Intervention for foot drop in a patient with subacute stroke

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INTRODUCTION

Foot drop is the result of a weak tibialis anterior muscle and can result as a complication of stroke. It is estimated that foot drop occurs in 20% of individuals following a stroke. The inability to completely lift the foot (due to foot drop) during the swing phase of the gait cycle can result in gait deviations. Loss of balance and decreased ankle proprioception are also major impairments in individuals with stroke and are major causes of instability and falls in this population. Approximately 75% of stroke survivors will have a fall within the first 6 months after a stroke. Walking is the most frequently cited activity (as high as 90%) in this population at the time of a fall. Considering the high fall incidence rates that occur during walking, it is no surprise that emphasis on early rehabilitative interventions in gait training is recognized as beneficial for improving dynamic balance, mobility, and functional independence.

PURPOSE

No research articles were found in a search of the literature concerning elastic wrap bandaging as a treatment intervention for foot drop; however, elastic wraps are frequently used in the clinical setting to assist with dorsiflexion during early gait training. The purpose of this case report was to compare and describe the immediate effects between elastic wrap bandaging and a posterior leaf spring AFO on gait kinematics and joint angles in a patient with subacute stroke and subsequent hemiparesis.

CASE STUDY

- The patient was a 72 year old male who presented with left sided hemiparesis due to a stroke in the right pons.
- Rehabilitation began two days following the stroke consisting of conventional physical therapy.
- The patient received a total of seven 1.5 hour therapy sessions since admission to the rehabilitation hospital.
- Right lower extremity strength testing: hip flexion (4+/5), knee flexion, knee extension, ankle dorsiflexion, and ankle plantarflexion (5/5)
- Left lower extremity strength testing: hip flexion (3-/5), knee flexion (2+/5), knee extension (3-/5), ankle dorsiflexion (2+/5), ankle plantarflexion (3+/5).
- The patient was able to ambulate 300 feet with a rolling walker and with minimal contact assistance from the physical therapist, receiving a FIM score of 4 for locomotion.
- The patient required supervision for bed mobility and chair transfers, receiving a FIM score of 5 for transfers.

INTERVENTION

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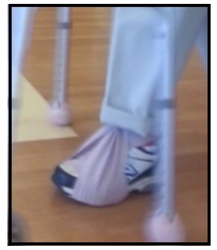
- Three trials of gait training were performed;
  - First without the use of any dorsiflexion assistance
  - Second while wearing a posterior leaf spring AFO
    - An Ossur posterior leaf spring for the left foot was inserted into the patient's shoe.
    - The patient's foot was then placed into the shoe and the strap was secured.
  - Third while utilizing Ace© wrap bandaging
    - The patient's left foot was wrapped into observed neutral dorsiflexion and slight eversion with a 4 inch Ace© elastic bandage starting from the distal foot to the proximal ankle in a figure-8 fashion.
- Standby supervision was provided to the patient by a physical therapist during each of the trials.
- For all three trials, the patient was instructed to ambulate 10 meters at his usual pace with the rolling walker.
- The patient was provided with rest breaks ranging from 45 seconds to 1 minute in between trials to allow for fitting of the posterior leaf spring, and during wrapping with the elastic bandaging.



PERFORMANCE MEASURES

- To assess the patient's performance during gait, the following objective measures were utilized:
  - Gait velocity
  - Cadence
  - Joint positioning at the trunk, the hip, and the knee assessed by the "Coaches Eye" Video Analysis software
  - Gait section of the Tinetti Performance Oriented Mobility Assessment

OUTCOMES

- The patient demonstrated no difference in Tinetti gait score, a 29.4% increase in gait velocity, and a 16% increase in cadence while utilizing the Ace© wrap bandaging when compared to results without any dorsiflexion assistance.
- With the posterior leaf spring, the patient demonstrated a 2 point decrease in the Tinetti gait score, a 5.6% decrease in gait velocity, and no change in cadence when compared to results without any dorsiflexion assistance.
- There was a 2 point increase in the Tinetti gait score, improved joint positioning, a 33% increase in gait velocity, and a 16% increase in cadence utilizing the elastic wrap bandaging in comparison to the posterior leaf spring.

Table 1: Gait speed and cadence

10 meter walk	Gait speed (m/s)	Cadence (steps per minute)
No assistance	0.588	67
AFO	0.555	67
Ace© wrap	0.833	80

Table 2: Tinetti gait assessment

Tinetti gait assessment	No assistance	AFO	Ace© wrap
Initiation of Gait	1	1	1
Step Length and Height	2	2	2
Foot clearance	2	1	2
Step Symmetry	1	1	1
Step Continuity	1	1	1
Path	1	1	1
Trunk	0	0	0
Walking Stance	1	0	1
Gait score	9/12	7/12	9/12

Table 3: Joint angle measurements during stance phase of gait

Joint angles		Initial Contact	Loading Response	Mid Stance	Terminal Stance	Pre Swing
No assistance	Hip	38° flexion	35° flexion	20° flexion	15° flexion	11° flexion
	Knee	14° flexion	20° flexion	11° flexion	17° flexion	32° flexion
AFO	Hip	32° flexion	21° flexion	21° flexion	7° flexion	19° flexion
	Knee	8° flexion	15° flexion	13° flexion	11° flexion	47° flexion
Ace© wrap	Hip	29° flexion	20° flexion	21° flexion	4° flexion	9° flexion
	Knee	13° flexion	7° flexion	12° flexion	18° flexion	38° flexion

Table 4: Joint angle measurements during swing phase of gait

Joint angles		Initial Swing	Mid Swing	Terminal Swing
No assistance	Hip	15° flexion	44° flexion	32° flexion
	Knee	53° flexion	25° flexion	8° flexion
AFO	Hip	20° flexion	32° flexion	35° flexion
	Knee	52° flexion	36° flexion	9° flexion
Ace© wrap	Hip	16° flexion	20° flexion	33° flexion
	Knee	47° flexion	16° flexion	11° flexion

DISCUSSION

- The elastic wrap bandaging and the posterior leaf spring had its greatest influence at initial contact, loading response, terminal stance, and midswing as determined by differences in change at either hip flexion, knee flexion, or both throughout the gait cycle.
- When utilizing the elastic wrap bandaging, better joint positioning was noted during gait, leading to a greater difference in joint measurements, when compared to the posterior leaf spring.
- A review of the literature revealed improvements in velocity, symmetry, and foot clearance during swing while utilizing a plastic AFO in the neurologic population, none of which occurred in this case study.
- There were no clinical benefits of using a posterior leaf spring in the management of foot drop during gait training, and in fact was disadvantageous to the patient.
- It is well known that higher repetitions at greater intensities are associated with neuroplastic changes needed for motor recovery.
- The results from this study demonstrate that elastic wrap bandaging for dorsiflexion assistance facilitates better joint positioning at the ankle, and increases cadence and gait speed in a patient with subacute stroke, all of which have the potential to enhance motor recovery.
- Given the clinical benefits of elastic wrap bandaging, clinicians should be confident in utilizing this technique during ambulation activities in this population to assist in motor recovery.
- Further study is needed to determine if this is consistent with the broader population of stroke survivors.

CONCLUSION

- Ace© wrap bandaging was a feasible, and a better alternative than the use of a non-custom posterior leaf spring in this patient with subacute stroke.
- The patient demonstrated a trend toward greater gains in mobility and motor control while utilizing the elastic wrap during ambulation.
- There were no clinical benefits of using a posterior leaf spring in the management of foot drop during gait training, and in fact was disadvantageous to the patient.
- This case report suggests that the use of Ace© wrap bandaging as an adjunct intervention may be beneficial in the early management of foot drop in patients with subacute stroke.