



Exercise Therapy with Evidence on Post Traumatic Stiffness (Knee)

Authors

Dr S.S.Subramanian¹, Mrs. S.J. Kanimozhiselvi², Mr. S. Dinesh³, U.Vanishree⁴,
PN.Venippriya⁵

¹M.P.T (Orthopaedics), M.S (Education), M. Phil (Education), Ph.D (Physiotherapy) The Principal, Sree Balaji College of physiotherapy, Chennai – 100 (Bharath) University, BIHER Chennai – 73.

Email: S.S.Subramanian@hotmail.com, Phone: 99400 47137.

²B.P.T.,MIAP, Tutor in Physiotherapy, Sree Balaji College of Physiotherapy, Chennai – 100. (Bharath) University, BIHER, Chennai – 73

Email: kani_kani1985@yahoo.co.in, Phone: 9003222893

³M.P.T., (Ortho)., MIAP, Asst Prof in Physiotherapy, Sree Balaji College Of physiotherapy, Chennai – 100. (Bharath) University, BIHER, Chennai – 73

Email: dineshan317@gmail.com, Phone: 9952097608

^{4,5}B.P.T. II Year

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. (Arkaderetal 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 Horowitz 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.

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

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

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.

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

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

Materials and Methodology

With weekly thrice frequency of each sessions lasting for 20-25minutes. 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.

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

Abbreviations

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

Gait:



Progression of Ambulation

Discussion

- Permanent fixation of the hip in primary positions, with limited passive or active

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 (Lauraleetal 1997) as reduced hip extension was significantly correlated with anterior pelvic tilting and reduced contralateral step length (Kotre 1990) These findings correlate with this study subject who had hip flexors tightness initially along with Tendoach-illies 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 osteotropic 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)



Thomas test/Hugh Owen Thomas well leg raising test



Galeazzi sign/Allis test

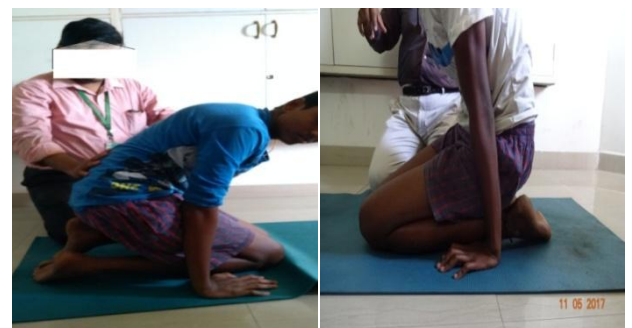
Open and Closed Kinematic Exercise

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.



(c) Functional Reeducation

Relevance of the study for pupil physiotherapists learning exercise therapy: Conservative management of an adolescent boy with femoral epiphyseal fracture treated with

physiotherapy was the core of this original case presentation in 25 session 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.

References

1. Proprioceptive Neuromuscular Facilitation (PNF):Its Mechanisms and Effects on Range of Motion and Muscular Function by Kayla B. Hindle¹, Tyler J. Whitcomb¹, Wyatt O. Briggs¹, Junggi Hong¹
2. The Effects of Physical Activity on the Epiphyseal Growth Plates: A Review of the Literature on Normal Physiology and Clinical Implications Timothy A. Mirtz,^{a,c} Judy P. Chandlerand Christina M. Eyers^bJ Clin Med Res. 2011 Feb; 3(1): 1–7. Published online 2011 Feb12
3. Growth Plate (Physeal) Fractures Treatment & Management Updated: Dec 12, 2014 Author: Charles T Mehlman, DO, MPH; Chief Editor: Dennis P Grogan,MD
4. Eccentric loading for achillestendinopathy strengthening or stretching? Allison GT Purdam C Br J Sports Med. 2009;43 (4):276.
5. Cumulative incidence of achilles tendon rupture and tendinopathy in male former elite athletes .Kujala UM Sarna S KaprioJ..Clin J Sport Med. 2005
6. Perspective. Osteoclastogenesis and growth plate chondrocyte differentiation: emergence of convergence 2003Odgren PR, Philbrick WM, GartlandA..
7. Growth plate physiology and pathology ,Iannotti JPVan der Eerden BC, Karperien M, Wit JM. Systemic and local regulation of the growth plate.Endocr RevOrthopClin North Am.1990 Jan;21(1):1-17.
8. Cartilaginous epiphysis and growth plate: normal and abnormal MR imaging

- findings. AJR Am J Roentgenol. 1992 May;158(5):1105-10 Jaramillo D¹, Hoffer FAAJR Am J Roentgenol 1992;
9. Insights about bone physiology and its clinical applications. Anatomy, 2001 Frost HM. From Wolff's law to the Utah paradigm:
 10. Biomechanical strategies for articular cartilage regeneration. Darling EM, Athanasiou KA Ann Biomed Eng 2003;31(9):1114-1124.
 11. A progressive 5 week exercise therapy program leads to significant improvement in knee function early after anterior cruciate ligament injury by J. Orthop sports physiotherapy, NOVEMBER 2010.
 12. Continuous Passive Motion, Early Weight Bearing And Active Motion Following Knee Articular Cartilage Repair: Evidence For Clinical Practice by Jenifer S Howard, Carl G. Mattacola, Spencer E. Romine, and Christian Laterman 2010.
 13. Comparison of the clinical effects of open and closed chain exercises after medial patello-femoral ligament reconstruction by Feng Zhang, Jun Wang , Fei Wang 2014. Curr Rev Musculoskelet Med. 2013 Sep; 6(3): 250–257.
 14. Hip arthroscopy for extra-articular hip disease Michael S. Reich, Claire Shannon, Eugene Tsai, and Michael J. Salata Curr Rev Musculoskelet Med. 2013 Sep; 6(3): 250–257. Published online 2013 Jul 24.
 15. Proprioceptive Neuromuscular Facilitation Stretching Mechanisms and Clinical Implications Melanie J. Sharman, 1 Andrew G. Cresswell^{1,2} and Stephan Riek¹ 1 School of Human Movement Studies, The University of Queensland, Brisbane, Queensland, Australia 2 School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Queensland, Australia