Exercise Therapy with Evidence on Post Traumatic Stiffness (Knee)

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Abstract
This case study where 14 year old subject following post epiphyseal fracture of tibia treated conservatively.
Aims and Objectives: Aims and objective of this presentation was to analyse impact of various means of exercise therapy in the rehabilitation with evidence and to find how case study can be used for learning of student physiotherapists.
Materials and Methodology: The subject was treated with physiotherapy from February 2017 to April 2017 for post immobilization stiffness of knee with specific PNF Techniques and kinematic exercises.
Result: With an Improved ROM, decrease in pain (VAS) by 50%, cadence have increased by two times and fivefold betterment with functional activities with womac score of the subject in 25 sessions.
Conclusion: The finding of this study were to be used for methodological application of exercise therapy as a major tool with evaluation of each session and time framed rehabilitation are the core component of this presentation.

Keywords: Epiphyseal fracture , Growth plate, Proprioceptive Neuromuscular Facilitation(PNF) Various PNF stretching techniques based on kabat’s concept are: Hold and relax technique; CR- contract relax CRAC- contract relax antagonist contract

Introduction
Bone has been described as a dynamic and highly interactive complex of many cells and tissue types (Odgrenetal 2003) The epiphyseal growth plate is made of several key aspects including cartilaginous, bony and fibrous components, which act together to achieve longitudinal bone growth (Ziannotti 1990). Distal femoral epiphyseal develops in the ninth week of fetal life and is the fastest and biggest growing epiphysis of the body, contributing to 40% of the lower extremity length (Pritchelt 1992). Distal femoral
epiphyseal fractures are not common but have a high rate of complications such as growth disturbances, with subsequent limb length discrepancy and angular deformity. (Arkader et al 2007). In growing children sprains and strains often result in potentially serious growth plate fractures and epiphyseal fractures. (Mehlman et al 2012). Epiphyseal fracture are the most common fractures occurring in the growing age groups with incidence of 0.8% of 2500 consecutive epiphyseal fracture. (Neer and Horowitzs 2014)

**Prevalence:** Distal femoral epiphyseal fractures are caused by sports trauma traffic accident and horse riding accidents (BeatyJh Kumar 2012) (Veena et al 2013), have recorded that fractures are common in boys in lower limbs and common age of fracture between 10-14 years.

**Aims and Objectives**

1. To evaluate the efficacy of various exercise therapy techniques on this subject’s rehabilitation.
2. To mobilize knee, hip and ankle joint.
3. To strengthen muscles around knee.
4. To promote gait retraining. Facilitate for his daily activities with obtained clinical prognosis.

**Background information**
A 14 years old boy had a history of fall from the vehicle on January 9, 2017 and was treated conservatively with above knee POP cast for distal femoral epiphyseal fracture and was referred to our physiotherapy department with pain, difficulty in bending the knee and walking on 24-02-2017.

X-ray AP View of Right Knee (09 Jan 2017)

Measurements and observations as on 24-02-2017 (Day 1)

- Ectomorph, ambulant with antalgic gait on toes (Right) using walking (Partial weight bearing) frame.

On examination:
- Right Tendoachillies tightness and hip flexors tightness

**Table 1:** Girth / circumference of gastrocnemius & quadriceps muscle (Muscle atrophy), Limb length discrepancy and Range of motion of knee joint

<table>
<thead>
<tr>
<th>Side</th>
<th>Muscle Atrophy (cm)</th>
<th>Limb Length Discrepancy (cm)</th>
<th>Range Of Motion Of Knee Joint (degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>Gastrocnemius 27.5</td>
<td>98.5</td>
<td>High sitting Active knee flexion 15° - 70°</td>
</tr>
<tr>
<td></td>
<td>Quadriceps 32.5</td>
<td></td>
<td>Prone lying Active knee flexion 15° - 75°</td>
</tr>
<tr>
<td>Left</td>
<td>Gastrocnemius 29</td>
<td>96.5</td>
<td>Full and Pain free</td>
</tr>
<tr>
<td></td>
<td>Quadriceps 33.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Physiotherapy interventions:**

i. Proprioception neuromuscular facilitation-Hold and relax technique.

ii. Progressive weight bearing exercises using functional re-education.

iii. Closed and open kinematic exercises using physio-ball.

iv. Knee mobilization, passive stretching of right hip and ankle.

**Materials and Methodology**
With weekly thrice frequency of each sessions lasting for 20-25 minutes. Initial few weeks open kinematic exercises, PNF, passive stretching of
hip and tendoachillies were carried. Each session was recorded with ROM obtained. From 6th week closed kinematic exercises and functional re-education were started. By 6th week partial weight bearing with walker then progressed to stick and by April 3rd subject was discharged with a set of home exercises. The patient results were presented as below with Pre and Post physiotherapy evaluation data.

Results

Table 2: Result of before and after physiotherapy on ROM of knee (Right), VAS, womac score, cadence, mode of ambulation of this subject.

<table>
<thead>
<tr>
<th></th>
<th>ROM (Degree)</th>
<th>VAS</th>
<th>WOOMAC SCORE</th>
<th>CADENCE (No. of steps /min)</th>
<th>MODE OF AMBULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE</td>
<td>15° – 75°</td>
<td>8</td>
<td>46</td>
<td>25</td>
<td>Walker – partial weight bearing</td>
</tr>
<tr>
<td>POST</td>
<td>0° – 120°</td>
<td>4</td>
<td>8</td>
<td>45</td>
<td>Independent with no walking aid</td>
</tr>
</tbody>
</table>

Abbreviations

ROM – Range of Motion ; VAS – Visual Analogue Scale ; WOOMAC - Western Ontanario Macmasters Universities Subjective rating scale on a 10 point scale

Gait: 

Motion at the hip joint. Locomotion is difficult and pain is sometimes present when the hip is in motion. It may be caused by trauma such as knee fracture (MeSH 2007)

- Stretching exercises of the hip flexors may be an easy but often ignored component of rehabilitation (Lauraleeetal 1997) as reduced hip extension was significantly correlated with anterior pelvic tilting and reduced contralateral step length (Kottre 1990) These findings correlate with this study subject who had hip flexors tightness initially along with Tendoachillies tightness and with hip flexors, stretching, hip extensors and dorsiflexors strengthening has shown an improved gait and increased weight bearing. Hence postimmobilization stiffness of the proximal and distal joints should be evaluated and treated with due exercises is a major practical point of this study findings.
- PNF techniques such as hold – relax were used to increase ROM and flexibility (FUNK etal 2003)
- Salameh Bweir Al Dajah., 2013 stated that soft tissue mobilization along with proprioceptive neuromuscular facilitation
values for reduction in pain and increases in range of motion. The growing skeleton is more responsive than the mature skeleton to the osteotrophic effect of exercises (Nilsson et al 2005). Type I salter harris fracture with closed reduction immobilization recovery was good (Burrei et al 2010) This subject similar type of epiphyseal Type I fracture where with good alignment and the subject recovery with knee flexion from 0-120 degree as shown in result table is note worthy with following means of exercise therapy used on this subject. The techniques such as - Contract – relax (CR) and contract relax antagonist contract (CRAC) method of PNF were used on this subject. Four physiological mechanism behind this technique which includes Autogenic inhibition, Reciprocal inhibition, stress relaxation and Gate control theory (Hindle et al 2012)

Open and Closed Kinematic Exercise
While open kinematic exercises were effective during early phases of 4th and 5th week following injury rehabilitation (Ingrid Eitzen 2010) closed kinematic chain exercises were widely used with physio ball on this subject during later phase (6th week till today) as evidenced by (Feng Zhang 2014)

Functional Re-Education and weight bearing exercises:
Functional re-education with gradual weight bearing for walking and to aid his daily activities such as transfers, toileting etc, were applied on this subject as learnt in exercise therapy under supervision is more worthy as translation of learned theory on a real life patient with clinical indication with evidence forms core of this presentation as evidenced by progressive weight bearing exercises (JENNIFER S HOWARD 2010) and exercises to improve daily activities should be the goal of therapy.

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Physiotherapy was the core of this original case presentation in 25 sessions of various means of exercises applied, the subject was functionally and clinically rehabilitated as evidenced by an increased range of knee flexion to 0-120°, an improved Womac score by five-fold, the subject became independent of his ADL activity and locomotion. Clinical knowledge, observation, reasoning, skills, evaluation and documentation were delivered along with clinical therapist to the pupil physiotherapist in that level of course further strengthens the clinical teaching with evidence as major purpose of this study.

**Uniqueness of This Research Presentation**
Application of learned skills and knowledge with clinical evaluation under supervision and guidance by the clinical physiotherapist students can learn acquire the confidence in handling patients, develops reasoning skills and enhances practical knowledge of how to handle the real life clinical situations.

**Critical Appraisal**
Applications of various concepts of physiotherapy in the rehabilitation were applied, evaluated, the skills were imparted by the clinical therapist to the student physiotherapist in their level of learning with evidence hence having noted clinical efficacy, purpose of documentation interaction with subject, care given were highlighted in this original study.

**Limitation and Further Recommendations**
Being single case study and for a shorter duration were major limitation. Larger sample size, other variables to evaluate such as X-ray, NMRI, functional scales could be carried further.

**Conclusion**
With an improved range of motion of hip and knee joints and quality of life of the subject in 25 sessions. The finding of this study were to be used for methodological application of exercise therapy as a major tool with evaluation of each session and time framed rehabilitation are the core component of this presentation. As a pupil physiotherapist learning skills and its applications on real living subjects under supervision builds confidence of the student, helps to visualize probable problems to be encountered and strives to develop problem solving skills, documentation and finer corrections if any required to be done by the faculty were the core components of this original study.

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