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Case Report

Physiotherapy Section

Eccentric Training as an Adjunct to Rehabilitation Program for Hereditary Multiple Exostoses: A Case Report

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ABSTRACT

Hereditary multiple exostoses an autosomal dominant skeletal disorder characterized by multiple cartilage-capped benign exostoses that typically occur in the metaphysis of long bones. The prevalence of hereditary multiple exostoses is estimated to be 1 in 50,000. Although, there have been many studies concerning this rare disorder, no research has yet examined the rehabilitation of hereditary multiple exostoses. The case diagnosed with hereditary multiple exostoses referred to our department with several complaints, namely pain, joint limitations, muscle weakness, and functional insufficiency after arthroscopic distal left femur exostoses excision. The aim of this case report was to present effectiveness of eccentric training as an adjunct to rehabilitation program for hereditary multiple exostoses. According to the results, eccentric training after arthroscopic exostoses excision may help reduce pain, increase range of motion, muscle strength, and functional levels in patients with hereditary multiple exostoses.

Keywords: Multiple hereditary exostoses, Pain, Treatment outcome

CASE REPORT

A 19-year-old male with Hereditary Multiple Exostoses (HME) who underwent arthroscopic exostoses excision of distal left femur at an external clinic because of his complaints, namely pain, joint limitation, and gait disorder [Table/Fig-1]. The patient was referred to our clinic due to similar complaints after arthroscopic exostoses excision. Written and verbal informed consent was obtained from the patient. The patient's demographic details and family pedigree were recorded. The family pedigree revealed similar complaints in his uncle. On examination the patient noted knee pain, which was exacerbated by activity especially squatting. His pain could be as high as 5/10 (where 0 indicates no pain and 10 is the worst pain imaginable). The active and passive range of motion of the knee was evaluated using a 360° universal goniometer when the patient lying prone on an examination table. Knee active and passive range of motion was measured 80° and 94°, respectively. Quadriceps and hamstring muscle strength was assessed with a hand-held digital dynamometer (Nicholas Manual Muscle Tester, Lafayette® Instruments, USA). Quadriceps femoris and hamstring muscle strength was measured 141.7 N and 43.8 N, respectively. Timed up and Go (TUG) test, Step up-down test (ten steps), 6-minute walking test, Tegner activity score, and modified Lysholm knee score were utilized to determine the functional level. TUG, step up-down test score, and six-minute walking distance was found 7.51 second, 13.93 second, and 566.2 m, respectively. Tegner activity score and modified Lysholm knee score was determined 2 and 75, respectively. Bilateral pes planovalgus and hamstring-gastrocnemius muscle tightness was observed. All measurements were recorded before treatment, 3 and 6 weeks after treatment.

[Table/Fig-1]: X-ray photograph of the patient after arthroscopic exostoses excision of distal left femur.

The rehabilitation program was administered as 60-min sessions, three sessions a week, every other day each session one day apart. Cold pack was applied to knee for 15 minutes to reduce pain. Neuromuscular electrical stimulation was used for strengthening the quadriceps muscle-vastus medialis obliquus (biphasic pulses, at 75 Hz and 250 μs phase duration, 20 minutes). Neuromuscular retraining exercises included straight leg raise exercises, terminal knee extension exercises, wall mini-squats with ball between the knees, and hip flexion, extension, abduction and adduction strengthening exercise with Theraband® (blue colour). Proprioceptive neuromuscular facilitation patterns were used with rhythmic stabilization for joint limitation, and slow reversal hold to re-establish proprioception and dynamic stabilization of the knee. Static stretching exercise protocol was applied on hamstrings and gastrocnemius muscles to enhance muscle flexibility [1]. Additionally the patient performed "Nordic hamstring" eccentric exercise. The nordic exercise could be done with a partner. The patient began the exercise on his knees with his torso perpendicular to the ground, while his partner applied pressure to his heels to ensure that the patient's feet stayed in contact with the ground throughout the motion of the exercise. The patient then resisted a forward-falling motion by eccentrically engaging the hamstring muscles. The patient was instructed to resist forward-fall as long as possible, attempting to reach a position parallel to the floor. The patient then allowed his body to fall using his hands and arms to cushion the impact and quickly pushed up to the starting position. The patient performed these exercises 3 sets of 15 repetitions 2 to 3 times a day. Rehabilitation program was continued for 6 weeks. A different colour Theraband® was used (black colour) and the numbers of repeats were increased after week 3 evaluations.

The clinical and functional outcomes before the treatment were compared with the outcomes obtained in weeks 3 and 6. Pain intensity during activity decreased by 60% in week 3 and the patient expressed no pain in week 6. Knee active range of motion

	Operated side					Other side		
	Before treatment	3 weeks after treatment	%	6 weeks after treatment	%	Before treatment	3 weeks after treatment	6 weeks after treatment
Pain intensity (cm)	5	2	60	0	100	0	0	0
Range of motion: Active (º)	80	127	58.8	132	65	122	125	128
Passive (º)	94	134	42.6	140	48.9	130	133	134
Muscle strength: Quadriceps (N)	141.7	254.5	79.6	283.9	100.4	284	300.8	315
Hamstring (N)	43.7	149.8	242.8	179.1	309.8	106	188	188.8

[Table/Fig-2]: Comparison of the clinical outcomes obtained before treatment, and 3 and 6 weeks after treatment.
cm: Centimeter, N: Newton

	Before treatment	3 weeks after treatment	%	6 weeks after treatment	%
Timed up and Go test (sec)	7.5	5.7	24	4.7	37.2
Step up-down Test (sec)	13.9	7.5	46	7.2	48.2
6 Minute Walk Test (m)	566	616	8.8	666	17.7
Tegner Activity Score	2	5	150	7	250
Modified Lysholm Score	65	70	7.7	80	23.1

[Table/Fig-3]: Comparison of the functional outcomes obtained before treatment, and 3 and 6 weeks after treatment.
Sec: Second, m: Meter

increased by 58.8% in week 3 and 65% in week 6. Knee passive range of motion increased by 42.6% in the week 3 and 48.9% in week 6. Quadriceps femoris muscle strength increased by 79.6% in week 3 and 100.4% in week 6. Hamstring muscle strength increased 242.8% in week 3 and 309.8% in week 6 [Table/Fig-2]. It was revealed that TUG test performance increased by 24% in week 3 and 37.2% in week 6. The patient could complete the step up-down test 46.4% faster in week 3 and 48% faster in week 6. Six-minute walking distance was improved by 8.72% in week 3 and 17.6% in week 6. Tegner activity level score increased by 150.6% in week 3 and 250% in week 6. Modified Lysholm score increased by 7.7% in week 3 and 23.1% in week 6 [Table/Fig-3].

DISCUSSION

The findings of this case report revealed that eccentric training was effective in decreasing pain, increasing range of motion and muscle strength, and improving functional levels after arthroscopic exostoses excision.

Exostoses develop in large numbers around the joint between the long bones [2], especially the distal femur and proximal tibia, small hand and foot bones, scapula, pelvis, and ribs [3]. In this patient, the exostoses were localized bilaterally around the distal femur and proximal tibia.

Pain, joint limitations, limb asymmetry, malignant degeneration, and neurovascular compression are the main complications of HME [3]. Valgus deformity of the knee and ankle, pectoral and pelvic asymmetry, ulnar deviation of the wrist, curve of radius and subluxation of radio-capitellar joint are seen in HME [4,5]. Similarly, in this patient, pain and joint limitations were observed. Additionally, bilateral pes planovalgus deformity was observed.

If there are growth disorders, neurovascular compression, severe pain or excessive limitation of range of motion in HME, surgical treatment may be needed. This patient underwent arthroscopic exostoses excision of distal left femur due to the pain and limitation of range of motion. Besides, conservative treatment could be used both before and after surgical interventions. Conservative treatment focuses on pain, joint limitations, and deformities [6,7]. However, there was no study to investigate the effect of eccentric training as an adjunct to rehabilitation program for HME.

In the present patient, pain, limitations in knee joint range of motion and muscle weakness were observed due to the exostoses. All these symptoms resulted in disability in walking, and a decrease in functional and daily living activities. At the end of the 6-week rehabilitation program, which included eccentric training, pain decreased, and joint range of motion, muscle strength, walking speed and distance, and functional level increased. During the rehabilitation program, no treatment-related complications were observed in present patient. Eccentric training as an adjunct to rehabilitation program is safe for the treatment of HME and can be tolerated without damage.

CONCLUSION

The results of the present case report showed that eccentric training after arthroscopic exostoses excision might decrease pain, increase range of motion, muscle strength, and functional levels in patients with HME. Therefore, eccentric training may be included in rehabilitation programs to attain these clinical and functional outcomes.

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