



EFFECT OF CIRCUIT TRAINING PROGRAM ON A CHILD WITH CONGENITAL LOWER LIMB SHORTENING – A SINGLE SUBJECT CASE STUDY.

Clinical Research

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ABSTRACT

Objectives: To study and report the effect of circuit training program in the management of congenital lowerlimb shortening.

Method: Single Subject Case study. A diagnosed case of congenital lower limb shortening was treated for one month with customized training protocols.

Results: Pre and post test data of functional and endurance level was collected using Goniometer, fatigue severity scale and 1 minute sit up test.

Conclusion: The patient showed clinical recovery following circuit training program for one month.

KEYWORDS

congenital lower limb shortening, circuit training program, goniometry

Introduction

Congenital shortening of the lower limb occurs very rarely, at a rate of 1–3 per 10 000 births. The clinical picture shows a reduction in the size of the lower extremity, consisting of shortening and thinning. The shortening applies to the pelvis and all the segments of the lower limb: femur, lower leg, and foot in any dimension, and in different proportions in particular segments. In many cases, other abnormalities, such as valgus or varus knee deformity, the lack of certain metatarsal bones, talocalcaneal coalition, structural or true leg length discrepancy and other foot deformities co-exist.⁽³⁾ These can lead to functional limitations along with decrease in endurance level. Circuit training is a new model of rehabilitation service delivery and is distinct from the concept of group therapy. Circuit training comprises a set of core activities, individually adapted, task specific and graded in time. Its physiological approach is based on integrated functional exercises targeting specific impairments in strength, balance and endurance.⁽¹⁾

As an Occupational Therapist our case study focus on how circuit training can be helpful in patients with shortened lower extremity unilateral overcome functional limitations and increase in endurance. There is little study related to circuit training on congenital limb shortening.

Clinical context

A male child aged 11 years with 127cms height and weight 36 kgs has a diagnosis of congenital limb shortening with deformities. He had difficulty in walking, presence of fatigue after walking for short duration, decreased active range of motion of hip internal and external rotation, presence of lower extremity deformities, limb length discrepancy of 2.5cms present and unable to perform full squat. As an occupational therapist our aim was:-

- to functionally regain the loss
- to improve the endurance level

History

The boy had a birth weight of 1.7 kgs with immediate birth cry and preterm(7 months) caesarean delivery. During postnatal period the child's immunization was proper but after birth he had severe respiratory distress which was managed by nasal continuous positive airway pressure(CPAP) and kept in incubator for 13 days.

At 7 months age antenatal scans showed short long bones, the ultrasonography study report for foetal mentioned intrauterine foetus with limb shortening. The chest xray report mentioned mediastinum and cardia shadow shift to the left and inadequate expansion and periphery devoid of parenchyma of the lung. The physical examination after birth didn't show any marked abnormality.

At 4years of age the child was advised for orthosis by consultant physician. The investigations were also carried out for Xray both

lowerlimb and reported by :

- Both hips frog lateral-coxavara deformity was seen in right hip with
- Right genuvalgum.
- Fuzziness was seen in metaphyseal regions of both lowerlimbs.

Another physician advised for shoe modification and asked to remove the orthosis. The child was referred to orthopaedic surgeon for surgical intervention. also Xray was again advised for both lower limb which reported by :

- Congenital coxavara of right hip,
- Metaphyseal irregularity of both lowerlimb and
- Shortening of right femur.

Observations

On observation following was noted:-

- Short stature-Button nose, short limbs, small limbs, small nasal bridge
- Genuvalgum and pes cavus of right lower extremity
- Pes planus of left foot
- Lordosis
- Right big great toe

Examination

Palpation

Anterior and posterior aspect of hip was accurately palpable except the greater trochanter of right lower extremity. Palpation of the anterior aspect of knee was palpable and did not reveal any abnormality.

Range of motion

All the movements and active range of motion(AROM) of hip flexion, hip extension, knee flexion, knee extension, ankle dorsiflexion, ankle plantarflexion, ankle eversion, ankle inversion, great toe and toe was within normal limit except hip abduction, hip adduction, hip internal and external rotation(Table 1). External rotation of hip revealed a firm end feel.

Table 1

Sl no.	Movements	Rt lower limb (in degree) AROM	Lt (in degree)
	Hip abduction	90-130	0-40
	Hip adduction	130-90	40-0
	Hip internal rotation	15-20	0-30
	Hip external rotation	15-60	0-60

Manual muscle Testing(MMT)

Manual muscle testing revealed slight decrease in muscle strength of lower extremity.

ADL evaluation

He is fully independent in ADL and loves to play cricket, video games and watching television.

Table-2 JOINT PLAY MOVEMENTS AND TEST

JOINT	JOINT PLAY	RESULT
Hip	Caudal glide of the femur	Normal
	Compression	Compression folds were more on the right(rt) side
	Lateral distraction	Normal
	Quadrant test	Felt the slippage of the head of the femur into the acetabulum
Knee	Backward glide of tibia on femur	Tissue stretch
	Forward glide of tibia on femur	Tissue stretch
	Medial translation of tibia on femur	Tissue stretch
	Lateral translation of tibia on femur	Tissue stretch
	Medial displacement of patella	Normal
	Lateral displacement of patella	Normal

Table-3 DEFORMITIES OF LOWER EXTREMITY

SL NO.	DEFORMITYS	TEST	RESULT
1	Lordosis	Wall test	Positive
2	Coxavara(rt)	Nelatons line test	Positive
3	Genu valgum(rt)	Plumbline test/q angle-17 degree	Positive
4	Pes planus left(lt)	Supple pesplanus test	Positive(moderate pes planus)
5	Pes cavus(rt)	Observation	Increase of arches of foot(mild pes cavus)
6	Tibia shortening(rt)	Prone knee flexion test	Positive
7	Femur shortening(rt)	Hip flexion test	Positive
8	Lower limb discrepancy	Rt-24inch, Lt-25inch	2.5 cms structural LLD

Fatigue evaluation

Fatigue severity scale^(6,7) scored 55/63, which shows that he easily get fatigued. 1 minute sit up test scored below average(32). While interviewing the parents it was also reported that after walking for a distance the child was unable to walk properly further.

Gait evaluation

An observational gait analysis was done⁽⁵⁾. The child had tendelenburg gait with adequate heel strike, toe off and swing. He walked with outwardly deviated foot.

Functional evaluation

On applying the hip function test, knee function test, ankle function test and foot function test, it was found that the components of the test were performed in normal manner.

He was unable to perform full squat(90 degree of hip flexion, 95 degree of knee flexion) and had difficulty in kneeling walking.

OCCUPATIONAL THERAPY INTERVENTION

The basic aim of intervention was:-

- to prevent further deformities
- to increase endurance
- to increase range for squatting
- to increase and maintain muscle strength of lower extremity.

We have treated the boy with functional circuit training program for one month.

For hyper lordosis positioning was advised which consisted of the following:-

- Wedge on chair
- One leg rest higher than other while standing
- Flat pillow below when sleeping on stomach
- Sleeping on back with pillows under knees

The training session for functional circuit training program began with a warm up(walking at usual pace for 10 minutes) and ended with a cool down(stretching for 5 minutes). During the FCT, the patient performed

1 day of balanced activities and 1 day of lowerbody strength based activities.

The circuit training protocol consisted of:-

- Static balance consisted of heel walking, toe walking and tandem walking with eyes open or closed.
- Dynamic balance consisted of walking along with catching objects, narrow walking, zigzag walking.
- Functional balance activities consisted of walking with obstacles, walking while picking up objects from the floor, walking while carrying a package that obstructed the view of the feet.
- Lower body exercises included functional tasks such as rising from a chair, stair climbing, knee bends, floor transfer, leg squat, leg extension, leg flexion, calf raise, abdominal curl using ankle weights.

Dosage

An 8 repetition maximum without weight was established at the first training session and repeated at the second training session. Initially the child performed one or two sets of 6-8 repetitions of each exercise, the number of repetitions was increased when a participant was able to complete 8 repetitions. The maximum number of repetitions was 15. The load was increased 0.5 kg when the child participant could perform 15 repetitions, up to maximum of 2 kg.⁽⁴⁾ The training facility was given thrice a week, for 45 minutes for 1 month.

OUTCOMES

The child found that squatting was easy for him, the range of motion of squatting increased at the end of 4th week when measured with goniometer.

Range of motion

1st week=(Hip flexion 90 degree, knee flexion 95 degree)
End of 4th week=(110 degree, knee flexion 103 degree)

Endurance level

1st week=fatigue severity scale- 55/63(fatigue present), 1 minute sit up test-32(below average)

End of 4th week=fatigue severity scale-26/63(fatigue reduced), 1 minute sit up test-48(good)

Muscle strength

1st week=iliopsoas(rt), gluteus maximus (rt), quadriceps(rt), hamstrings(rt)-4/5

End of 4th week=All the muscles mentioned above were-4⁺/5

CONCLUSION

In this case of congenital shortening of lower limb, we found that functional circuit training was effective in improving the functions and endurance level.

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