surgery, the patient returned to her pre-injury level of sports and daily activities. The patient was encouraged to continue stretching and quadriceps-strengthening exercises on a daily basis. She also underwent repeated stress radiographs during the follow-up. The posterior tibial translation (SSD) was successfully reduced from a SSD of 9 mm at the preoperative state to 3mm at the two-year follow-up.

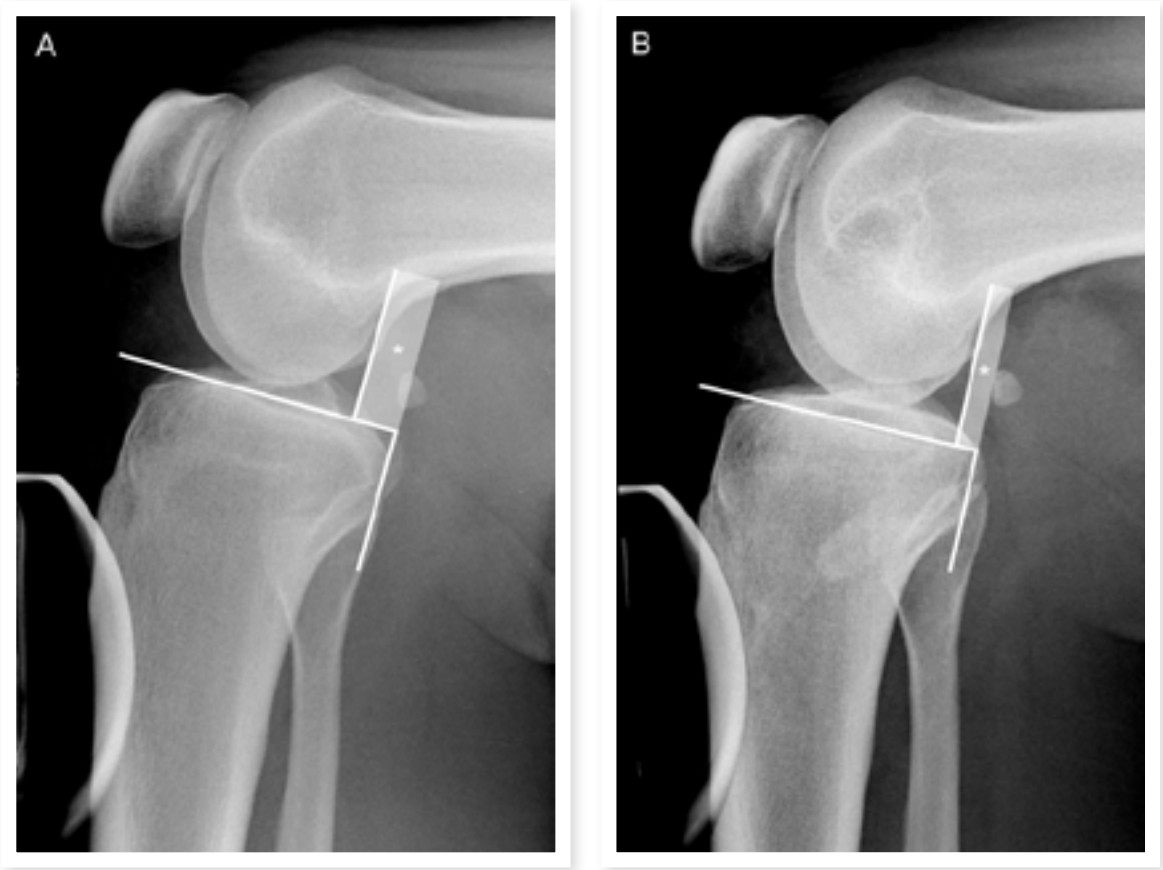


Figure 2: Posterior tibial translation (*) was determined according to the technique using peripheral bony landmarks. Perpendicular to the tangent of the joint line, the midpoints between the most posterior contours of the medial and lateral femoral condyles and tibial plateaus were created. The distance between these two points was regarded as the posterior tibial translation, which was reduced from a SSD of 9 mm at the preoperative state (A) to 3 mm postoperatively (B).

CONCLUSION

After initial non-surgical treatment of the PCL injury, the patient presented recurrent feeling of instability and was not able to return to her pre-injury level of activity, we discussed PCL reconstruction using autologous hamstring tendons. After successful surgical treatment and consequent execution of the rehabilitation plan the patient was able to return to pre-injury level of activities. The Rebound PCL supported an accelerated rehabilitation by increasing weight bearing and ROM 6 weeks after surgery.

Rebound PCL Case Study

39 year old male with grade II-III PCL tear, non-surgical treatment

Clemens Gwinner, MD & Tobias Jung, MD

INDICATION

A 39-year-old male patient reported to our emergency department after a fall during soccer practice. The reported trauma mechanism was similar to the aforementioned patient, including a forced posterior tibial translation of the flexed knee.

DIAGNOSTICS

Physical examination revealed mild-to moderate joint effusion with a limited active and passive knee flexion. Localised swelling and tenderness were noted on the proximal aspect of his tibia as well as in the popliteal fossa. Lachman's test and anterior drawer, Varus and Valgus test as well as examination of the posterolateral corner were all negative. However, the posterior drawer test revealed a moderate laxity comparing the affected and uninjured knee. Based on these findings was established the diagnosis of a grade II-III PCL tear.

Conventional radiographs did not show any relevant pathological findings. We performed a MRI to detect concomitant injuries (MRIs have been shown to have a high accuracy in the assessment of acute PCL injuries). We have abandoned performing stress radiographs in the acute setting to avoid additional strain on the healing ligament.

TREATMENT OVERVIEW / TREATMENT GOAL

Conservative treatment is often recommended if the PCL is injured in isolation. Unlike its anterior counterpart, the PCL has been shown to have a high intrinsic healing potential in numerous studies. For patients with grade I or grade II injuries, conservative treatment is reported to result in satisfactory outcomes, with the majority of patients returning to their level of pre-injury activity. Contrary, patients with grade III injuries recover comparably slower.

Rebound PCL Case Study

39 year old male with grade II-III PCL tear, non-surgical treatment

Clemens Gwinner, MD & Tobias Jung, MD

NON-SURGICAL TREATMENT–REHABILITATION

Similar to the postoperative treatment, we immobilised the patient in a knee immobiliser with posterior tibial support for four weeks during day- and night time. This was done to counteract posterior tibial translation caused by gravity and hamstring traction. After four weeks the Rebound PCL brace was fitted on the patient and ROM was increased to 90° knee flexion. The primary goal of rehabilitation was to achieve near to normal quadriceps strength, which typically spans 6–9 months. Physical therapy was performed as follows:

ITEM	PHASE 1 (week 1-4)	PHASE 2 (week 5-6)	PHASE 3 (7-12 week)	PHASE 4 (week 13-52)	PHASE 5 (week 53-)
Orthosis	Straight knee immobiliser with posterior pad (day and night)	Rebound PCL in the day, straight immobiliser with posterior pad at night		—	—
Weight bearing	PWB (15 kg)	PWB to FWB	FWB		
ROM	0-0-60 passive, prone	0-0-90 passive	0-0-120 passive 0-0-90 active	0-0-free active	
Physio	PRICE muscle activation straight leg raises no hamstring contraction EMS			dynamic stabilisation hamstring activation muscle building neuromuscular practices	

The rehabilitation protocol included immobilisation for six weeks in a straight knee immobiliser with posterior tibial support, which performed an anteriorly directed force on the proximal tibia in order to counteract posterior tibial translation. The patient was encouraged to start isometric contraction of the quadriceps immediately after surgery. Partial weight bearing and gradual passive mobilisation in prone position were performed during this period. After four weeks, the knee immobiliser with posterior pad was changed to the custom-made Rebound PCL and full weight bearing was gradually established. Return to sport is allowed if 85% of the muscular strength compared to the uninjured side is achieved. Swimming and jogging is usually allowed from the 6th month onwards. Contact or pivoting sports can be resumed after 12 months.

REASONS TO USE THE REBOUND PCL BRACE

The posterior cruciate ligament is composed of two bundles, the larger anterolateral and smaller posteromedial bundle. Both bundles function in a codominant and synergistic fashion as the primary restraint of posterior tibial translation during higher grades of knee flexion. Dr. Robert LaPrade and colleagues (LaPrade et al., Knee Surg Sports Traumatol Arthrosc (2015) 23:3070–3076) were able to demonstrate that the Rebound PCL brace applies increasing anterior forces to the proximal tibia at higher flexion angles, thus the physiological loading profile of the PCL is respected.

Furthermore, it has been advocated that a slow and rather conservative rehabilitation following PCL injury or reconstruction is mandatory to a successful clinical outcome. However, we deliberately decreased the interval of partial weight bearing from six to four weeks after PCL injury/ reconstruction, taking the aforementioned results into account.

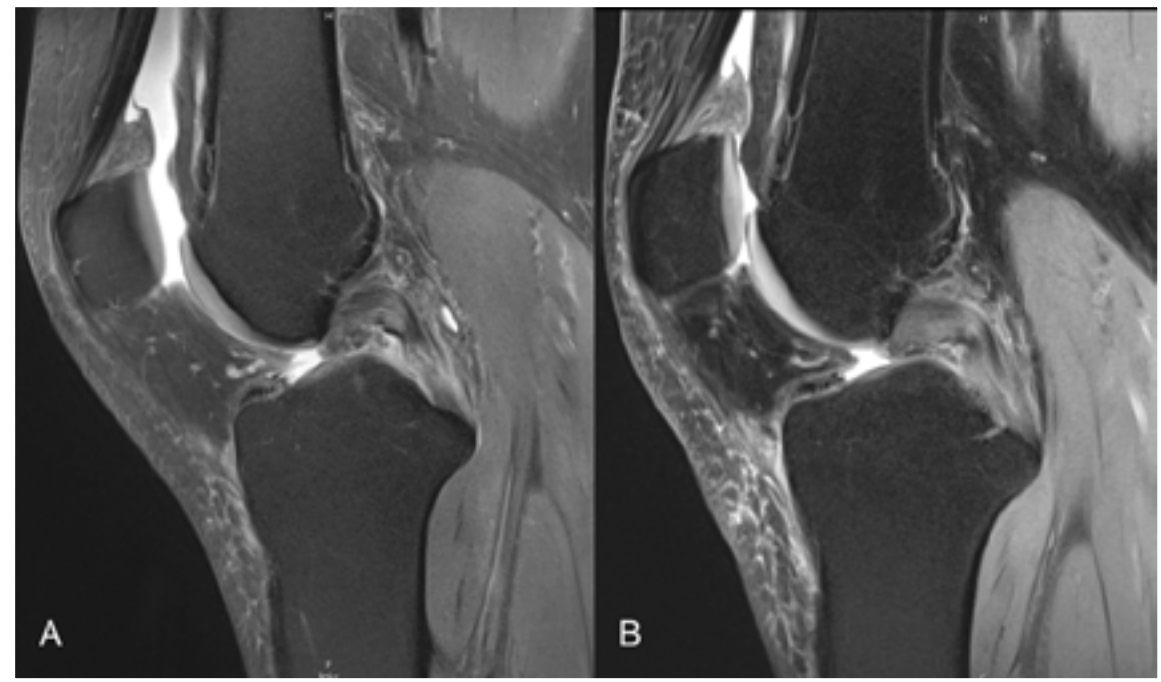
Tobias Jung, MD

Center for
Musculoskeletal Surgery

Charité-University
Medicine Berlin

CLINICAL OUTCOME

The follow-up stress radiographs revealed a remaining posterior tibial translation (SSD) of 2mm at the 12 month follow-up. The patient gradually went back to sports and continued playing soccer 14 month after injury.



Three month post injury, the patient returned for a follow-up MRI scan. Pictured: Mid-substance tear of the PCL in the MRI post injury (A); healing ligament three month after injury (B).

CONCLUSION

Treatment algorithms for injuries of the posterior cruciate ligament continue to cause considerable controversies. Even though the posterior tibial translation can be successfully reduced by current surgical techniques, there is still little consensus on the ideal rehabilitation after PCL injury or reconstruction. Dynamic braces–which closely mimic the physiological loading of the PCL–might further contribute to improve outcome parameters.

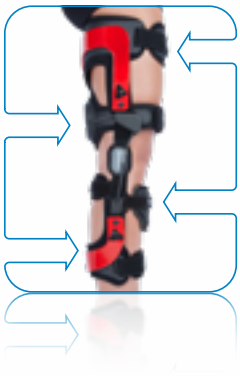

ÖSSUR

REBOUND® ACL

The custom made Rebound ACL brace is designed to apply a physiologically correct, dynamic force optimum for functional rehabilitation of anterior cruciate ligament (ACL) ruptures, whether during non-surgical treatment or following surgical reconstruction.

Dynamic force

The dynamic load of the Rebound ACL on the femur is generated by applying an anterior directed dynamic force on the thigh area, and opposing counter forces on the anterior aspect of the tibia.



Reduced load on the ACL

The Dynamic Tension System™ (DTS) is designed to increase the load on the femur as the knee goes from flexion into extension, providing an anterior directed force necessary to decrease load on the ACL to allow it to heal.

Specific load adaptation

The Rebound ACL allows for specific load adaptation according to the patient's individual anatomy and rehabilitation related requirements.

FUNCTIONAL HEALING® BY ÖSSUR

Rebound ACL Treatment Recommendations

Karl Eriksson
MD, PhD
Assistant Professor
Senior Consultant
Orthopedic Surgeon

Stockholm South Hospital and Sophiahemmet Private Hospital, Stockholm, Sweden

Member of: ISAKOS, ESSKA, ACL study group, Australian Knee Society, Magellan Society.

Committe member ESSKA and ISAKOS . Editorial board KSSTA

Domestic membership: Swedish orthopedic society

RECOMMENDED INDICATION

Non-surgical– Partial ACL rupture in general or total ACL rupture (predominantly mid substance rupture) in non active or mid active patients. Also ACL ruptures in patients where primary ACL reconstruction should primarily be avoided due to co-morbidity or other factors. Surgical– Acute ACL reconstruction in patients with grade 1-2 MCL injury or grade 1 LCL or PLC injury.

RECOMMENDED DIAGNOSTICS

- History of trauma
- Clinical examination
- Plain X-ray
- MRI within 7 days

TREATMENT GOAL

Normalized or nearly normalized laxity. Functional healing of partially or totally injured ACL.

SURGICAL TREATMENT

Single bundle ACL reconstruction using quadruple semitendinosus graft with suspensory fixation (Tight rope tibial and femoral side). Anatomic positioning with femoral drilling through medial portal.

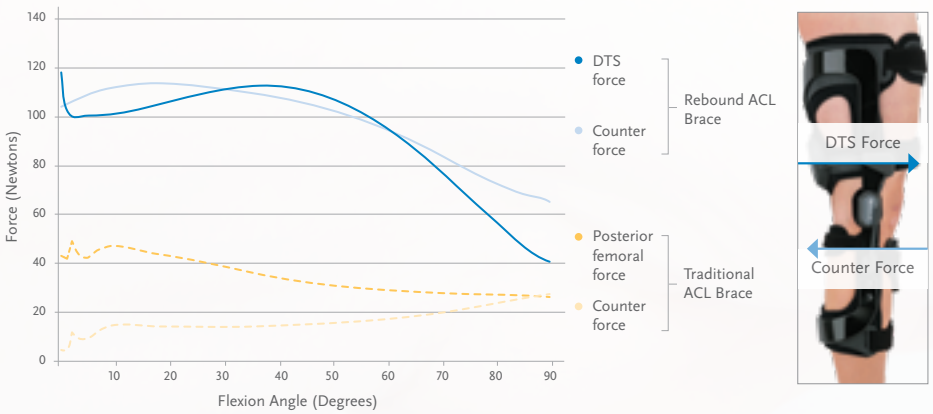
REHABILITATION

- Weight bearing as tolerated supported with crutches 3 weeks. Free ROM.
- Closed chain exercises 6 weeks.
- Use of the Rebound ACL week 1-12, Free ROM.
- Jogging > 12 weeks.
- Return to sports 6-9 months.

REASONS TO USE THE REBOUND ACL BRACE

Non-Surgical – To enhance non-operative treatment of an ACL rupture or partial rupture or partial rupture. Surgical – As a adjuvant treatment in ACL reconstructions with specific injury patterns.

Average anterior-posterior force on the ACL through knee flexion



Rebound ACL Case Study

Acute femoral ACL rupture & osseous avulsion fractures
of the medial + lateral posterior meniscus root

INDICATION

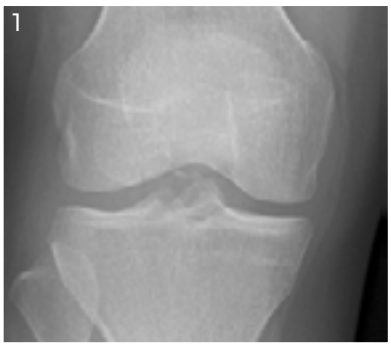
A 19-year-old woman was primary treated in another hospital and came in with conventional radiographs (CR) based diagnosis of an emintia avulsions fracture to the ambulance to the local emergency room. The leg was initially stabilized in a conventional brace. The patient described an isolated knee torsions injury with valgus and external rotation at a bicycle accident as she tried to avoid to fall.

The first preclinical survey leads to an acute anterior knee instability without any high grade concomitant ligament injuries.

DIAGNOSTICS

Clinical examination: The initial inspection and palpation showed no injury of the integument, but a swollen capsule with existing joint effusion. There was no tenderness of palpation at the medial or lateral collateral ligaments (MCL and LCL). Without any signs of mechanical limitation indicating a bucket- handle meniscus injury, the joint effusion restricted the range of motion (ROM) to 0-0-45. The examination of the ligament status revealed in 0° and 30° flexion a stable medial ligament and lateral collateral ligament complex. The biceps femoris tendon showed no abnormalities. The examination of the anterior cruciate ligaments (ACL) detected positive results for the anterior Lachman test and the anterior drawer test (ADT). As result of the joint effusion and the painful examination status, the pivot shift test was not valid performable. All tests for posterior cruciate ligament (PCL) and the posterolateral complex (PLC) were negative. The first clinical survey confirmed the preclinical diagnosis of an acute anterior knee instability.

Conventional radiographs: The external CR (knee anteroposterior view and lateral view) confirmed the internal radiology protocol and were re- assessed. The re-assessment of the lateral view revealed an osseous avulsion fracture directly posterior to the anatomic tibial anterior cruciate ligaments (ACL) insertion and anterior to the posterior cruciate ligament (PCL) insertion. The anteroposterior view detected multiple fracture lines at the eminentia region (figure 1+2).



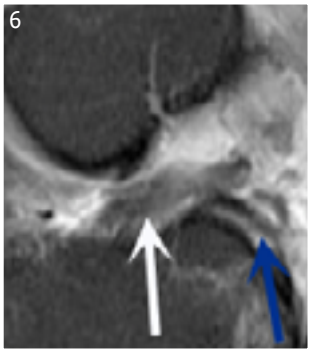
Computer tomography (CT): the assessment revealed the dislocated osseous avulsion fracture of the medial posterior meniscus root (figure 3) and a minimally dislocated periostal avulsions fracture of the lateral meniscus root (figure 4). There was no eminentia avulsion fracture of the ACL detectable.

Priv.-Doz. Dr. med. Dr. rer. nat. Thomas Stein

Executive senior physician in the department for Sport traumatology

Knee- and shoulder surgery

Berufsgenossenschaftliche Unfallklinik
Frankfurt am Main, Germany



Magnetic resonance imaging (MRI): the assessment confirmed the CT diagnosis of acute osseous avulsion fracture of the medial (figure 5, white arrow) and a periostal avulsion of the lateral posterior meniscus root (figure 6, blue arrow). There were no signs of interior meniscus injuries. Additionally, the MRI clarified the clinical anterior knee instability and showed a proximal insertion-near ACL-rupture (figure 6, white arrow). The bone bruise signs loco tyfigureo (lateral condyle and posterolateral tibia) indicated an acute ligament rupture of the ACL. The were no further injuries of the medial and lateral collateral ligament complexes or the PCL/ PLC. There were no signs of extended cartilage defects.

TREATMENT OVERVIEW / TREATMENT GOAL

The acute dislocated avulsion fractures of the posterior medial and lateral meniscus roots display the indication for an early arthroscopic intervention. The therapy options for the ACL injury are the primary refixation and additive transarticular augmentation with FibreWire systems or the planned two- step ACL reconstruction.

The surgical goal was the one-step double transtibial root repair in combination with the arthroscopic transfemoral ACL- refixation with additive transarticular augmentation. Because of the acute tibia head fracture situation with strongly restricted postoperative rehabilitation existed an increased risk of an arthrofibrosis, therefore the one- step osseous root-repair in comination with an ACL-reconstruction was not planned. In case of a not repairable ACL injury, the early ACL- reconstruction 8–10 weeks after root-repair was scheduled.

The postoperative rehabilitation protocol contents the initial stabilization with a dynamic ACL brace for 8 weeks without weight bearing. The dynamic stabilization including muscle building physiotherapy and neuromuscular practices start after the brace application.

SURGICAL TREATMENT

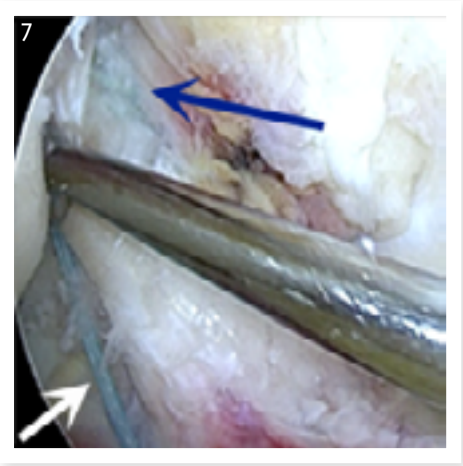
Arthroscopic procedure: after applying the tourniquet, the portal placement was set analogue to an ACL reconstruction with an high para-tendinous anterolateral and a deep suprameniscal anteromedial portal, additionally the high anteromedial portal will be placed with regards to the posterior lateral meniscus root. The intraoperative situs confirmed the pre- operative diagnosis regarding the root- lesions and the proximal ACL injury.

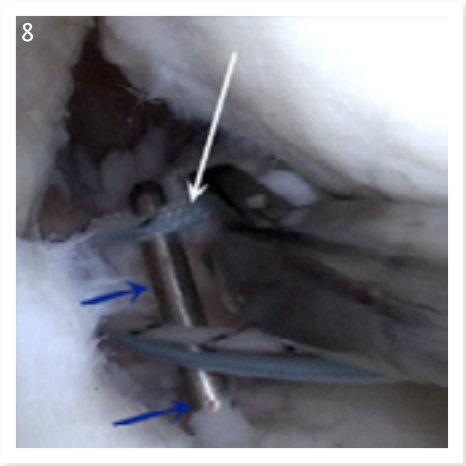
ACL- refixation: For the ACL-repair, FibreWire No2 (FW, Arthrex) is used. For the ACL-repair, the FW No2 is shuttled through the distal ACL- remnant (shuttle-device Suture-Lasso, Arthrex). Using the tibial and femoral drilling guides, two 2.4mm drill wires are placed at the femoral and at the tibial ACL-insertion area.

Rebound ACL Case Study

Acute femoral ACL rupture & osseous avulsion fractures
of the medial + lateral posterior meniscus root

SURGICAL TREATMENT





The transfemoral drill wires were used to retrieve the both ACL-refixation FW (size No2) and the both trans-articular FW No5. Addionally, the bone-marrow stimulation procedure (micro- fracturing) was applied at the femoral ACL insertion area (figure 7 blue arrow=ACL refixation; white arrow = augmentation).

Root repair: The fracture zone of the osseous avulsion root lesions were debrided with the shaver, until each osseous fragments was reduceable to the anatomic region with the probe. Two drill wires (diameter 2.4mm) were placed in each tibial fracture zone of the lateral and medial posterior meniscus root injury. Using the Suture-Lasso (Arthrex), a cross-U-stich with each two FW No2 were set directly about the osseous insertion at the fragment of the medial and the lateral meniscus horn. These FW No2 were shuttled throught the two drill wire holes of each meniscus root fracture zone (figure 8 blue arrow = Suture-retriever; white arrow = FW No2).

All transtibial suture placements were set superior to the pes anserinus tp preserve the hamstrings for a later ACL reconstruction. Figure 9 shows the overview of suture placements. Because of an old pretibial scar, the incision had to be performed in a horizontal line (figure 11).

After placing the knee in 30 degree of flexion and internal rotation, sutures are knotted in following order:

a) Trans-articular FW b) Trans-femoral ACL-refixation c) Trans-tibial root-repair medial and lateral

POST-SURGICAL REHABILITATION

The initial conventional brace was applied directly in the operation room after wound closing. The custom-made Rebound orthosis can be assessed at the contralateral knee after surgery. After reduction of swelling and effusion, the custom-made orthosis can be applied.

The postoperative rehabilitation protocol contents the initial stabilization with this specific dynamic ACL brace for 12 weeks with partial weight bearing (PWB) from the 9th postoperative week and full weight bearing (FWB) from the 12th week. The dynamic stabilization including muscle building physiotherapy and neuromuscular practices start after the brace application.

Priv.-Doz. Dr. med. Dr. rer. nat. Thomas Stein

Executive senior physician in the department for Sport traumatology

Knee- and shoulder surgery

Berufsgenossenschaftliche Unfallklinik
Frankfurt am Main, Germany

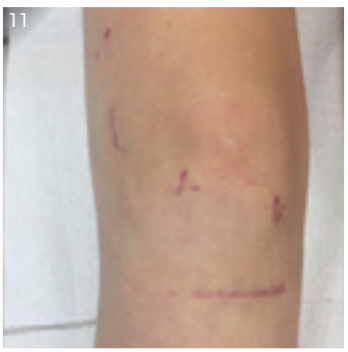
ITEM	PHASE I (week 1 – 2)	PHASE II (week 3-6)	PHASE III (7-12 week)	PHASE IV (week 13-52)	PHASE V (week 53 -)
Orthosis	Immobilizer–24h/day	Rebound–24h/day	Rebound–24h/day	Discontinue brace over time	—
Weight bearing	No WB	No WB	7+8 No WB 9+10 PWB 11 - FWB	FWB	FWB
ROM	0 -0- 30 passive	0 -0- 60 active	0-0-90 active 0-0-90 active	0 -0- free active	0 -0- free active
Physio	PRICE muscle activation EMS NO CPM	Muscle activation EMS NO CPM	Muscle activation EMS NO CPM	dynamic stabilization muscle building neuromuscular practices	Return to sport: 90% of muscular strength neuromuscular recovery ligamental stability dynamic stabilization

REASONS TO USE THE REBOUND ACL BRACE

The custom-made orthosis specifically protects the repaired menissu structures, while the ligamental healing process (ACL) is not able to protect the posterior horns of the menisci (secondary anterior stabilization). The complete joint preserving restoration of the posterior meniscus horn avulsions fractures and the ACL-preserving ligament repair was successful.

CLINICAL OUTCOME

The applied treatment strategy resulted in good ligament consolidations. The ACL shows minimal partial instability (Lachman+/ ADT+) without rotational instability. All clinical meniscus signs were negative. The radiologic follow up control documented the adequate consolidation of the posterior root fragments (pic 9+10) with a minimally invasive approach (pic 11). The goal of the postoperative rehabilitation remains to decrease the persisting dynamic instability and neuromuscular deficits.



CONCLUSION

The anatomic ligament repair with complex meniscus avulsion root repairs can be treated in an one-step-procedure with a dynamic orthosis during the early rehabilitation phase.

Rebound ACL Case Study

Acute anteromedial knee instability with complete tear of the ACL and complete tibial injury of the MCL and POL

INDICATION

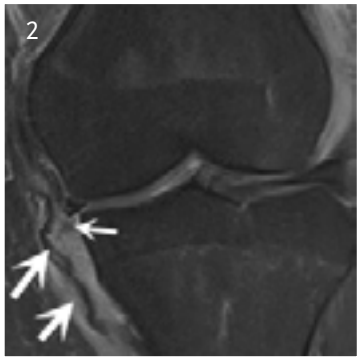
A 27-year-old man was brought to the local emergency room after a motor cycle accident. The leg was initially stabilized in a conventional brace. The patient described an isolated knee injury, but was not able to recapitulate the exact injury sequences. The effort to consider the mechanism of injury let assume, that the lower leg experienced a combined valgus and external rotation force effect.

The first preclinical survey demonstrated an acute anteromedial knee pain with probable anteromedial knee sub-dislocation and spontaneous reduction without any signs of nerve and blood vessel abnormalities.

DIAGNOSTICS

The initial inspection and palpation showed no injury of the integument, but a swollen capsule with existing joint effusion with tenderness of palpation at the medial tibial insertion of the MCL. The joint effusion and the pain limited the range of motion (ROM) to 0-5-90. The examination of the ligament status revealed in 0° and 30° flexion a complete and painful instability of the medial ligament complex, whereas the lateral collateral ligament and the biceps femoris tendon showed no abnormalities. The examination of the anterior cruciate ligaments (ACL) detected positive results for the anterior Lachman test and the anterior drawer test (ADT). The pivot shift test was not possible given the joint effusion and painful, limited range of motion. All test for posterior cruciate ligament (PCL) and the posterolateral complex (PLC) were negative. The first clinical survey indicated an acute anteromedial knee instability with a complete tear of the anterior cruciate ligament (ACL) and complete tibial injury of the medial collateral ligament (MCL) and the posterior oblique ligament (POL).

The standardized conventional radiographs (CR; knee anteroposterior view and lateral view) excluded knee associated fractures or high grade osseous defects, but indicated a dorsolateral tibial head impression and a lateral femur condyle impression. These injury pattern are supposed to indicate to a high grade ACL injury.



Priv.-Doz. Dr. med. Dr. rer. nat. Thomas Stein

Executive senior physician in the department for Sport traumatology

Knee- and shoulder surgery

Berufsgenossenschaftliche Unfallklinik
Frankfurt am Main, Germany

The magnetic resonance imaging (MRI) assessment confirmed the initial clinical diagnosis and showed an acute two-ligament-injury with a tibial insertion- near ACL-rupture (figure 1) in combination with complete tibial avulsion injuries of the MCL and the POL (figure 2 small arrow = deep layer MCL; big arrow = superficial layer MCL). The lateral ligament complex and the PCL were normal. There were signs of lateral meniscus contusion and an impressions fracture at the dorsolateral tibia head outside of the weight bearing line. There were no signs of extended cartilage defects of high grade meniscus injuries.

TREATMENT OVERVIEW / TREATMENT GOAL

The acute anterolateral two-ligament- injury (with an acute tibial ACL-rupture in combination with complete tibial avulsion injuries of the MCL and the POL) of a young and high demanding patient displays an indication for surgical intervention.

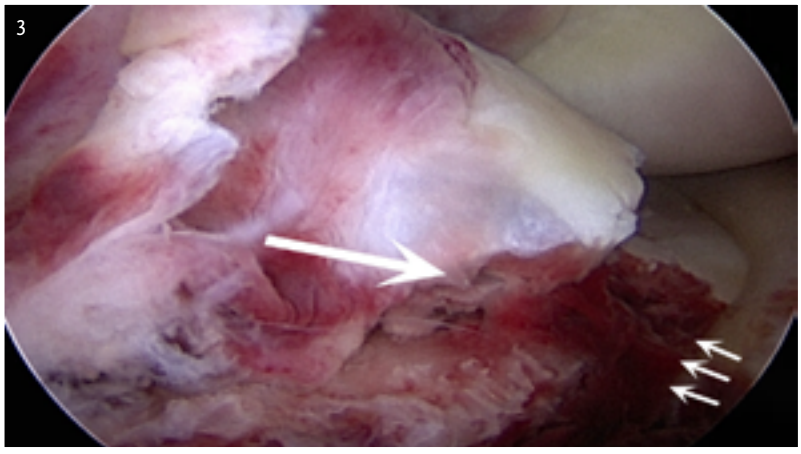
The analysis of the MRI excluded an injury of the posterior structures (posterior capsule and PCL/ popliteus tendon), what allows an early surgical intervention. Principally, an injury of the posterior capsule permit an early arthroscopic therapy because of complications following posterior intraoperative fluid extravasat and a secondary compartment situation. In case of posterior capsule injuries, the arthroscopic intervention showed be planned between the 10th to 14th day after injury. Before surgical intervention of an two-ligament injury, injuries of the posterior vessels and nerves has to be excluded by an angiography and specific neurologic examination.

The surgical goal is the one-step, two-ligament repair with arthroscopic transtibial ACL-refixation with additive transarticular augmentation and an open anatomic refixation of the superficial and deep layer of the MCL and the refixation of the POL.

The postoperative rehabilitation protocol contents the initial stabilization with a dynamic ACL varus (lateral off-load) brace for 12 weeks with partial weight bearing from the 9th postoperative week. The dynamic stabilization including muscle building physiotherapy and neuromuscular practices starts after the brace application.

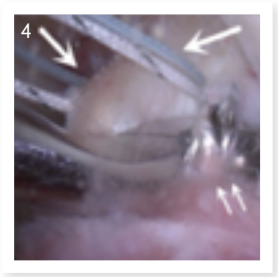
SURGICAL TREATMENT

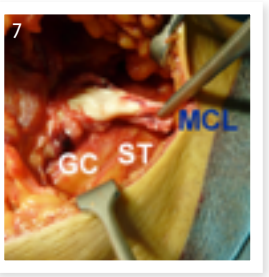
Arthroscopic procedure: The intra-operative situs showed an acute periostal avulsion of the ACL (figure 3 big arrow = proximal remnant, small arrows = tibial insertions area). Without applying a tourniquet, the portal placement is set analogue to an ACL reconstruction with an high para-tendinous anterolateral and a deep suprameniscal anteromedial portal, additionally the high anteromedial portal will be placed. Using the tibial and femoral drilling guides, two 2.4mm drill wires are placed at the femoral and at the tibial ACL-insertion area.



Rebound ACL Case Study

Acute anteromedial knee instability with complete tear of the ACL and complete tibial injury of the MCL and POL





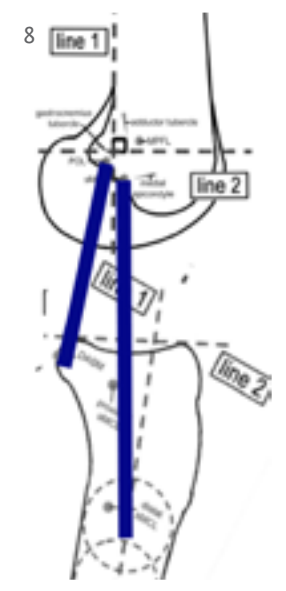
Transarticular augmentation: For the transarticular augmentation, the FW No5 is used. At first, the two FW No5 are transfemorally shuttled by the two femoral drill wires. The drill wires were placed trought the anatomic insertion area of the native ACL, one posterior and one anterior to the uninjured proximal part of the native ACL. To exclude converging drill channels, the applications of the two drill wires were performed separately in 110 and 120 degrees of flexion. After transfemoral FW pull out, the two tibial FW ends were transtibially placed using the SutureRetriever and the two initially drill holes for the ACL-refixation. Picture 4 shows the distal ACL-refixation (big arrows) and the implanted 2.4mm drill wire with the tibial drill guide for the additive trans-articular augmentation (small arrows).

Concomitant injuries: If the diagnostic arthroscopy revealed concomitant lesions at the end of the arthroscopic suture placement meniscus and chondral injuries can be treated. Picture 5 shows the graphic injury of the ACL and picture 6 shows the graphic injury pattern of the MCL and POL (modified from: Wijdicks et al., JBJS am 2010).

Open medial stabilization: After painting the anatomical landmarks and applying the tourniquet, the open medial approach was set distal to the joint line and between the two tibial anatomic insertion areas of the MCL and POL. After longitudinal incision of the deeper fascia, the tibial remnants of the MCL and POL are mobilized. Picture 7 shows the tibial avulsion of the superficial MCL, which is dislocated into an extra-anatomic position (above the insertion of the hamstrings).

Using the exact lateral knee view of the conventional radiographs, the following three anatomic points are marked at the medial tibia: 1) insertion area of the deep MCL, 2) insertion area of the superficial MCL and 3) insertion area of the POL.

Pictures 8 (modified from: Wijdicks et al., JBJS am 2010) and 9 show the insertion areas of the dMCL, the sMCL and the POL. The postoperative radiograph (pic 9) documented the anatomic repair.



At the points (1) and (3) suture anchors (5.5 FT CorkScrew double loaded with FW No2 / Arthrex) are placed and the FW No2 is shuttled through the distal portion of the ligament remnants in Krackow-stich-technique. A 3.5mm drill hole is set at point (2) to insert the 4.5mm BioComposite PushLock anchor at the end of the medial ligament repair.

After placing the knee in 30 degree of flexion, varus and internal rotation, sutures are knotted in following order:

a) Transarticular FW
b) Transtibial ACL- refixation
c) POL
d) dMCL
e) sMCL (setting the 4.5mm BioComposite PushLock anchor with the FW of the dMCL- fixation)
f) Closing the fascia at the medial open approach

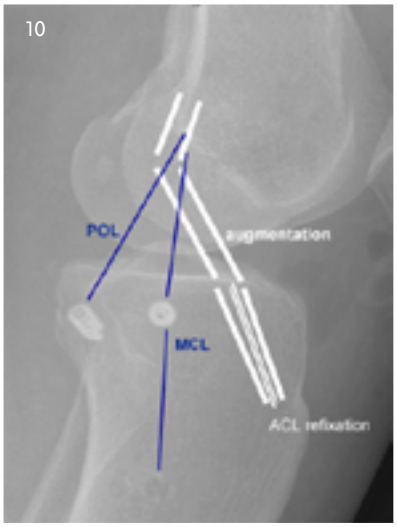
Priv.-Doz. Dr. med. Dr. rer. nat. Thomas Stein

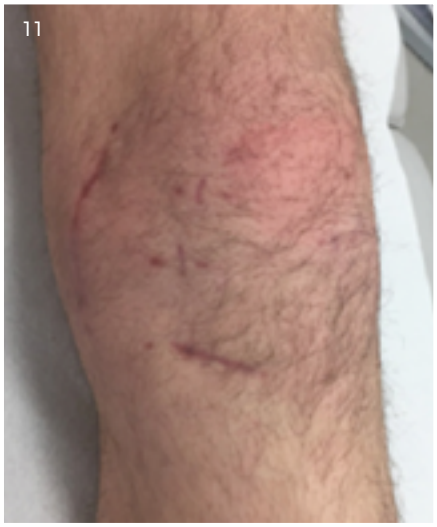
Executive senior physician in the department for Sport traumatology

Knee- and shoulder surgery

Berufsgenossenschaftliche Unfallklinik
Frankfurt am Main, Germany

Picture 10 shows the overview of suture placements. All trans-tibial suture placements were set superior to the pes anserinus tp preserve the hamstrings for a later ACL (pic 11).





POST-SURGICAL REHABILITATION

The initial conventional brace is applied directly in the operation room after wound closing. The custom-made rebound orthosis can be assessed at the contralateral knee after surgery. To support the repaired medial ligament complex, there will be dynamic anterior support with addional varus position (lateral off load) applied. After reduction of swelling and effusion, the custom-made orthosis can be applied.

The postoperative rehabilitation protocol contents the initial stabilization with this specific dynamic ACL varus brace for 12 weeks with partial weight bearing (PWB) from the 9th postoperative week and full weight bearing (FWB) from the 12th week. The dynamic stabilization including muscle building physiotherapy and neuromuscular practices start after the brace application.

ITEM	PHASE I (week 1 – 2)	PHASE II (week 3-6)	PHASE III (7-12 week)	PHASE IV (week 13-52)	PHASE V (week 53 -)
Orthosis	Conventional–24h/day	Rebound–24h/day	Rebound–24h/day	—	—
Weight bearing	No WB	No WB	7+8 No WB 9+10 PWB 11 - FWB	FWB	FWB
ROM	0 -0- 30 passive	0 -0- 60 active	7-10 0-0-90 active 7-10 0-0-90 active	0 -0- free active	0 -0- free active
Physio	PRICE Muscle activation EMS NO CPM	Muscle activation EMS NO CPM	Muscle activation EMS NO CPM	dynamic stabilization muscle building neuromuscular practices Autologue ACL or MCL reconstruction if persisting or secondary instability	Return to sport: 90% of muscular strength neuromuscular recovery ligamental stability dynamic stabilization Autologue ACL or MCL reconstruction if persisting or secondary instability

Rebound ACL Case Study

Acute anteromedial knee instability with complete tear of the ACL and complete tibial injury of the MCL and POL

CLINICAL OUTCOME

The applied treatment strategy results in a good ligamental consolidations. The ACL shows minimal remaining partial instability (Lachman+/ ADT+) without rotational instability. The medial ligament complex showed a full ligamental stability in 0° flexion and partial instability in 30° flexion. The goal of the postoperative rehabilitation remains to decrease the persisting dynamic instability and neuromuscular deficits.

CONCLUSON

The treatment of multi-ligament injuries of the knee should be performed in one-step, ligament-preserving techniques with an anatomic repair and a specific rehabilitation protocol according to the the injury patterns. The dynamic orthosis support the knee kinematic in the early post-operative interval enable by valgus or varus modification and ACL or PCL support an injury-specific protection.


FUNCTIONAL
HEALING®
BY ÖSSUR
REBOUND® CARTILAGE

ÖSSUR® REBOUND® INJURY SOLUTIONS: A LIFE WITHOUT LIMITATIONS

Össur is proud to offer one of the most comprehensive injury solution product lines. After establishing biomechanical expertise as a leader in prosthetic design, Össur has focused on serving the needs of clinicians with some of the most proven and respected designs in the industry.

Rebound® PCL

Rebound® ACL

Rebound® Cartilage &
Rebound® Cartilage Custom

Rebound® DUAL &
Rebound® DUAL Custom

Rebound® POST-OP Knee

Visit ossur.com.au to learn more.

FOLLOW ÖSSUR ON

WWW.OSSUR.COM.AU

Össur Australia - OA & Injury Solutions
TEL 1300 123 268 TEL +61 3 8761 6408
FAX +61 3 9923 6866
infomelbourne@ossur.com

ÖSSUR®
LIFE WITHOUT LIMITATIONS

 | P-900285-B