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Preoperative physiotherapy in proximal femoral osteoid osteoma with lytic lesion.

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Abstract

Osteoid osteoma of the proximal femur is a painful benign tumour that may cause severe functional limitations, antalgic gait, and risk of joint contracture. Although surgery is the definitive treatment, preoperative physiotherapy plays a crucial role in optimizing mobility and surgical preparedness. We present the case of an adolescent with a proximal femoral lytic lesion confirmed as osteoid osteoma, who underwent structured prehabilitation before surgery. Physiotherapy interventions included pain control, range-of-motion maintenance, muscle strengthening, gait training with assistive devices, and patient-family education. Over three weeks, the patient demonstrated marked improvements in pain, mobility, strength, and functional independence, enabling safer surgical planning. This case highlights the novel educational value of integrating physiotherapy into the preoperative management of bone tumours. Structured rehabilitation not only reduces disability and prevents complications but also enhances postoperative recovery and patient confidence.

Keywords: *Osteoid osteoma, rehabilitation, physical therapy, proximal femur, lytic lesion, bone tumour*

1. Introduction:

Osteoid osteoma is a benign bone tumor that usually affects the shafts of the body's long bones, particularly in the second and third decades of life(1). Males between the ages of 10 and 25 are most commonly affected. It can be seen radiologically as a sclerotic border around a partially calcified or radiolucent nidus. Osteoid osteoma is more common in youth and young adults and has a 3:1 incidence rate in men and women(2). Rarely found in the epiphysis, osteoid osteoma is distinguished by an osteolytic area encircled by variable degrees of reactive sclerosis, as well as later bone marrow changes that could lead to an inaccurate diagnosis(3). A diagnosis might be challenging when osteoid osteomas show up in unexpected locations and have ambiguous clinical and imaging characteristics(4). The articular surface is rarely affected, and the lesion is typically smaller than 1.5 cm in size. About 5 percent are subperiosteal. Although osteoid osteomas most frequently affect the leg's long bones, they can affect

nearly any bone, including the axial spine.(5,6). Articular lesions can result in contracture, edema, and joint pain, which could account for the groin soreness to deep palpation observed in our instance. Vertebral osteoid osteomas can lead to scoliosis and cause back discomfort(7). When the pathognomonic pattern of core radiolucency with surrounding sclerosis appears on plain radiographs, osteoid osteoma is frequently diagnosed(6). During the first week, physical therapy began, and the main goals of treatment were to control discomfort and edema. After applying muscular release techniques to the affected muscle areas, a 20-minute microwave treatment was administered to reduce inflammation and pain(8).

Physiotherapy in osteoid osteoma plays more than just a supportive role — it can be decisive in conservative management, particularly for restoring mobility, treating contractures, and improving function alongside NSAID therapy(9). Role of physiotherapy, especially in pediatric and adolescent patients, where surgery might be avoided if symptoms are controlled. When combined with NSAID therapy, physiotherapy contributes to restoring joint mobility by addressing stiffness and range-of-motion limitations caused by pain or protective muscle guarding. Treating contractures, which may develop in weight-bearing joints (such as the hip) due to prolonged pain-related movement restriction. Improving overall function and correcting secondary gait disturbances that often accompany chronic pain. Supporting long-term outcomes by preventing compensatory musculoskeletal problems and enabling faster return to normal activity(10). While the surgical management of osteoid osteoma is well established, reports describing the role of structured preoperative physiotherapy are scarce. This case is educationally novel as it highlights how targeted rehabilitation before surgery can preserve mobility, reduce pain, and optimize postoperative recovery in a patient with proximal femoral involvement.

2. Patient Information:

A girl in early adolescence, who is a student, right-handed dominant, presented with a 2-year complaint of pain in the right thigh and difficulty in walking. The patient reported no history of antecedent trauma or falling. Her parent denied any history of fever, loss of appetite, or weight loss. She complains of severe pain at night from 12 am approx. For this, she visited the private hospital, where an investigation was done, such as an X-ray, and medication was given, but the pain didn't subside, then her parent took her to a tertiary specialist centre, where an investigation was done and an X-ray and an CT was done and the imaging confirmed a lytic lesion of the proximal femur, consistent with osteoid osteoma.
Before the surgery, the patient is referred to the physiotherapy department for rehabilitation. The goals of physiotherapy include,
Pain Management – Use of modalities (e.g., TENS, thermotherapy) and gentle exercises to reduce discomfort and muscle spasm.
Restoration of Range of Motion (ROM) – Targeted stretching and mobilization techniques to counteract hip stiffness caused by pain-avoidance patterns.
Strengthening – Progressive strengthening of hip stabilizers, quadriceps, hamstrings, and core to support the femur and improve weight distribution.
Gait Training & Functional Re-education – Correction of antalgic gait, training with assistive devices if required, and gradual reintroduction to normal walking patterns.
Post-surgical Rehabilitation – Accelerated recovery through early mobilization, scar tissue management, strengthening, and prevention of secondary complications (disuse atrophy, contractures).
Improved Quality of Life – By restoring mobility, independence, and reducing disability, physiotherapy helps patients return to daily activities and sport, where appropriate. The timeline of events is summarized in (Table 1).

Events	Dates / Relative Time
Onset of pain	~2 years prior to presentation
Visit to a private hospital	12.04.2025

Visit to a tertiary centre and diagnosed with a lytic lesion of the proximal femur with osteoid osteoma	16.05.2025
Referred for physiotherapy	17.05.2025
Preoperative physiotherapy initiated	17.05.2025

Table 1: Timeline of events

3. Clinical Findings:

When evaluated in a supine position, the patient was conscious, attentive, and oriented of time, place, and people. The physical examination was preceded by verbal consent. A physical examination showed limitation in the right hip range of motion in comparison to the left hip, mainly in abduction and internal rotation. No hotness, redness, or skin changes were noticed. Moreover, no groin tenderness and intact neurovascular examination distally. Furthermore, no mass was palpated. The patient felt pain when moving and struggled to move the right hip. Range of motion given in (Table 2). Manual muscle testing of affected side is mentioned in (Table 3). Manual muscle testing of Unaffected side is mentioned in (Table 4).

Right Lower Limb (Affected Side – Joint ROM Progression)

Joint	**Pre-op Day 1**	**End of 2nd Week**	**End of 4th Week**	**End of 6th Week**	**End of 8th Week**
Hip flexion	0–60° (pain-limited)	0–90°	0–110°	0–115°	0–120°
Hip extension	0–5°	0–10°	0–15°	0–18°	0–20°
Hip abduction	0–15°	0–25°	0–30°	0–35°	0–40°
Knee flexion	0–110°	0–120°	0–125°	0–128°	0–130°
Knee extension	–5° (slight flexion contracture)	0°	0°	0°	0°
Ankle dorsiflexion	0–20°	0–20°	0–20°	0–20°	0–20°
Ankle plantarflexion	0–40°	0–40°	0–40°	0–40°	0–40°

Table 2: Range of Motion

Right Lower Limb (Affected Side)

Muscle group	**Pre-op Day 1**	**End of 2nd Week**	**End of 4th Week**	**End of 6th Week**	**End of 8th Week**

Hip flexor	3/5 (pain-limited)	4-/5	4/5	4+/5	5/5
Hip extensor	3-/5	4-/5	4/5	4+/5	5/5
Hip abductor	2+/5 (weak, painful)	4-/5	4/5	4+/5	5/5
Knee flexor	4-/5	4+/5	5/5	5/5	5/5
Knee extensor	3+/5 (pain inhibition)	4+/5	5/5	5/5	5/5
Ankle dorsiflexor	5/5	5/5	5/5	5/5	5/5
Ankle plantar-flexor	5/5	5/5	5/5	5/5	5/5

Table 3: Manual Muscle Testing of Affected Side

Left Lower Limb (Unaffected Side)

Muscle group	**Pre-op Day 1**	**End of 2nd Week**	**End of 4th Week**	**End of 6th Week**	**End of 8th Week**
Hip flexor	5/5	5/5	5/5	5/5	5/5
Hip extensor	5/5	5/5	5/5	5/5	5/5
Hip abductor	5/5	5/5	5/5	5/5	5/5
Knee flexor	5/5	5/5	5/5	5/5	5/5
Knee extensor	5/5	5/5	5/5	5/5	5/5
Ankle dorsiflexor	5/5	5/5	5/5	5/5	5/5
Ankle plantar-flexor	5/5	5/5	5/5	5/5	5/5

Table 4: Manual Muscle Testing of the Unaffected Side.

GAIT ASSESSMENT

On Preoperative day 1, the antalgic gait pattern (shortened stance phase on the right/affected side) is seen in the patient. Mild to moderate limp, worse after prolonged walking.

Step length:

- Reduced on the **left (sound limb)** → due to shortened right stance phase.
- Compensatory, relatively longer step on the affected right side during swing.

Stance phase (Right, affected side):

- Decreased weight-bearing time.
- Early heel rise due to hip pain.

Swing phase (Right):

- Hip flexion limited (due to pain/contracture).

Knee:

- Slight flexion during stance (protective, secondary to hip pain).

- Extension lag may be noted in terminal swing if hip pain is high.

Hip:

- Limited extension in late stance due to anterior hip contracture/pain.
- Reduced abduction and internal rotation in dynamic tasks.

Cadence & velocity:

- Reduced cadence (slow walking).
- Decreased walking speed overall.

Assistive device use:

Often, none if pain is moderate, but sometimes child may adopt compensatory hand support (on thigh) or ask for external support during a painful flare.

Diagnostic Assessment:

An X-ray was obtained. Pre-operative X-ray was done (Figure 1)

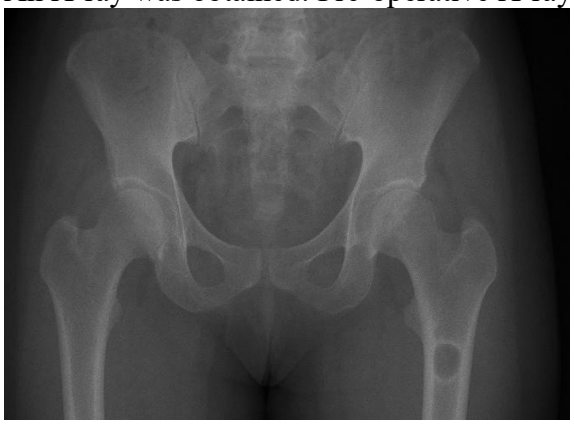

Figure 1. X-Ray of the hip in AP view

The right proximal femur shows a small, well-defined, round radiolucent lesion with central nidus and surrounding sclerosis, located in the subtrochanteric region.
Cortical thickening around the lesion can also be noted.
No obvious fracture line or dislocation.
Joint spaces of both hips are preserved.
The pelvis and contralateral femur appear normal.

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Differential Diagnosis:

- Osteomyelitis (ruled out due to absence of systemic features and characteristic radiology)
- Ewing's sarcoma / other small round cell tumor (excluded by imaging features and clinical course)
- Stress fracture (unlikely given duration and nocturnal pain pattern)

Therapeutic Intervention: Preoperative care, including medications like aspirin, pan40, and calcium, is given in (Table 5). Early physiotherapy started to aid recovery and restore mobility. Physiotherapy treatment given in (Table 6).

Medical Management (Preoperative)

Medication	Dose	Frequency	Purpose
Aspirin	75 mg	Once daily	Analgesic/anti-inflammatory

Pantoprazole	40 mg	Once daily	Gastroprotection
Calcium carbonate	500 mg	Once daily	Supplementation

Table 5: Pre-operative Medications

PHYSIOTHERAPY TREATMENT

Phase	Week	Goals	Physiotherapy Management	Dosage
Phase I: Pain & Mobility Focus	Week 0–1	- Reduce pain - Maintain available ROM - Prevent contractures - Educate patient & family	- Pain modulation: cryotherapy, TENS - Gentle active/assisted ROM (hip, knee, ankle) - Positioning to prevent hip/knee flexion contracture - Breathing exercises - Crutch training & activity modification	- TENS: 15–20 min, 1–2x/day - ROM: 10 reps × 2 sets, 2–3x/day - Breathing: 5–10 min/day
Phase II: Mobility & Strength Preservation	Week 1–2	- Improve unaffected limb strength - Maintain core & distal limb function - Optimize gait with minimal pain	- Isometric strengthening (hip extensors, abductors, quadriceps, hamstrings) - Ankle pumps/circles - Core stabilization exercises - Pre-gait training with axillary crutches	- Isometrics: 5–10 sec hold × 10 reps, 2–3x/day - Core: 10 reps × 2 sets/day - Gait: 10–15 min/day
Phase III: Functional Readiness I	Week 3–4	- Increase pain-free hip & knee ROM - Build proximal stability - Enhance gait with crutches	- Active-assisted → active ROM (hip, knee) - Straight leg raises, bridging (if pain-free) - Core strengthening - Progressive crutch gait training (including turning/stairs if safe)	- ROM: 10–15 reps × 2 sets/day - Strengthening: 15–20 min/day - Gait: 15–20 min/day
Phase IV: Functional Readiness II	Week 5–6	- Improve muscle strength (hip & knee) - Enhance balance & coordination	- Progressive resisted isometrics (theraband if tolerated) - Closed-chain exercises (mini squats, heel raises	- Strengthening: 20 min/day - Balance: 5 min/day - Endurance walk: 10–15 min/day

		- Maintain endurance	within tolerance) - Static balance (single-leg stance on unaffected side, partial on affected) - Endurance: short walk with crutches	
Phase V: Pre-surgical Optimization	Week 7–8	- Maximize pre-op strength & ROM - Ensure independence with mobility aids - Maintain cardiovascular fitness - Reduce anxiety & prepare for surgery	- Continue strengthening program (hip abductors, extensors, quadriceps, core) - Dynamic balance with crutches (safe patterns) - Endurance training (stationary cycle or supported walking) - Breathing/relaxation training for peri-op preparedness	- Strengthening: 20–30 min/day - Balance: 5–10 min/day - Endurance: 15–20 min/day - Relaxation: 10 min/day

Table 6: Physiotherapy management

Outcome and Follow-Up

Outcome measures were taken on preoperative day one and at the end of week 8 and is given in (Table 7).

Outcome Measure	**Preoperative Day 1**	**End of Week 3**
Visual Analog Scale (VAS)	8/10 (during movement) 3/10 (at rest)	2/10 (during movement) 0/10 (at rest)
Range of Motion (ROM)	Restricted hip movements (esp. flexion & abduction) due to pain and guarding	Improved hip and knee ROM with physiotherapy, and contracture prevention was achieved
Muscle Strength (MMT)	Hip flexors/extensors: Grade 3-/5 (pain-limited) Quadriceps: Grade 3/5 Hamstrings: Grade 3+/5	Hip flexors/extensors: Grade 4-/5 Quadriceps: Grade 4-/5 Hamstrings: Grade 4/5
Gait Assessment	Antalgic gait with reduced stance phase on the right side; requires support for longer distances	Improved gait pattern with axillary crutches; partial weight-bearing with reduced pain
Functional Independence	Dependent for stair climbing, prolonged standing, and community ambulation	Independent with crutch-assisted walking; able to perform ADLs with minimal difficulty

Table 7: Outcome measures

Follow-up reported here is preoperative (8 weeks). Postoperative outcomes will be described in future follow-up.

4. Discussion:

Lytic lesions of the proximal femur due to osteoid osteoma are rare but carry significant morbidity due to pain, antalgic gait, and risk of pathological fracture. While definitive treatment is surgical, prehabilitation provides crucial functional benefits(11,12).
Although surgery or ablation are the conventional methods of treating osteoid osteoma, prehabilitation—structured physical therapy prior to surgery—has shown definite advantages in other surgical specialties. In oncologic surgery, prehabilitation has been shown to improve both preoperative functional capacity and postoperative results in numerous randomized controlled trials. In patients awaiting oncological resections, for instance, prehabilitation dramatically increased peak oxygen consumption (VO_2 peak) and 6-minute walk distance (6MWD), according to a systematic review and meta-analysis(13). Prehabilitation has also been demonstrated to improve quality of life both before and after joint replacement and spinal operations in orthopedic surgery populations by lowering back pain and increasing muscle strength(14).
Prehab programs that include aerobic, resistance, and respiratory training have demonstrated viability and safety in esophagogastric cancer patients outside of oncologic and orthopedic settings, leading to increases in respiratory function, exercise capacity, and muscle strength(15).

Translating these findings to our case of proximal femoral osteoid osteoma in adolescence, several key insights emerge:

1. Contracture and Muscle Weakness Prevention.

Although not specifically investigated in osteoid osteoma, comparable orthopedic research demonstrating function improvements after prehabilitation supports the use of preoperative physical therapy to treat hip stiffness, avoid contractures, and enhance periarticular muscle(14,15)

2. Optimizing Surgical Readiness

Improvements in respiratory function and physical performance in prehabilitation studies focusing on malignancy led to better postoperative outcomes, confirming the notion that similar regimens could improve surgical readiness and recovery even in benign but incapacitating conditions like osteoid osteoma(15,16).

3. Quality-of-Life Considerations

Prehabilitation that increases exercise capacity and decreases symptom burden often improves patient-reported outcomes. Teenagers with hip discomfort could benefit much from this in terms of their preoperative self-esteem, independence, and psychological health(17).

This case highlights that physiotherapy played a vital role in optimizing pain relief, maintaining joint mobility, and gradually restoring muscle strength in the preoperative period. When combined with definitive medical and surgical management, physiotherapy facilitated functional recovery and contributed to a better overall outcome for the patient.

5. Conclusion:

Osteoid osteoma of the proximal femur can severely impair hip mobility and gait in adolescents.
Structured preoperative physiotherapy reduces pain, prevents contractures, and maintains muscle strength.
Prehabilitation enhances patient confidence, prepares for surgical recovery, and minimizes postoperative complications.

Integration of physiotherapy into multidisciplinary bone tumor care should be considered standard practice.

Patient's Perspective:
When the pain started and gradually increased, I was unable to walk properly, and my hip movements became restricted. I could not sleep at night. Physiotherapy made the biggest difference—it reduced my pain, improved my movements, and allowed me to walk independently again. I gradually returned to school and now feel much more confident.

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