



Early gait training program and proprioceptive neuromuscular facilitation in the patient with post debridement amputation – A rare case report

Aachal Birelliwar¹, Vrushali Athawale¹, Angela Kapoor^{2✉}, Waqar M. Naqvi³

¹Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Science, Wardha, India

²Department of Cardiorespiratory Physiotherapy; Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Science, Wardha, India

³Department of Community Physiotherapy; Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Science, Wardha, India

✉Corresponding author

Department of Cardiorespiratory Physiotherapy; Ravi Nair Physiotherapy College,
Datta Meghe Institute of Medical Science,
Wardha, India;
Email: angelakapoor1@gmail.com

Article History

Received: 18 July 2020

Reviewed: 19/July/2020 to 03/September/2020

Accepted: 04 September 2020

E-publication: 09 September 2020

P-Publication: September - October 2020

Citation

Aachal Birelliwar, Vrushali Athawale, Angela Kapoor, Waqar M. Naqvi. Early gait training program and proprioceptive neuromuscular facilitation in the patient with post debridement amputation – A rare case report. *Medical Science*, 2020, 24(105), 3421-3426

Publication License



This work is licensed under a Creative Commons Attribution 4.0 International License.

General Note

Article is recommended to print as color digital version in recycled paper.

ABSTRACT

Introduction: Lower limb amputation is most common amputation. Indication for amputation is traumatic injuries, tumours, vascular diseases and thermal injuries. **Case description:** A case of 56 year male, presented in this report who had a pain over right foot with blackish colour discoloration results gangrene over dorsal aspect of right foot. The patient was having the history of diabetes since 10 years and operated with midfoot amputation. The primary goals of the rehabilitation program are to increase range of motion, improve muscle strength and prevention of stiffness and deformities. **Conclusion:** Dynamic balance and overall mobility of patient is improved by Proprioceptive neuromuscular facilitation and also improving the parameters, gait performance and ambulation of patient. The combined effect of strengthening exercises, PNF technique, Gait training had significantly produced the positive effect on patient by performing activities of daily living and improving quality of life of patient.

Keywords: Post debridement gangrene, gait training, amputation, proprioceptive neuromuscular facilitation, rehabilitation.

1. INTRODUCTION

Amputation is traumatic procedure which mostly affects lower limb which leads to altered activities of daily living, balance and gait (Dorta, 2015). Amputation is mostly common indication for thermal and traumatic injuries, peripheral vascular disease, tumours, and congenital disorders. It is life saving procedure. It is also performed to remove infected, ischemic and necrotic tissue (Mostafa et al., 2016). Most common complication of diabetes mellitus is diabetic foot. It is most adverse effects of diabetes mellitus on feet. Diabetic foot should manage properly and should manage early to improve quality of life, decrease number of amputation and maintain health of status (Chawla, 2005). Role of physiotherapy is very essential in amputation and has great importance to the treatment and rehabilitation of patient (Dorta, 2015). In rehabilitation, gait training is a key of ambulation (Anjum et al., 2016).

2. PATIENT INFORMATION

A 56 year male, driver by occupation with right hand dominance visited to orthopaedic department and referred for physiotherapy for rehabilitation. Patient stated that he had pain over right foot with blackish colour discoloration having history of diabetes mellitus since 10 years. Patient also had foul smelling discharge from the right foot, which result in gangrene over the dorsal aspect of the foot. Patient also stated with family history of diabetes mellitus and tobacco chewing since 10 years. By orthopaedic surgeon, proper investigation was done, and had an amputation of all the toes of right side because of gangrene. After surgery, patient visited to physiotherapy department for rehabilitation with the complaints of pain over dorsal aspect of right foot, difficult in mobility with alteration in gait pattern and difficulty in performing basics activities of daily living. On NPRS the pain was 6/10.

3. OBSERVATION

The right lower extremity was inspected in supine position after taking consent of patient. Patient keep the extremity in knee extended position with ankle plantar flexed. Blackish colour discoloration of feet because of gangrene was observed with healed scar as it is shown in figure 1 & 2. Oedema was present.



Figure 1 Figure showing blackish discoloration over dorsal aspect of foot.



Figure 2 Figure showing bandage in foot in neutral position.

Palpation

On palpation local temperature was normal. Tenderness was present with grade 2. Distal pulsations of both the extremities were present; length of the scar is 10cm.

Examination

The muscle power of dorsiflexors and plantar flexors of right ankle was 3/5. The muscle strength of knee flexors and extensors were 4/5. The neurological assessments showed that there were reduced in superficial sensations of right foot. The range of motion assessment was done through goniometer from base line. Both active and passive range of motion was examined and it has been shown in table 1.

Table 1 Range of motion assessment on 1st day of treatment

	Active ROM	Passive ROM
Hip flexion	0-110 ⁰	0-120 ⁰
Hip extension	0-10 ⁰	0-20 ⁰
Hip abduction	0-30 ⁰	0-40 ⁰
Hip adduction	0-35 ⁰	0-45 ⁰
Hip internal rotation	0-35 ⁰	0-45 ⁰
Hip external rotation	0-40 ⁰	0-45 ⁰
Knee flexion	0-120 ⁰	0-130 ⁰
Knee extension	0 ⁰	0 ⁰
Ankle dorsiflexion	0-10 ⁰	0-15 ⁰
Ankle plantarflexion	0-30 ⁰	0-40 ⁰

Intervention

Rehabilitation started on the first day of visit after filling consent form from the patient. Rehabilitation primary goals are to increase range of motion, improve muscle strength and prevention of stiffness and deformities. On 1st day it is important to prevent contracture. Knee flexion contracture most commonly develop. This contracture can be prevented by proper positioning of limb. Bed positioning program has given which consist of stretching of patient's knee into extension and maintain position for 40 minutes. For scar management, scar mobilisation was given in sitting position to improve circulation. Push-up exercises have been given to improve muscle strength which may be use in ambulation at later stage. Strengthening exercises is given to muscles like quadriceps, hamstrings to improve muscle strengthwith manual and mechanical resistance. Active movement was given in joint like hip, knee and ankle and for 5 repetitions with follow upof 4 days. On 5th day, cryotherapy was given to reduce oedema. Bed mobility exercises were given to the patient. The patient was taught transferring from supine to sitting and sitting to standing.

In Gait training, crutch walking should start early as possible. In initial days, patient was properly monitored. Gait training, is done through parallel bars in front of mirror. Stance phase and swing phase is individually was practised. Then progressed to crutch

walking. Upright posture is placed centre of gravity over hip joints gait practise sessions. By utilizing hand contact, postural control was improved. While walking, maintain reciprocal movement of stump and normal alignment of pelvis. Strengthening and range of motion exercises was continued. On 13th day, PNF techniques was started to which is easy to perform and for stable mobility. It is essential to strengthen muscle like knee – flexors, extensors which are functionally important. Gait training and exercises was continued. Trunk rotation and alternate arm swings was practised regularly. On 22nd day of Rehabilitation exercises, PNF techniques were continued. Progression in strengthening exercises was done by increasing intensity and duration. It is necessary to increase vigorous of exercise to make functionally free range of motion. Functionally training was also given for work of daily routine (figure 3 & 4).



Figure 3 Patient performing Strengthening exercise for Ankle Joint



Figure 4 Patient performing Strengthening exercise for Hip flexors

Outcomes

Table 2 Range of motion assessment after rehabilitation

	Active ROM	Passive ROM
Hip flexion	0-115 ⁰	0-125 ⁰
Hip extension	0-15 ⁰	0-25 ⁰
Hip abduction	0-35 ⁰	0-45 ⁰
Hip adduction	0-40 ⁰	0-50 ⁰
Hip internal rotation	0-40 ⁰	0-50 ⁰
Hip external rotation	0-45 ⁰	0-50 ⁰
Knee flexion	0-125 ⁰	0-135 ⁰
Knee extension	0 ⁰	0 ⁰
Ankle dorsiflexion	0-15 ⁰	0-20 ⁰
Ankle plantarflexion	0-35 ⁰	0-45 ⁰

NPRS: Pre: 6/10 Post: 2/10

Functional Independent Measure Score: Pre: 84/126 Post: 100/126

Timed up and go test Pre: ≤ 30 seconds; Post: ≤ 22 seconds

Berg balance scale: Pre: 20/56 Post: 35/56

Dynamic Gait Index score: Pre: 0/24 Post: 17/24

After 26th day of rehabilitation there was a significant improvement in following parameters. Pain intensity on NPRS is 2/10. The muscle power of dorsiflexors and plantarflexors of right ankle was 4/5. The muscle strength of knee flexors and extensors were 5/5. Range of motion was increased which is shown in table 2. Tenderness was present with grade 1. There was decrease in blackish colour discolouration of feet was observed. The Oedema was reduced. Patients gait pattern was normal.

Follow up

A 1 month's follow up period was observed. As the improvement was observed on Range of motion, Muscle strength, Activities of daily living, and exercise tolerance which was on documentation, RPE maintained by patient that has been taught during home program exercise prescription and also contacted telephonically.

4. DISCUSSION

In this case patient stated the pain over dorsal aspect of foot, difficulty in mobility, gait impairments and difficulty in performing basics activities of daily living. Knee flexion contracture most commonly develop. It was prevented by positioning of limb. Bed positioning program was given which consists of stretching of patient's knee and maintain position for 40 minutes (Fox et al., 2000). Cryotherapy was advice which results in increasing blood flow, reduction of oedema, and for relaxation (Dorta, 2015). Passive and active exercises were given in all joints to increase range of motion of dorsiflexion, plantar flexion, hip flexion, knee flexion (Bawiskar et al., 2020).

Progressive strengthening exercises include thera-band exercises was also given (Tudosie et al., 2011). Dynamic balance and overall mobility of patient is improved by Proprioceptive neuromuscular facilitation and also improving the parameters, gait performance and ambulation of patient. PNF improves muscle strength of hip extensors, knee flexors, hip flexors. PNF also improves functional status of people and locomotion (Anjum et al., 2016). PNF stimulates muscle groups and its one of the principle is to increase joint range of motion and promote relaxation (Daneshmandi et al., 2011).

Physiotherapy in post-operative phase starts from parallel bars with assistive devices (O'Neill, 2008). Muscle activity at ankle and hip and postural adjustments are must needed to initiate gait (Vrieling et al., 2008). Transfers includes sitting to standing. Extend heel on floor and patient should sit slightly forward and trunk weight should shifted over thighs. Position and weight should supported on remaining leg feet should be parallel (Vaidya et al., 2020). For gait training, it is important to perform amputee exercises and for weight shifting. It is done in parallel bars in front of mirror. To correct the trunk posture, therapist teaches postural control by utilizing hand contact. Mirrors is used for visual feedback while gait training (Mensch, 1983).

5. CONCLUSION

The present case is an example of amputation of all the toes which is very rare case in the rehabilitation sciences. This case report provides the insight patient compressive recovery rehabilitation program that can help patient to relive from pain, increase in strength and range of motion, improvement in balance and equilibrium with proper gait pattern. The combined effect of strengthening exercises, PNF technique, Gait training had significantly produced the positive effect on patient by performing activities of daily living and improving Quality of Life of patient.

Acknowledgement

We thank the patient who participated and contributed samples to the study.

Author's Contribution

All authors contributed equally to the manuscript.

Funding

This study has not received any external funding.

Conflict of Interest

The authors declare that there are no conflicts of interests.

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Data and materials availability

All data associated with this study are present in the paper and/or the Supplementary Materials.

Peer-review

External peer-review was done through double-blind method.

REFERENCES AND NOTES

1. Anjum, H., Amjad, I., Malik, A.N. Effectiveness of Proprioceptive Neuromuscular Facilitation Techniques as Compared to Traditional Strength Training in Gait Training Among Transtibial Amputees. *Journal of the College of Physicians and Surgeons--Pakistan: JCPSP* 2016; 26(6): 503-506.
2. Bawiskar, D., Dhote, S., Phansopkar, P. Early physical rehabilitation post-surgery in a complex type 5 Schatzker Tibial plateau fracture improves functional outcomes: A case report. *Medical Science*, 2020;24(104): 2675-2682.
3. Chawla, S., Diabetic Foot Ulcer – A Case Study. *Journal of Exercise Science and Physiotherapy* 2005; 1(1,2): 98-99.
4. Daneshmandi, H., Atri, A.E., Ghasemi, A., Rahmani, P. The Effects of Pnf & Static Stretching On Knee Rom of Amputee Athletes. *Brazilian Journal of Biomotricity* 2011; 5(4): 255-262.
5. Dorta, H.S. Physical Therapy in the Pre and Post the Transtibial Amputation. *Int J Phys Med Rehabil* 2015, 3:3:276.
6. Fox, P., Richardson, J., McInnes, B., Tait, D., Bedard, M. Effectiveness of a Bed Positioning Program for Treating Older Adults With Knee Contractures Who Are Institutionalized. *Physical Therapy* 2000; 80: 363–372.
7. Mensch, G. Physiotherapy following through-knee amputation. *Prosthet Orthot Int* 1983; 7:79–87.
8. Mostafa, N.M., Mohamed, Z.A.E.-L., Rashad, S.M. Effect of exercise program on functional ability of patients with lower limb amputation. *Journal of Nursing and Health Science (IOSR-JNHS)* 2016; 5, 01–07.
9. O'Neill, B. Cognition and Mobility Rehabilitation Following Lower Limb Amputation, in: Gallagher, P., Desmond, D., MacLachlan, M. (Eds.), *Psychoprosthetics*. Springer London, London 2008; TEAMED: pp 53–65.
10. Tudosie, A., Popescu, S., Cinteza, D., Romanescu, S., Popa, R., Sandu, A., Romila, A., Tiniuc, A.M., Florea, R. Rehabilitation in a Patient with Replantation of Amputated Distal Leg. *A Journal of Clinical Medicine* 2011; 6(1): 36-44.
11. Vaidya, L., Kumar, K., Naqvi, W., Narang, S., Pisulkar, G., Dadlani, M. Revision of total hip replacement surgery in elderly patient and its recovery based on periprosthetic fracture rehabilitation. *Medical Science*, 2020;24(104):2628-2638.
12. Vrieling, A.H., van Keeken, H.G., Schoppen, T., Otten, E., Halbertsma, J.P.K., Hof, A.L., Postema, K. Gait initiation in lower limb amputees. *Gait & Posture* 2008; 27: 423–430.