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From Fixation to Function : A Case Study on Effectiveness of Combined Isometric Resisted Repeated Activation and Dynamic Functional Training After Femoral IM Nailing

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Abstract:

Epidemiology of condition: Long bone fractures are among the most common orthopeadic injuries worldwide, particularly affecting middle aged males due to trauma (road traffic accidents, falls). Increasing urbanisation and motor vehicles use have led to a rising trend in such injuries.

Geographic condition: In India, trauma cases are seen due to :

- road traffic accidents
- occupational hazards
- limited early rehabilitation awareness and access can delay recovery

Technique of procedure: Intramedullary nailing is considered the gold standard surgical intervention for long bone shaft fractures due to its biomechanical stability, minimal soft tissue disruption and early weight bearing advantages. Despite successful surgical fixation, optimal recovery depends on structured physiotherapy interventions to restore ROM, muscle strength, functional mobility.

Scope of study: while surgical outcomes of IM nailing are well documented, there is limited literature emphasizing the role of physiotherapy approach that contributed to faster functional restoration in a 47 year old male patient post IM nailing. The study aims to demonstrate the effectiveness of targeted rehabilitation in reducing recovery time and improving clinical outcomes.

Case Description, Assessment:

A 47 year old male presented to physiotherapy department, he was absolutely fine until 5 months ago when he sustained an injury after falling from a height while at work, following the fall he developed a fracture of shaft of left femur and subsequently underwent intramedullary nailing. The patient reported chief complains of pain while movement/weight bearing, stiffness and difficulty in performing weight bearing activities after 5 months later of the surgical procedure. These impairements highlighted the need of structured physiotherapy rehab program

symptoms: the patient experienced moderate to severe pain at the surgical site , swelling, reduced joint mobility, difficulty in walking, standing and climbing stairs. There was also a sense of muscle weakness and instability in affected limb.

There was No significant past medical history

Functional limitations: The patient had difficulties with basic activities of daily living such as independent walking, sit to stand transitions, stair negotiation, squatting and other functional movements.

Clinical examination: On Observation we noted antalgic gait pattern, swelling around surgical site, muscle wasting in quadriceps and hamstring, surgical scar present, postural asymmetry. On palpation we noted local rise in temperature, tenderness over surgical site, muscle tightness in surrounding musculature. In Range of motion (ROM) we noted reduced active and passive ROM in adjacent joints eg. Knee flexion- 90 degree, knee extension- 5 degree Lag.
MMT of hip flexors- grade 2, hip extensors- grade2, hip abductors and adductors- grade 2. VAS score – at rest: 2/10, during movement/weight bearing: 5/10
On investigating XRAY we noted confirmed shaft fracture of the femur with IM nailing in situ.

Uniqueness of the study
This case is unique due to the accelerated functional recovery achieved. Typically, delayed rehab leads to complications such as joint stiffness, quads inhibition, prolonged gait abnormalities.

Why this case is worth reporting
there is limited evidence emphasizing the effectiveness of late start but intensive physiotherapy protocols in post IM nailing patients. This case demonstrates that even after delayed presentation, strategically accelerate recovery, reduce disability and restore functional independence.

Physiotherapy intervention:
A special technique which I used which made my protocol unique and helped in patients recovery is a combination of isometric-resisted-repetitive activation and dynamic functional training
Total duration- 4 weeks, Frequency – 4/5 sessions per week

Phase wise rehabilitation-
1. **Phase (week 1) pain reduction and activation:** static and dynamic quadriceps, hamstring exercises, ankle pumps, gentle active assisted ROM of knee and hip, patellar mobilisation, Isometric resisted repetitive activation.
2. **Phase 2 (week 2-3) strengthening and mobility:** Active ROM progression, SLR, partial weight bearing training, initiation of gait training with support.
3. **Phase (week4) functional and dynamic training:** -partial weight bearing gait training, sit to stand, step ups, stair climbing, balance exercise.

Result:
Following 4 weeks of targeted physiotherapy intervention and special technique which I used (IRR Isometric resisted repetitive activation +dynamic training), the patient demonstrated significant improvements in pain, ROM (As given in table below) it was marked increased in knee mobility, especially knee flexion including reduced stiffness and helped in joint function. Improvement in quadricep strength (result given in table below) highlights the effectiveness of active strengthening Isometric resisted repeated activation approach

PRE AND POST TREATMENT OUTCOMES-

Outcome measure	Pre treatment	Post treatment
Pain (VAS)	2/10at rest,5/10 activity	1/10at rest, 2/10 activity

Knee flexion	90 degree	120-130 degree
Knee extension	Extension lag-5 degree	Full extension- 0 degree
Quadriceps strength(MMT)	Grade 2/5	Grade 4/5
Weight bearing	Partial with support	Full but with support

Discussion:

The present case study demonstrates significant improvement in pain, ROM, muscle strength and functional independence following a targeted physiotherapy protocol initiated 5 month after IM nailing of femur. Previous literature suggests that early physiotherapy initiation following IM nailing leads to better functional outcomes and prevents complications such as joint stiffness. The present case showed accelerated recovery despite delayed initiation. The marked improvement in knee ROM & quads strength observed in this case aligns with studies highlighting the role of neuromuscular re education and resistance training in post-op ortho rehab.

The success of intervention can be attributed to several factors-

Targeted muscle activation (IRR isometric resisted repetitive activation approach), progressive loading and functional training , combination of static and dynamic exercises eg. Walking , stair climbing

THIS CASE HIGHLIGHTS

Even with delayed physiotherapy initiation ,structured rehab can produce rapid and clinically significant recovery. Quad strengthening and functional retraining are critical components in post IM nailing rehab. A goal oriented and individualised physiotherapy plan is more effective than a generalised protocol.

STUDY LIMITATIONS

Single patient , short follow up duration (long term outcomes eg.return to full activity were not assessed), lack of control (makes it difficult to attribute improvements solely to intervention), patient related factors (motivation, compliance and individual healing response may have influenced outcomes)

Conclusion

This case study highlights the effectiveness of a targeted physiotherapy rehab program consisting of Irr (isometric resisted repetitive activation) +dynamic functional training in a 47 year old male following IM nailing of femur. Despite the delayed initiation of physiotherapy (5month post-op) the patient showed marked improvement in pain reduction (VAS 5/10 to 2/10 during activity)increased knee ROM (90-120 Degree) enhanced muscle strength & restoration of independent gait and ADLs. The case emphasises that structured, progressive, individualised physiotherapy interventions can significantly accelerate recovery even when rehab is initiated

Future scope of study: larger sample size (future studies involving more patient are required to generalise the effectiveness of this rehab approach), long term follow up (assessing long term outcomes such as return to work,endurance and prevention of comlications),advanced outcomes measures (use of standardised scales), comparison studies (comparing early vs delayed physiotherapy initiation to establish stronger clinical evidence.

This case supports the growing evidence that well planned physiotherapy can be a decisive factor in accelerating post-op orthopedic recovery and improving patient quality of lifeer

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