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Trochleoplasty

Guideline Summary

Aims	Regain ROM and strength and stability but avoid heavy loading and shear at the PFJ particularly in the first 3 months e.g. loaded quadriceps deep flexion and rotation.
ROM	Aim for > 90 degrees flexion and full extension at 6 weeks and FROM by 12 weeks
Mobility	Protected weight bearing with crutches +/- Brace (as post operative instructions) until adequate quadriceps control and pain. Typically, at least 6 weeks
Work	Patients may consider return to work at 12 weeks with a phased return recommended if involving manual work. If sedentary job can return as feels able and not detrimental to adhering to rehabilitation (usually after 6 weeks). Need to be mindful of impact on swelling/rehabilitation. Should be guided by consultant and physiotherapist assessment of strength/functional ability
Driving	Not before 6 weeks and Patient must have stopped using crutches, be able to sit comfortably and have ROM/power to perform an emergency stop. The law states patient should be in complete control of the car at all times, and it is their responsibility to ensure this and inform their insurance company.
Sport	
Cycling	Static bike from 7 weeks with no or low resistance. Progress as symptoms allow
Swimming	• Exercise in water e.g. pool walking – when can safely get in and out, wound healed, PWB/FWB and no ROM restriction • Front crawl Not before 7 weeks if symptoms allow • Breaststroke Not before 13 weeks
Jogging/Running	Not before 16 weeks AND Milestones Achieved
Non-Contact Sport	Training Not before 24 Weeks AND Milestones achieved
Contact sport	Not before 12 months AND Milestones achieved
Common Complications	• Stiffness – Consider early Hydrotherapy. If not achieved 90 degrees by 6 weeks ensure has clinic review • On going instability - if persistent instability after 12 weeks ensure review in clinic • Anterior knee pain – reassure patient often improves but take numerous months to settle (commonly > 3 months) if persistent review in clinic • PFJ OA

Rehabilitation Practice Guideline

This is a **general guide** to rehabilitation, the time scales are an approximate guide and may be altered depending on various factors such other surgical procedures, pain, swelling, muscle control and healing. The pain experience is very variable person to person, it is not unusual to experience pain for a number of weeks postoperatively and should not prevent participation in rehabilitation. The programme should be adapted as required by the patient's symptoms. The patient's management should be tailored to meet individual objectives.
Rehabilitation aims to protect the soft tissue procedures and any concomitant osteotomy in the early Phases and to maximise the range of motion, strength and function.

Please check the post-operative notes for any variation in management and concomitant other procedures that may affect the milestones

Surgery

Trochleoplasty is a surgical procedure that creates a deeper groove in the trochlea to prevent recurrent patella dislocations, and the associated pain and disability. A thin flap of the cartilage in the knee joint will be lifted away to expose the bone beneath it. This area of bone will then be reshaped to create a new groove.
The flap of cartilage will then be laid back down. The cartilage is usually malleable enough that it conforms to the shape of the new groove that was created. The flap will then be fixed in place with some dissolvable suture tape.
Some patients may need additional surgical procedures such as ligament reconstruction to improve the stability of the patellofemoral joint or an osteotomy to further improve the position of the patella in the new groove.

Rehabilitation variations/ Considerations

Trochleoplasty is often carried out along side other surgery for example-

- If carried out along side a Distal Femoral or High Tibial osteotomy consider weight bearing status maybe more restricted following osteotomy
- Be mindful of limiting PFJ loading when following the HTO/DFO guideline in the first 6 weeks. No external resistant with trochleoplasty for 6 weeks. Consider limiting ROM closed chain 0-30 degrees when trochleoplasty carried out before 6 weeks
- If carried out with a Tibial Tuberosity Osteotomy (TTO) consider – Exercise guidelines are very similar There maybe some WB or ROM limitations post TTO with trochleoplasty if not secured with tibial plate.

Following TTO XR review, healing and osteotomy pain needs considering before progressing particularly with impact and plyometric work

Due to the amount of variability, if uncertain, early liaison with Senior Physiotherapist or surgical team

Preparation for Surgery - Prehabilitation

Aims:

- Achieve full range of movement as preoperative stiffness can lead to post operative stiffness
- Build muscle strength / limit quadriceps and hamstring atrophy
- Maintain cardiovascular fitness
- BMI below 35 to reduce post operative complications
- Stop smoking and restrict alcohol intake
- Consider home circumstances including stairs and access
- Ensure good social support from family and friends
- Patient to understand postoperative rehabilitation
- Build muscle to aid post operative recovery
- Work preparation. Prepare patient for possible length of time off required depending on job

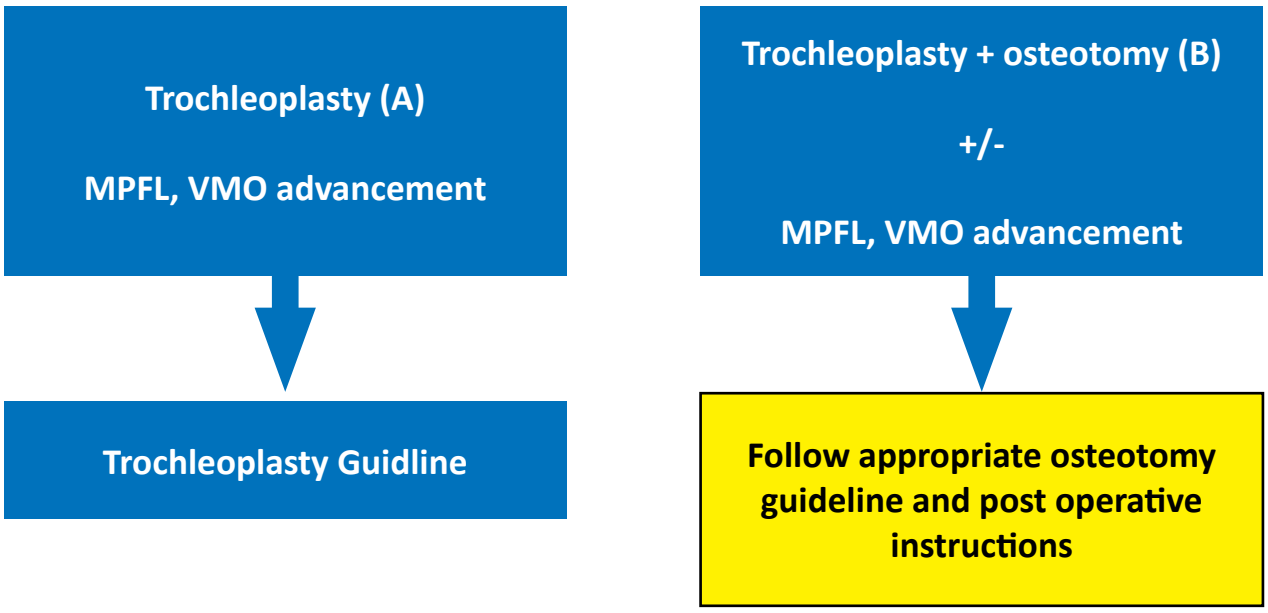
Exercises to consider

- Strengthening
- Squat/leg press/ knee extension as tolerated
- Bridge progressions
- Hip Abduction – resisted
- Calf raises
- Cardiovascular fitness
- Strengthing in knee flexion as may feel more stable within this range

Post Operative Weight bearing and ROM

Post operative weight bearing guidelines are detailed below. These should be followed unless otherwise stated by Consultant in post operative instructions.

Type	Surgery	Weight Bearing	ROM	Brace	Rehabilitation
A	Trochleoplasty Alone Trochleoplasty and MPFL Trochleoplasty and VMO advancement	WB as tolerated with crutches up to 6 weeks at physiotherapy discretion/quads function	As Surgeon preference follow post operative notes Commonly 0-90° Over 6 weeks as pain allows	Surgeon preference – T-ROM	Trochleoplasty protocol
B	Trochleoplasty + Osteotomy TTT Rotational osteotomy, Wedge osteotomy +/- MPFL/VMO advancement	WB as post op notes as dependent on type of osteotomy with crutches 0-6 weeks	As Surgeon preference follow post operative notes This may depend on fixation	Surgeon preference	Follow appropriate osteotomy guideline



Phase 1 - Immediate Post Operative (Day 0 - 2 weeks)

Aims:

- Protection from load & shear forces through Patellofemoral joint
- Pain management and control knee effusion
- Restore knee flexion and extension ROM and prevent adhesions
- Gain quadriceps activation
- Safe discharge

Precautions:

- Follow weight bearing / ROM restrictions and bracing as per consultant post operative instructions
- Avoid loading the Patellofemoral joint
- **NO** resisted quadriceps
- Flexion ROM within limits of pain

Milestones for Progression:

- ☐ Successful surgical procedure
- ☐ Safe discharge from hospital
- ☐ Patient understands post operative instructions
- ☐ OPD physiotherapy appointment made
- ☐ Able to complete home exercise programme independently
- ☐ TROM in situ and safety/care leaflet provided

Rehabilitation:

- Knee braced in extension for mobilisation
- Ensure patient understands post operative instruction for weight bearing, range of movement and brace
- Teach gait with aids +/- stairs as per post operative instructions
- Swelling management strategies – cryotherapy 20 minutes x 3 daily
- Ensure pain controlled +/- pain medication
- Begin ROM as per post operative instructions
- Ensure knee brace is correctly fitted and adjusted appropriately

Exercises to consider:

- Ankle pumps
- Isometric quads, hamstrings and glutes
- Hamstring and calf stretches
- Hip, ankle and upper body strength as tolerated - exercises which do not compromise weight bearing or ROM status

Patient referred to Hydrotherapy by inpatient team

Phase 2 – Outpatient Physiotherapy (2-6 weeks) ROM restoration

Patient should be seen in outpatient physiotherapy service from 2 weeks post operatively.

Aims:

- Protection from load & shear forces patellofemoral joint
- Pain management and control knee effusion
- Restore knee flexion and extension ROM
- Gain quadriceps activation
- Normal gait pattern with crutches

Precautions:

- Follow weight bearing / ROM restrictions and bracing as per consultant post operative instructions
- Avoid exercises that load the PFJ
  - ◊ **No** open chain resisted quadriceps
  - ◊ **No** closed chain Body weight exercises > 30 degrees flexion

Milestones for Progression:

- ☐ Full knee extension by 2-3 weeks
- ☐ Independent with HEP
- ☐ Active knee flexion 90 degrees **IF NOT ACHIEVED BY 6/52 DISCUSS WITH SENIOR AND ENSURE HAS REVIEW IN SURGICAL CLINIC**
- ☐ Minimal/Improving pain and swelling
- ☐ Good quadriceps contraction
- ☐ Normal PFJ mobility
- ☐ SLR with no lag
- ☐ Wound healed

Complete Outcome Measures and establish patient appropriate goals

- KOOS - PF
- Lysholm score

Rehabilitation:

- Ensure patient understands post operative instruction for weight bearing, range of movement and brace
- Swelling management strategies – clearance/ lymphatic massage, compression, elevation as required
- Ensure pain controlled +/- pain medication
- Consider electrical stimulation for quadriceps
- Brace can be removed when resting in 0 degrees extension and for exercises within restricted ROM
- Brace can be removed at 2-4 weeks if SLR without lag if no additional Post operative restrictions

Exercises to consider:

- Continue previous exercises
- Passive and active knee ROM as tolerated in brace/out of brace - Heel slides
- Knee extension ROM - Heel prop
- Seated knee flexion
- Static quads / Straight leg raise / Prone knee lockouts
- Hamstring isometrics
- Side lying hip abduction
- Hamstring and calf stretches
- Passive ROM mobilisation within post op limitations
- Cross education – Strengthen other limb as able (be aware patient may have contralateral instability)

Introduction to hydrotherapy (approx. 2–6 weeks post-op)

Criteria:

- Protection of Osteotomy site from traction
- Pain management and control knee effusion
- Restore knee flexion 90 degrees and extension ROM
- Gain quadriceps activation
- Normal gait pattern with crutches

Aims:

- Help restore ROM/prevent stiffness
- Normalise walking pattern and function
- Assist in strengthening

Example Exercises

- **Walking:** Begin with gentle walking in the water, focusing on a normalized gait pattern. Start in deep water and progress to more shallow depths to increase weight bearing. If PWB patient needs to be submerged from there waist or higher.
- **Range of motion (ROM):** Perform within limits of post op restrictions. Avoid buoyancy assisted (BA) knee flexion in standing as may force the joint. Work on hip ROM using BA movement
- **Stretching:** Gentle stretching of the hamstring and calf muscles.
- **Strengthening:** Introduce assisted strengthening with exercises such as:
  - ◊ Mini-squats with support, progressing from a higher water level to a lower one.
  - ◊ Step ups/ step downs/ side step ups in deep water
  - ◊ Hip extension and abduction exercises
  - ◊ Calf raises
  - ◊ Core control in standing i.e. forward lean with float ensuring stability of LL.

Precautions:

- No Flippers for 12 weeks as this can traction the osteotomy site
- No resisted Open chain quadriceps 12 weeks (buoyancy assisted knee extension)

Phase 3: Progression and strengthening (approx. 6–12 weeks post-op)

As the osteotomy site heals and the patient gains strength and confidence, Hydrotherapy program can become more dynamic and challenging.

Example Exercises

- **Weight bearing:** Progress toward full weight bearing in the pool, as tolerated and approved by the surgeon in post operative plan and clinic review/XR. Challenge proprioception through turbulence or through adjusting their BOS.
- **Range of motion (ROM):** To full ROM (unless otherwise specified in post op notes). Example of exercise: woggle press down, gentle knee lunge on step, passive stretches by therapist, cycling in sitting (no flippers or resistance).
- **Strengthening:**
  - ◊ Step-ups and step-overs using water steps with reducing support of the wall
  - ◊ Single-leg balance exercises to improve proprioception
  - ◊ Hip strengthening with resistance
  - ◊ Avoid Open chain knee extension until 12 weeks i.e. no buoyancy resisted knee flexion
  - ◊ Core stability and UL work
  - ◊ Kicking on back with straight legs
  - ◊ Cycling with no resistance
- **Swimming:**
  - ◊ Upper body swimming – with pull buoy 6-8 weeks
  - ◊ Front crawl kicking from 8 - 10 weeks with straight legs.
  - ◊ Full front crawl/ back crawl swimming 10-12 weeks post op.
  - ◊ Breaststroke should be delayed until 16 weeks as its leg kick can place rotational forces on the knee.

Precautions:

- No Flippers for 12 weeks as this can traction the osteotomy site
- No resisted Open chain quadriceps 12 weeks (buoyancy assisted knee extension)

Phase 4: Progression and strengthening (approx. 12 weeks post-op)

If struggling with on land physiotherapy continue in pool.
Resistance and flippers can be added to the programme if there is no/minimal Osteotomy site pain and check XR in clinic is confirmed to be showing consolidation.

Milestones for progression to on land only

- ROM 0- > 110 degrees
- Minimal swelling and controlled pain
- FWB – normalised gait
- Improving quadriceps contraction and strength

Phase 5 – Early Loading / Strengthening (7 - 12 weeks)

Aims:

- Protection from excessive load & shear forces PFJ
- Pain management and control knee effusion
- Achieve full flexion ROM
- Return to FWB and normalise gait pattern
- Progress quadriceps strength and lower limb control
- No/Minimal PFJ instability
- Reviewed in clinic

Precautions:

- No breast stroke til 3/12
- No impact activities (Running, Jumping , landing , plyometrics or change of direction training at this Phase/ until at least 16 weeks)
- **No resisted open chain exercises**
- If unsure on progressions liaise with senior Physiotherapist

Milestones for Progression:

- ☐ No Pain > 2/10
- ☐ No effusion
- ☐ Symmetrical ROM
- ☐ Normal gait
- ☐ No Brace
- ☐ 30 min walk with minimal pain or post activity effusion
- ☐ SLR no lag
- ☐ Single leg stance
- ☐ 12 weeks post op

Rehabilitation:

- Normalise gait no aids
- Swelling management strategies if required
- Ensure pain controlled +/- pain medication
- Close kinetic chain exercises as weight bearing allows

Exercises to consider:

Exercises need to be tailored to their functional aim.

Once 100° flexion is achieved and has minimal swelling, can start using a stationary bike on minimal resistance.

Begin Progressive, concentric to eccentric exercises within pain limits. Consider modified ROM depending on pain.

Proprioceptive exercises once good control and strength achieved.

Proprioception:
Single leg balance (once FWB).

Swimming—freestyle and pool walking.

Start unresisted open chain exercises.

Driving:

Patient must have stopped using crutches, be able to sit comfortably and have ROM/power to perform an emergency stop. Law states patient should be in complete control of the car at all times and it is their responsibility to ensure this and inform their insurance company.

Phase 6 – Building Strength/Capacity (13 - 16 weeks if milestones met)

Aims:

- Full pain-free Knee & PFJ ROM
- No instability
- Good quads and pelvic control in single knee dip
- Raise fitness targets and set new goals
- Increase speed of balance reactions and improve
- Coordination for functional activities

Precautions:

- No running until 16 weeks
- No contact sports
- No cutting sports

Milestones for Progression:

- ☐ Minimal pain and swelling with rehab
- ☐ Review in clinic approximately 16 weeks or before if ongoing instability
- ☐ FROM
- ☐ no instability
- ☐ Pain < 2/10 VAS
- ☐ 16 weeks +
- ☐ QASL questionnaire.
- ☐ Collect outcome measure
- ☐ Good neuromuscular control
- ☐ Double leg squat to 90° flexion with pain/ swelling
- ☐ Capacity tests > 70% to non-operated limb:
  - ◊ SL bridge
  - ◊ SL Calf raises
  - ◊ Side plank
  - ◊ Quads using hand held dynamometer or 1 leg 5 max rep leg press 0-40 degrees

Rehabilitation:

- Continue with previous interventions as indicated
- Increase fitness
- Gradual increase in resisted exercises both open and closed chain as pain allows
- Continue with proprioceptive training— increase rotational control

Exercises to consider:

- Continue with exercise bike
- Single leg calf raise
- Leg press < 90° flexion
- Seated hamstring curl
- Bridge progressions

Proprioception:

- Introduce plyometrics foot landing double – single as control allows if appropriate to patient goals

Return to work:

Patients may consider return to work at 12 weeks with a phased return recommended if involving manual work. Need to be mindful of impact on swelling/rehabilitation. Should be guided by consultant and physiotherapist assessment of strength/functional ability

Phase 7 – Optimising Function (16 weeks + and met milestones) As patient goals required

Aims:

- Progressive strengthening of lower muscles
- Increase function
- Progress cardiovascular fitness
- Advice on returning to training/sports specific training

Precautions:

- This patient population often do not want participate in higher level sports. Therefore this stage needs to be patient specific
- No running / impact until at least 16 weeks
- Depending on patients goals non impact training initially

Milestones for Progression:

- ☐ No/minimal effusion
- ☐ Able to walk 5-10km unaided with no pain/ swelling
- ☐ Single leg squat good control
- ☐ LSI 80% Quads and hamstring (Biodex/HHD)
- ☐ No giving way or instability
- ☐ 6 months post operative

Rehabilitation:

- Graded progression to loaded exercises > 90° flexion
- Progression of bilateral and single leg exercises

Strengthening:

Progress strength

- Progression of squat range and DL to SL as tolerated
- Leg press
- Split squats
- Seated knee extension add resistance
- Deadlift / RDLs
- Stool pulls / chair walking
- Band walks
- Single leg calf raise
- Dynamic balance

Phase 8 – Goals Specific Rehab (6 - 12 months)

Aims:

- Increase loading
- Initiation of load acceptance work and running
- Progress lower limb strength
- Return to sport

Precautions:

- No return to non contact training before 24 weeks
- No return to contact sport 12 months

Milestones for Progression:

- ☐ Deep squat pain free
- ☐ Tolerates DL/SL impact activity with equal control
- ☐ Completion of jog/run programme without pain or swelling
- ☐ No Pain/swelling after activity
- ☐ Limb symmetry 80% plus Hamstring/glutes/calf
- ☐ Hamstring/Quad ratio 70% (Biodex)

Rehabilitation:

- Continue strength training
- Rehab specific to patient needs

Start landing drills and double leg plyo's:

- CMJ to box
- Tall to short
- DL CMJ
- Step and land
- Step/land/push back
- March in place / jogging on spot
- A – skips / B skips
- Vertical jump height (force decks)

Return to running criteria:

- No effusion
- Pain free hopping in place
- Landing mechanics equal to non operated limb
- LSI 70% quads strength
- SL squat x 15
- SL hamstring bridge x 20
- SL heel raise x 20
- SLS x 45 seconds
- At least 9 months post op

Reintroduction to running

- Introduce jogging -> Walk/jog programme
- Shuttles – acceleration / deceleration
- Walk/jog/run/jog/walk
- Steady state running

Phase 9 – Return to Sport (12 – 18 months)

Aims:

- Introduce agility and change of direction
- Introduce goal specific skills
- Maximise lower limb strength
- Increase confidence

Precautions:

- No return to non contact training before 24 weeks
- No return to contact training before 28 weeks

Milestones for Progression:

- ☐ Tolerates change of direction drills
- ☐ Psychologically ready for return to restricted training
- ☐ Symmetrical performance with sport specific drills
- ☐ Safely progress to full sport

ForceDecks / hop testing:

- Countermovement jump / DL Drop Jump:
  - ◊ Peak landing force asymmetry <10% LSI
  - ◊ Jump height <10% LSI
- Single leg jump:
  - ◊ Jump height <10% LSI
- Single leg hop for distance <10% LSI
- Triple hop <10% LSI

Complete Outcome Measures:

- IKDC - >93
- KOOS-Sports Questionnaire >90%

Rehabilitation:

- Continue with strength training – reduce frequency to allow sports specific training
- Return to running programme / increase running speed / acceleration / deceleration
- Include exercises/training from athletes usual repertoire
- Progress speed, add perturbation, reactive, environmental changes and decision making

<u>Introduce change of direction:</u>

- Add change of direction when sufficient control is achieved
- Side stepping
- Side to side jumps

<u>Progress to planned change of direction drills:</u>

- S bends
- Planned cutting drills - 45/90/135/180
- Reactive change of direction – partner drills
- Acceleration/deceleration shuttles

Progress through Control-Chaos Continuum (Taberner et al. 2019)

Graded return to training / sport

- ◊ Non contact –> full training -> full play (dependent on Consultant opinion)

Scan to see Trochleoplasty information on the Royal Orthopaedic Website

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Version No	Date Approved	Date of implementation	Next Review Date	Reason for change (e.g. full rewrite, amendment to reflect new guidelines, updated flowchart, etc.)