Rehabilitation Guidelines for patients undergoing Precice Nail Lengthening

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<tr>
<th>Date Approved</th>
<th>Joint Academic Committee</th>
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<tr>
<td>Ratifying Body</td>
<td>Physiotherapy rehabilitation guidelines –</td>
</tr>
<tr>
<td>Related Documents</td>
<td>Holly Doyle</td>
</tr>
<tr>
<td>Author</td>
<td>Click to choose an Executive Director.</td>
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<td>Owner (Executive Director)</td>
<td>Operations and Transformation - Direct Care</td>
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<td>Directorate</td>
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<td>Superseded Documents</td>
<td>List any subject your guideline fits into (see the <a href="#">Subjects</a> Excel document under ‘Policies’ on Forms and Templates for list of options). Please replace all this text.</td>
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<tr>
<td>Subject</td>
<td>Rehabilitation, physiotherapy, limb deformity surgery, complications, outcomes, milestones, function, treatment, exercise, pain relief, restrictions, limitations, sport, fitness, postural awareness, pain education, mobility, goals, precautions, compliance, knee pain, leg pain</td>
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<td>Review Date</td>
<td>e.g. NHSLA</td>
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<tr>
<td>Keywords and Phrases</td>
<td>RNOH Limb Reconstruction service</td>
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<tr>
<td>External References</td>
<td>Clinical staff only</td>
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<td>Consultation Group/Approving Bodies</td>
<td>Outcome 1: Respecting and involving people who use services</td>
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<td>Readership</td>
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<td>CQC Outcomes</td>
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<td>Outcome16: Assessing and monitoring the quality of service provision</td>
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NHSLA General Standards

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1. Introductions and aims of guideline

Please note that this is advisory information only. Your experiences may differ from those described. All exercises must be demonstrated to a patient by a fully qualified physiotherapist. We cannot be held liable for the outcome of you undertaking any of the exercises shown here independently of direct supervision from the RNOH.

As a specialist orthopaedic hospital we recognise that our broad and often complex patient group needs an individualised rehabilitation approach. Our emphasis is on patient-specific rehabilitation, which encourages recognition of those patients who may progress slower than others. These rehabilitation guidelines are therefore ‘milestone driven’ and designed to provide an equitable rehabilitation service to all our patients. They will also limit unnecessary visits to the outpatient clinic at RNOHT by helping the patient and therapist to identify when specialist review is required.

2. Definitions

See Section 4

3. Duties and Responsibilities

This section N/A for this guideline

4. Body of guideline

Indications for Surgery

The main indication for Precice Nail surgery is limb length discrepancy. The aim of surgery is to grow new bone and change the length of the limb.

Possible Complications

- Infection
- Bleeding
- Nerve and blood vessel damage
- Deep vein thrombosis
- Joint stiffness and soft tissue tightness
- Pulmonary embolism
- Persistent / Recurrent pain
- Joint instability
- Failure to gain length
• Delayed union of bone
• Loosening of the nail
• Re-fracture

**Surgical Techniques**

A Precice nail is a device, surgically placed within the bone, which is used to grow new bone and change the length of the limb. The nail contains a magnet and a gear system, this enables the nail to lengthen or shorten. It is activated when a programmed external handset is placed on the limb.

The operation involves the nail being inserted into the centre of the bone to be lengthened and secured with screws. The bone is also divided in a specific place. The patient will have surgical wounds where the nail and screws are inserted and also in the area where the bone has been divided.

After 1 week, the division in the bone will be in the early stages of healing, this is when lengthening should commence. As the bone is pulled apart using the nail, new bone starts to form along a line of tension created by the device and then continues to grow in the gap.

**Expected Outcome**

- The bone is normally lengthened at the rate of 1mm/day and the patient is flat foot touch weight bearing during the lengthening process.
- The bone needs to harden (consolidate) before the nail is removed.
- The nail will most likely be in place for 18-24 months.
- Every patient is different and the amount of lengthening and time to lengthen may differ between patients. Whilst lengthening they will attend clinic every 2 weeks and have x-rays to confirm that new bone is forming. Based on the x-rays and the soft tissue length can define if lengthening is slowed down or sped up.
- Correction of the deformity.

**Pre-operatively**

The patient may be seen pre-operatively, and with consent, the following can be assessed:

- Current functional levels
- General Health
- Social / Work / Hobbies
- Functional range of movement
- Balance / Proprioception
- Gait / mobility, including walking aids, orthoses
- Multidisciplinary approach with psychologists, pain management, nursing and Physiotherapy (guide to stretches)
• Post-operative expectations, commitment to exercises and maintaining protocol.
• Patient information leaflet issued
• Post-operative management explained

Post-operatively

Always check the operation notes, and the post-operative instructions. Discuss any deviation from routine guidelines with the team concerned.

INITIAL REHABILITATION PHASE: In-patient Stay (Usually 6-8 days)

Goals

• To be safely and independently mobile with appropriate walking aid/s, adhering to flat foot touch weight bearing status.
• To be independent with home exercise programme.
• To understand self-management / monitoring.
• Maintaining full range of Hip/knee/ankle ROM- Achieve 90 degrees of knee/hip flexion prior to discharge.
• Minimal swelling

Restrictions

• If sedentary employment, may be able to return to work from 2-4 weeks post-operatively, as long as provisions are made to elevate leg, remain non-weight bearing and no complications.
• Children may be able to return to school if adaptations are made possible with classrooms and mobility.

Treatment

• Pain-relief: Ensure adequate analgesia.
• Advice / Education: Teach how to monitor sensation, colour, circulation, temperature, swelling, and advise on scar tissue expectations and advise what to do if concerned. Teach protection, rest, and elevation. Advice on maintaining good postures for muscles that could be compromised by lengthening process (ie. If Tibial lengthening do not let foot rest in equinus all day) and on implications of contracture if do not complete stretches.
• Swelling management.
• Exercises:
  Example exercises

AROM exercises for hip/knee/ankle to ensure maintaining range despite reduced weight bearing.

Stretches for relevant muscle groups for nail position:
Femoral nail: Quads, hamstrings, ITB, adductors and glutes

Tibial Nail: Gastrocs, Soleus, TA and tibialis anterior

5 sets of stretching daily-Stretching prior to lengthening in the morning, then 1hr after lengthening (usually 3 x daily) and then once more in evening once lengthening for the day is complete.

Emphasis on stretching the more pennate or posterior/lateral muscle groups especially gastrocs, hamstrings and ITB. These muscle groups are more likely to lead to contractures.

Stretch to the point of pain and hold for 30 seconds 3 x each muscle group, with 15 seconds rest in between each stretching exercise.

Gait re-education: Ensure safely and independently mobile flat foot touch weight bearing with walking aid/s

Stretches taught rigorously in preparation for lengthening phase. Focus on correct stretching technique (in line with touch weight bearing restriction), of Gastrocs/hamstrings/quads/adductors/ITB/soleus, combined with education on stretching to point of tolerance.

- Exercises: Some example exercises:

  Precice tibial exercise sheet (TBC)

  Precice Femoral exercise sheet (TBC)

Hamstrings-Ankle raised with knee unsupported-gravity assisted stretch

Prone foot hangs over edge of bed.

Quads- heel to bottom stretch

ITB- Adduction past the midline using a non-elastic band for assistance

Adductors: Abduction with forward lean in sitting

Gastrocs: With band around forefoot.

- Knee/hip and ankle range of movement exercises

- Strengthening- Maintain flat foot touch weight bearing muscle strength, isometric and open chain quads and hamstrings, hip flexion, ankle dorsiflexion and plantarflexion.

- Pacing advice as appropriate.
• **Mobility:** Ensure patient is independent with transfers and mobility, including stairs if necessary.

**On discharge from the ward**
- Independent and safe mobilising with appropriate walking aid/s, including safety on stairs if appropriate.
- Independent and safe with home exercise programme.
- Maintaining hip/(knee at least 90 degrees flexion) /ankle range of movement
- Independent with swelling management
- Ongoing out-patient physiotherapy arranged for within 2 weeks post op

**Milestones to progress to lengthening phase**
- Achieving and maintaining full ROM of hip/knee/ankle
- Safe with flat foot touch weight bearing mobilisation
- Minimal effusion
- Ideally full quadriceps activation (full isometric contraction and ideally no quads lag on SLR when assessed by physiotherapist)

**LENGTHENING PHASE:** Day 6/7- up to 80 days (1mm a day, depends on length of bone patient needs to achieve).

**Goals**
- Maintain full range of hip/knee and ankle
- Maintain flat foot touch weight bearing throughout lengthening stage
- Monitor closely for first signs of contracture and stop lengthening immediately.
- Lengthening 3 x daily (femoral nail), 2 x daily (tibial nail)
- Pain controlled.

**Restrictions**
- If sedentary employment, may be able to return to work from 2-4 weeks post-operatively, as long as provisions are made to elevate leg, and no complications.
- Driving: unable to drive whilst weight-bearing status restricted.
- Maintain non-weight bearing status.

**Complications:**
- The data we have collected shows the most vulnerable period for contractures to develop is around day 30 (seen at 3cm through hip musculature, 2 cm through knee musculature).
- Implant failure of nail or gear box.
- Wound infection.
Treatment Options

- **Pain Relief**: Ensure adequate analgesia and taken prior to lengthening
- **Advice / Education**: Comprehensive education and instruction on restrictions and on carrying out activities of daily living to manage pain and swelling
- **Posture advice / education.**
- **Swelling management.**
- **Gait re-education.**
- **Mobility**: Ensure safely and independently mobile with walking aid/s progressing to safe and independently mobile without mobility aid/s.
- **Exercises**: Example exercises

**Strengthening**- Maintaining quads, glutes and hamstring strength in line with flat foot touch weight bearing.

**Stretches**- As previously discussed, and consistent re-evaluation and monitoring of range to identify tight muscle groups.

**Main Issues:**

- From our data collection patients with short stature and congenital short femur had a higher risk of knee contractures with a retrograde femoral nail.
- Retrograde femoral nail- the median length at which ROM decreased was 3.25cm of lengthening.
- Antegrade femoral nail-the median length at which ROM decreased was 3cm of lengthening.
- Antegrade tibial nail-Most soft tissue issues are observed from 2cm of lengthening.
- Retrograde tibial nail-85% of patients had knee stiffness with a retrograde nail which occurred from 1.5cm of lengthening.

- **Hydrotherapy** if appropriate (available), once wounds healed and to help improve range of movement if contractures develop etc.
- **Pacing advice** as appropriate.

**Milestones to progress to next phase**
- No evidence of contractures
- Good bony consolidation on X-ray

**POST LENGTHENING REHABILITATION PHASE:**

**Goals**
- Return to full weight bearing as per consultant guidelines.
- Commence loading programme

**Restrictions**
- Ensure patient follows Consultant’s instructions on weight bearing status week by week, if no complications and good consolidation then 25% week 1 after cessation of lengthening, 50% week 2, 75% week 3 and 100% by week 4.

**Treatment**
- **Pain Relief:** Ensure adequate analgesia
- **Advice / Education:** Comprehensive education and instruction on restrictions and on carrying out activities of daily living to manage pain and swelling.
- **Posture advice / education.**
- **Swelling management.**
- **Mobility:** Ensure safely and independently mobile without walking aid (if applicable).
- **Exercises**
  - Example exercises: Cycling, Cross trainer
- **Alter-G treadmill (If available)** – especially relevant at 25%-75% weight bearing as can start normalisation of loading tissues and bone at weight bearing status.
- **Balance / Proprioception** progress weight shift exercises to single leg balance and ultimately proprioceptive exercises.
- **Strengthening** of muscles stabilising the knee, hip and ankle.
  - Strengthening of other muscle groups as appropriate.

**Core stability and gluteal control work**

- **Stretches** – maintain stretches as appropriate to ensure normal flexibility of quadriceps, hamstrings and calf muscles in weight bearing position.

- **Review lower limb biomechanics and kinetic chain,** addressing issues as appropriate.
- **Biofeedback** may be used if altered sequencing of muscles.
- **Manual therapy:**
  - Soft tissue techniques as appropriate.
  - Joint mobilisations as appropriate.

  **Hydrotherapy (if available)** - especially relevant at 25%-75% weight bearing as can start normalisation of loading tissues and bone at weight bearing status.

- **Pacing advice** as appropriate.

### Milestones for discharge

- Good proprioceptive control dynamically.
- Return to normal functional level.
- Achieved patient goals.

### Failure to meet milestones

- Refer back to team / Discuss with team.
- Continue with outpatient physiotherapy if still progressing and appropriate goals.

### Failure to progress

If a patient is failing to progress, then consider the following:

## 5. Monitoring and the effectiveness of this guideline

<table>
<thead>
<tr>
<th>POSSIBLE PROBLEM</th>
<th>ACTION</th>
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| Swelling         | Ensure elevating leg regularly.  
Use ice as appropriate if normal skin sensation and no contraindications.  
Pacing.  
Use walking aids.  
Circulatory exercises.  
Modify exercise programme as appropriate.  
If does not decrease over a few days, refer back to |
<table>
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<th>surgical team</th>
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<tbody>
<tr>
<td><strong>Pain</strong></td>
<td>Decrease activity.</td>
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<tr>
<td></td>
<td>Ensure adequate analgesia.</td>
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<tr>
<td></td>
<td>Elevate regularly.</td>
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<td>Reduce amount of lengthening (liaise with surgeon)</td>
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<td>Pacing discussion and modify exercise programme as appropriate. Should continue isometric work at all times.</td>
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<td>If persists, refer back to surgical team.</td>
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<tr>
<td><strong>Breakdown of wound</strong></td>
<td>Refer to surgical/CNS team.</td>
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<td>e.g. inflammation, bleeding, infection</td>
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<td><strong>Contracture</strong></td>
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<td>Identify reduced range of movement as soon as possible and alert surgical team.</td>
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<td>Stop lengthening process with approval from surgical team, until soft tissue length catches up to bone length.</td>
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<td>Re-enforce importance of stretches// increase daily number.</td>
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<td>Consider local anaesthetic or botox injections with surgical team.</td>
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<td><strong>Varus deformity</strong></td>
<td>Alert surgical team immediately</td>
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<td>(mainly tibias)</td>
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**Appendix 1:**  **Glossary of Terms**
Please add text here.

**Appendix 2:**  **Other linked trust policies and guidelines**
Other orthopaedic rehabilitation guidelines for knee surgery would sit here
Link to rehabilitation guidelines for all other teams
Appendix 3: Extra sources of information and support

Summary of evidence for physiotherapy guidelines

A comprehensive literature search was carried out to identify research relating to rehabilitation following Precice Nail surgery. However due Precice nail surgery being an innovative new surgical practice, there is no research currently available on rehabilitation after Precice Nail surgery. Therefore we reviewed other lengthening methods and results of stretching programmes on normal muscles as well as effects of lengthening in animal models. After reviewing the articles and information, and discussion with the consultants and therapists at the RNOH, the physiotherapy guidelines were produced on the best available evidence.

References:


Appendix 4: Privacy Impact Assessment and Equality Analysis

Please add text here. This guideline is available on request in large print and alternative languages. It is a manager’s responsibility to ensure employees are aware of these options.

* The following policies must be sent for review to the Local Counter Fraud Specialist:

- Fraud and Bribery
- Standard Financial Instructions
- Declaration of Interests
- Gifts and Hospitality
- Whistleblowing
- Disciplinary
- IT
- Anti-Money Laundering
- Managing Sickness Absence
- Secondary Employment
- Expenses
- Overpayment
- Financial Redress
- TOIL (Time off in Lieu)
- Code of Conduct/Standards of Business Conduct
- Data Protection
- Lone Worker
- Patient Transport
- Commercial Sponsorship
- Overseas Visitors
- Disclosure