Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 2 Issue 10 October 2019

Research Article

Concepts in Foot Drop Management- Review of the Current Literature

Bassel El-Osta* and Rachel Wilson

Trauma and Orthopaedics Department, Royal Free Hospital, UK

***Corresponding Author:** Bassel El-Osta, Trauma and Orthopaedics Department, Royal Free Hospital, UK.

Received: August 20, 2019; **Published:** September 30, 2019

DOI: 10.31080/ASOR.2019.02.0106

Abstract

Foot drop is a chronic disabling condition with many causal mechanisms. Here we present a review of current literature with the aim being to identify the highest quality papers available describing current management practices for foot drop using Hawker data extraction methodology. No comparison has been made between heterogeneous treatment methods, the emphasis here has been to assimilate and categorize the many treatment methods being applied in clinical practice. A search of the available literature from 1970 to the present was undertaken using specific key words. Out of close to 3600 articles, 12 of the most relevant articles were selected for review. These were the highest quality articles describing current treatment methods for foot drop. This review has highlighted the international interest in the problem of foot drop and the varied approaches to management, however it is clear that a best option has yet to be defined, and clinician preference remains the deciding factor in choice of management option. Reviewed publications were found not to compare treatment methods under consistent criteria, and superiority of one treatment method over another method was not indicated by any publication. This review indicates that although many treatment modes exist, no meaningful comparison can be made between these heterogeneous methods, and thus- a best practice method remains undetermined. The development of valid efficacy measures is the next step to comparing treatment methods and thereby discerning the most successful methods for management of foot drop.

Keywords: Foot Drop; Common Peroneal Nerve Palsy; Stroke; Hawker Data Extraction Method; Ankle Foot Orthosis

Introduction

Foot drop is observed when significant weakness of the dorsiflexor muscles of the foot and ankle result in a distinctive gait abnormality. In this, patients excessively flex the knee and hip to lift high the affected foot so as to avoid the dragging of the toes across the ground producing a characteristic 'steppage gait' pattern [37]. Normal dorsiflexion of the foot is achieved through the use of the muscles of the anterior compartment of the lower leg. The common peroneal nerve (CPN) innervates this compartment, and is particularly vulnerable to trauma at the point where it wraps around the fibular head [37]. The chronic nature of foot drop leads to impaired quality of life for patients and incurs huge cost to health services through the provision of therapies. As yet, no best treatment method has been described. Foot drop has multiple pathologically distinct causal mechanisms, known causes of foot drop are summarised below (Table 1).

Category	Type	References
Traumatic and compressive	Direct or indirect common peroneal nerve injury Rupture of anterior tibialis tendon Traumatic brain injury	37
Perioperative	Compression injury during general anaesthetic Following arthroplastic knee surgery Associated with epidural anaesthetic	32 28 27
Vascular	Stroke	20
Neurodegenerative	Multiple Sclerosis Motor Neuron Disease Degenerative cord lesions	24 31 23
Toxic	Drug induced myopathy/neuropathy	4
Neuropathic	Amytrophic Lateral Sclerosis Diabetic Neuropathy Sciatic nerve injury Lumbosacral plexus injury L5 nerve root compression	13 43 17 6 30
Myopathic	Poliomyolitis Charcot Marie Tooth	19
Neoplastic	Bony tumours	40

Table 1: Key causes of foot drop.

Incidence of foot drop

According to the Agency for Healthcare Research and Quality (AHRQ), during 2009, in the US alone, there were 1787 incidences of hospital admission due foot drop, averaging 2.4 days stay in hospital at an estimate cost of 30000 US dollars [44]. The exact prevalence of foot drop within the UK cannot be determined due to lack of formally recorded figures [14]. However it is estimated that up to 20% of all stroke survivors will experience some degree of foot drop [39]. With around 110,000 new cases of stroke in England per year this estimates between 5,300 and 11,100 new patients per year across the UK presenting with foot drop post stroke [46,48]. Similarly, of an estimated 126,699 multiple sclerosis sufferers in the UK, a significant number of these will be afflicted by both unilateral and bilateral foot drop [47].

Reasons to treat

Foot drop is recognised by the World Health Organisation as 'an impairment of body structure that may markedly influence the activities and participation of the affected individual' [45].The quality of life impact for the individual is significant due to repeated hospital admissions, clinic appointments, and the need for continued use of health resources. Foot drop frequently prevents individuals from driving, engaging in many sports or regular exercise, and in severe cases will limit walking normal distances. The treatment requires extensive input from multiple specialist health care groups including primary care specialists, surgeons, neurophysiologists and physiotherapists. The socio-psychological consequences associated with the chronic pain and gait disturbances seen in foot drop can not be underestimated and may cause patients to seek help for anxiety or depressive symptoms from their health care provider, and the need for chronic pain specialist management. The prognosis for individuals with foot drop depends on the causal factors, and the chosen therapeutic intervention. Prognosis may be determined through interval assessments with EMG and nerve conduction studies [26].

Methods

The aim of this review is to define and classify the existing treatment methods for foot drop described in current literature. In addition we aimed to look particularly at available devices and their biomechanics. Finally we considerred the extent to which these articles have addressed the issues of patient satisfaction and acceptability with respect to these different therapies. This review cannot consider a comparison between different methods of foot drop management as highlighted here, no appropriate efficacy measures exist for which a comparison between methods can be made.

Study design

Literature review of published literature using several search engines and a 3 phase selection process.

Search methodology

The authors reviewed close to 3600 articles dated between 1970 and 2015. The majority of articles were PubMed indexed and appeared in peer review journals. The search was conducted using EBSCO database with relevant search terms (Table 2).

The 'and/or' method was used to narrow the search and extract the most relevant articles for inclusion in the review. The titles and abstracts of selected articles were screened according to pre-defined criteria and included or excluded accordingly. Papers were included if they contained quantitative research, addressing management of foot drop, in English and describing new treatment methods. Qualitative, mixed method study designed papers were excluded, as were reviews and case studies. Papers were not included if they described the same treatment methods as other papers with higher data extraction scores.

Search terms
Foot N1 drop
Floppy foot
Footdrop*
Gait disorders
Neurologic/TH/SU/RH/DT
Peroneal Neuropathies/DT/RH/SU/TH
Foot Orthoses
Orthotic Devices

Table 2: Search terms utilised.

Outcomes

Phase 1

Both authors carried out the literature search to ensure that all relevant articles would be identified. The search produced a total of 3568 articles. Candidate articles were screened by title. Titles that both authors agreed were irrelevant to the aim of this review were excluded (3045). The remaining articles (523) that seemed to be relevant to the topic or for those that no consensus between the authors was reached were forwarded to the next phase.

Phase 2

All abstracts of articles selected during Phase 1 were read and evaluated by checking their concordance with the inclusion criteria. All studies meeting the criteria were forwarded to the next phase of the search process. If no consensus was reached for a particular article, the article was also forwarded to the next phase. All other studies (471) were excluded.

Phase 3

In the final phase of the search process, a total of 52 articles passed on from Phase 2 were read and evaluated against the inclusion criteria. Additional manual searching of the reference lists of all 52 articles produced one additional article. Of these, 25 articles with text irrelevant to the study, or not meeting inclusion criteria were excluded. In addition, 13 qualitative studies were excluded. 3 studies were excluded due to non-availability as full text. After three exclusion phases 12 articles remained for in depth review.

Figure 1: Search phases.

Review methodology

All included studies were assessed using pre-prepared data extraction sheets for the appraisal of methodologically heterogeneous studies as tested by Hawker., et al [10]. The data extraction sheet features nine components pertaining to methodology, design and statistical method. Included articles were reviewed against these components and rated on a scale of 1 (very poor) to 4 (very good). An overall score for each article was obtained through collating the nine Hawker component scores, this ranged from very poor (scoring 9) to very good (scoring 36). Any article scoring less than 18 was considered to be of poor to very poor quality (Table 3).

The data extraction and synthesis process consisted of re-reading, isolating, comparing, categorizing and relating relevant data. Included articles were read repeatedly to obtain an overall understanding of the material. See results, table 4.

Inclusion criteria	Exclusion criteria
1. Empirical research / quantitative study design	1. Qualitative or mix-method study designs
2. Addressed treatment of foot drop	2. Reviews, case studies or doctoral dissertations
3. English language	3. No comparison or new innovation described.

Table 3: Predefined inclusion and exclusion criteria were used for screening of retrieved articles.

Results

Discussion

The large volume of articles identified at the start of the review process was reduced to a manageable number of 12 relevant publications that fulfilled all inclusion criteria (Table S1). It is clear that there is an international interest in the problem of foot drop and its management, as evidenced by publications from groups based in varied global institutions including the UK, Japan, USA, and Turkey. In the most comprehensive publication found in the search process the author had discussed all the available treatments to date, with particular focus on the effect of combination FES with Botulinum toxin for spastic foot drop [42]. However this article did not offer a comparison of the described treatment methods. The remaining 11 publications tended to compare a few of the treatment methods but under varying conditions. No publication indicated superiority of one treatment device or method over another device or method. No randomized controlled trials exist for comparison of bracing with surgical management. Evidently, patients who are candidates for surgical procedures may not be appropriate for bracing and vice versa.

Management option	Method of action
Orthotics and physical therapy	An external device applied to the limb to improve function, stabilise gait, reduce pain through differential transfer of load, correct flexible deformities and reduce the progression of fixed deformities. E.g. ankle foot orthosis (AFO) These may be flexible or rigid and usually consist of a shoe insert, calf shell and calf strap.
Surgical options	Options include nerve decompression, nerve grafting, or nerve repair. Tendon transfer procedures are considered typically when there is insignificant neural recovery after one year. Arthrodesis of the ankle or mid-foot aims to create a stable well aligned foot and ankle.
Medical options	Treatments for painful paraesthesia accompanying foot drop include amitriptyline, Nortriptyline, Pregabalin, Gabapentin. Local treatment with transdermal capsaicin or Diclofenac may help to reduce symptoms but will not improve the mechanical abnormality.
Neurotrophic or neuroprotective drugs	Promote survival of neural cells through anti-inflammatory mechanisms. Erythropoietin is one such drug that has been shown to accelerate functional recovery after peripheral nerve injury.
Nerve stimulators	May be external or implanted and radio-frequency activated.

Table 4: Five main categories of management options for foot drop.

Author/ Reference	Country of Origin	Aim of the study	Design, sample and RR	Data Collection and Analysis	Ethical Consideration
Wilkenfeld., *et al.* [42]	Boston, USA	To discuss how FES and Botulinum toxin injections can work synergistically	Review of methodology and paper	Nil	Nil
Ninkovic., *et al.* [26]	Austria	To present further surgical improvements, refinements of the Ninkovic technique, and results after long-term follow-up	Descriptive, technical and prospective. Limited power with only 18 patients. RR: 40% (n= 8)	Electromyographic testing used before and after surgery. Active ROM measured. Divided into 4 categories	Approval of the IRB
Flores., *et al.* [9]	Brazil	To demonstrate the outcomes obtained after the transfer of a branch of the tibial nerve to the peroneal nerve for recovery of foot drop	Retrospective follow-up, descriptive, Limited power with 13 patients. RR: 25% (n=3)	Subjective and Clinical grading system. Including the BMR grading system	Approval of the IRB
Hwang., *et al.* [15]	Korea	To investigate how the Elastic Walking Band could improve walking patterns as compared with walking without the Elastic Walking Band in stroke patients.	Descriptive, qualitative prospective study. paired *t*-test Limited power with 15 patients only. RR: 0% (n=0)	Gait analysis in different units comparing barefoot to with elastic band	Approval of the IRB
Graham., *et al.* [12]	United Kingdom	To discuss the most effective form of treatment including orthotics and the use of functional electrical stimulation.	Exploration of different management treatment. No specific research.	Nil	Nil
Alam., *et al.* [2]	Malaysia	To review the engineering design of AFO with articulated ankle joint, developed in recent years for "drop-foot" treatment. Focus limited to design elements, design considerations, and working mechanism of the devices.	Exploratory, no definitive study. No research methodology. No statistics.	Nil	Nil

Steinau., *et al.* [36]	Germany	A technique of posterior tibial tendon transfer through the interosseus membrane and fixation to the anterior tibial and long peroneal tendon ''Bridle procedure'' (stirrup-plasty)	Descriptive paper. No obvious statistical method has been used. RR: 40% (n=22)	Clinical, Dynamometer, Pedobarography and patient assessment used	Approval of the IRB
Hwang., *et al.* [16]	Korea	To examine the effects of gait training using the AFO-shaped elastic band.	Descriptive, prospective study with a small number of 11 patients. ANOVA was used as statistical method and than Bonferini for correction method	Assessing the gait including velocity, cadence and straight length.	Approval of the IRB
Kottink., *et al.* [22]	Netherland	To determine the therapeutic effect of using a new implantable, 2-channel peroneal nerve stimulator for 6 months versus an ankle-foot orthosis (AFO)	Prospective, randomised control, 29 patients was included, RR: 20% (n=6)	Used of MVC and TA muscle activity, walking speed, Correlation Between RMS max of the TA Muscle and Walking Speed. The Wilk-Shapiro test has been used.	Approval of the IRB
Elsner., *et al.* [7]	Switzerland	To evaluate the mid- to long-term outcomes of osseous and soft-tissue procedures	Retrospective, descriptive, audit studies, 19 patients were included, RR:0% (n=0)	Assessment of dorsiflexion strength, Pain, gait pattern and overall satisfaction, Kolmogorov-Smirnov normality test, two unpaired groups with the Mann Whitney rank sum test.	Not applicable
Vigasio., *et al.* [1]	Italy	Proposition for a procedure aiming to provide appropriate direction of pull with adequate length and fixation in a new method to restore balanced foot dorsiflexion thereby correcting the foot and digit drop and producing a normal gait without the use of orthoses.	Retrospective, unblended study, 16 patient sample size, all with complete traumatic CPN palsy. RR: 0% (n=16)	Stanmore system questionnaire, Seddon's method, Baropodometric study, Static and dynamic analyses	Approval of the IRB
Bethoux., *et al.* [5]	USA	To investigate and to measure the effects on gait performance and QoL of the WalkAide FES system (WA) compared with an AFO in individuals with foot drop secondary to hemiparetic stroke	Prospective, unblinded, parallel-group RCT of subjects with foot drop due to stroke, 495 patients involved, RR: 20% (n=96)	multiple imputation, non-inferiority analysis, SIS Mobility, ADL/IADL and Social Participation domain scores	Approval of the IRB

Table S1: Results.

Available treatment

From this literature review, it is possible to tabulate the multiple available treatment modalities into five main categories (Table 4). The advantages and disadvantages of several of these methods are discussed below.

Orthotics and physical therapy

Mechanical methods for the treatment of drop foot often utilise an Ankle Foot Orthosis (AFO) to hold the foot in dorsiflexion [21,34]. This can assist with toe clearance during the swing phase of gait [21]. AFOs commonly used for spastic drop foot drop hold the ankle at a generally constant angle, with variable amounts of compliance around that point. Unfortunately, AFOs tend to be poorly tolerated by patients [34,38]. Despite improvements in design and capacity for customisation, orthotic devices are frequently reported as uncomfortable by patient, this being the main disadvantage of this method. In addition, the 'fixed' AFO device is limited by its function in constraining the foot in a fixed flexion posture, whereas the 'dynamic' model, although allowing greater mobility at the joint, has a bulky appearance and is expensive. It has also been shown that orthotic devices may lead to pressure sore formation, and impede the ability to generate a standing torque from a seated position or to climb stairs [42].

For patients with ankle spasticity as well as weakness, stretching by physical therapy can be undergone, occasionally in combination with serial casting [3]. This is an important component of treatment, especially if there is an element of soft tissue contracture in addition to spasticity. Dynamic splinting or splints with built-in mechanical stretching functions are an alternative to serial casting [8].

Surgical management

In severe cases of contracture, surgical resection is sometimes considered [18]. Surgical options described include tendon transfer, bridle procedures and nerve grafts [1]. The articles reviewed here have not considered these methods in appropriately powered studies or in comparison to best non-surgical options. Ultimately, surgical methods may cause unwanted side effects and a limited period of benefit. Failure rate is significant; particularly in the case of nerve transfer procedures [33].

Medical management

A range of general pharmacologic treatments for spasticity associated foot drop exist. The most commonly used clinically are baclofen, a structural analogy of GABA (gamma-amino- butyric acid); tizanidine, which binds to central alpha 2- adrenergic receptors; dantrolene, a direct muscle relaxant, and benzodiazepines. This review has indicated a breadth of work done on the use of Botulinum Toxin (BTX). BTX is a protein that exists in seven serotypes produced by the bacterium *botulinum clostridium*. All serotypes act on the same target organs and produce similar effects [35]. The primary mechanism of BTX is to prevent the release of acetylcholine at the presynaptic terminal, thus impairing neuromuscular transmission and inducing weakness. Botulinum Toxin has been shown to provide good quality symptom relief for foot drop, but is limited by the short-term nature of these effects. Phenol or other alcohol injections are well-known focal treatments for spasticity. Neurolysis using alcohol will generally weaken a muscle for months to over a year and can weaken large and powerful spastic muscle groups [11].

Nerve stimulators

Functional Electrical Stimulation (FES) uses an electrical current to activate muscles groups found to be weak or paralysed due to lack of descending commands (upper motor neuron damage) but with preserved lower motor neurons and musculature. FES has been investigated in a variety of clinical situations, including upper and lower-limb weakness, bladder dysfunction, diaphragmatic dysfunction and postural control [29,41]. This review indicates that FES is a treatment modality addressed in this selection of most relevant and highest quality literature available, based on Hawker criteria, but evidence presented in favour of this method remains limited due to small patient populations and lack of suitable comparison measures to alternatives.

Conclusion

We appreciate that foot drop is a heterogeneous problem with many different causes and will present across a spectrum of severity. This review has indicated an international interest in the problem of foot drop, and that work is underway on multiple types of treatment modality, which have been categorized herein (Table 4). There is however a lack of primary research in the literature. The available literature consists mainly of case reports and reviews. Although many groups world wide are interested in the problem of foot drop and have described treatment methods trialled under various conditions, there were very few publications describing a combination of two or more methods with no compelling results for efficacy and duration of effect. Further to this, we suggest that management options must be appropriate for the patient holistically according to comorbid features and functional status, for exam-

ple the management of post stroke foot drop in an elderly patient contrasts with the management of foot drop after knee dislocation in a young athlete. Further studies are needed to elucidate the role of different treatment modalities in such patients.

A further deficit of current literature is the lack of focus on patient perceptions of various methods, and no use of defined acceptability measures. Existing treatment methods appear to have limited acceptability to patients, namely due to discomfort, and generally do not provide long-term relief. The issue of cost must be addressed, as the cost of treatments are variable, ranging from the inexpensive elastic band device to highly expensive custom orthotic devices and multiple courses of Botulinum Toxin injections.

Only a small number of methods have been compared, under inconsistent parameters. The mixed nature of foot drop aetiology makes appropriate comparison between methods difficult. Further work is needed to identify efficacy measures for the various treatment methods, with consideration of patient experience and acceptability. Once identified, these efficacy measures may be used to assimilate evidence for the use of different treatments in foot drop patients over a specified time scale with a common end point.

Ethics Approval and Consent to Participate

Not applicable

Consent for Publication

The Authors gives consent for publication.

Availability of Data and Material

All data and material are available upon request.

Funding

No fund has been received.

Author's Contributions

BEO and RW wrote the manuscript and reviewed articles, BEO reviewed the main body of articles for the literature review and edited the manuscript.

Bibliography

1. Adolfo Vigasio., *et al.* "New Tendon Transfer for Correction of Drop-foot in Common Peroneal Nerve Palsy". *Clinical Orthopaedics and Related Research* 466.6 (2008): 1454-1466.

2. Alam M., *et al.* "Mechanism and Design Analysis of Articulated Ankle Foot Orthoses for Drop-Foot". *The Scientific World Journal* (2014): 867869.

3. Albany K., *et al.* "Physical and occupational therapy considerations in adult patients receiving botulinum toxin injections for muscle overactivity". *Muscle and Nerve Supplement* (2008): 219-230.

4. Berthelot CN., *et al.* "Distal lower extremity paresthesia and foot drop developing during adalimumab therapy". *Journal of the American Academy of Dermatology* 53.5-1 (2005): 260-262.

5. Bethoux F., *et al.* "The Effects of Peroneal Nerve Functional Electrical Stimulation Versus Ankle-Foot Orthosis in Patients with Chronic Stroke: A Randomized Controlled Trial". *Neurorehabil Neuro Repair* 28.7 (2014): 688-697.

6. Dyck PJ and Thaisetthawatkul P. "Lumbosacral plexopathy". *Continuum (Minneap Minn) Peripheral Nervous System Disorders* (2014).

7. Elsner A., *et al.* "Lambrinudi arthrodesis with posterior tibialis transfer in adult drop-foot". *Foot and Ankle International* 31.1 (2010): 30-37.

8. Farmer SE., *et al.* "Dynamic orthoses in the management of joint contracture". *The Journal of bone and joint surgery British* 87.3 (2005): 291-295.

9. Flores LP., *et al.* "Clinical results of transferring a motor branch of the tibial nerve to the deep peroneal nerve for treatment of foot drop". *Neurosurgery* 73.4 (2013): 609-615.

10. Goldsmith MR., *et al.* "Synthesising quantitative and qualitative research in evidence-based patient information". *Journal of Epidemiology and Community Health* 61.3 (2007): 262-270.

11. Gracies J., *et al.* "Traditional pharmacological treatments for spasticity". Part I: Local treatments. In: Mayer N, Simpson D, editors. Spasticity Etiology, evaluation, management, and the role of botuli- num toxin. Bronx (NY): We Move (2002): 44-64.

12. Graham J. "Foot drop: explaining the causes, characteristics and treatment". *British Journal of Neuroscience Nursing* 6.4 (2010): 168-172.

13. Hardiman O., *et al.* "Clinical diagnosis and management of amyotrophic lateral sclerosis". *Nature Reviews Neurology* 7.11 (2011): 639-649.

14. Horsley W. "East Midlands Specialised Commissioning Group Orthotic Functional Electrical Stimulation (FES) for 'drop foot' of neurological origin". (2012).

15. Hwang YI., *et al.* "Effects of the Elastic Walking Band on gait in stroke patients". *Neuro Rehabilitation* 32.2 (2013): 317-322.

16. Hwang YI., *et al.* "The effect of an AFO-shaped elastic band on drop-foot gait in patients with central neurological lesions". *Neuro Rehabilitation* 32.2 (2013): 377-383.

17. Immerman I., *et al.* "Lower extremity nerve trauma". *Bulletin of the Hospital for Joint Diseases* 72.1 (2014): 43-52.

18. Keenan M and McDaid P. "Orthopaedic interventions for the management of limb deformities in upper motor neuron syndromes". New York (NY): Humana Press (2002): 197-255.

19. Kirienko A., *et al.* "Correction of poliomyelitis foot deformities with Ilizarov method". *Strategies in Trauma and Limb Reconstruction* 6.3 (2011): 107-120.

20. Kluding PM., *et al.* "Foot Drop Stimulation Versus Ankle Foot Orthosis After Stroke 30 Week Outcomes". *Stroke* 46.6 (2013): 1660-1669.

21. Kogler G. "Orthotic management. Clinical evaluation and management of spasticity". New York (NY): Humana Press (2002): 67-93.

22. Kottink AIR and Hermens HJ. "Therapeutic effect of an implantable peroneal nerve stimulator in subjects with chronic stroke and footdrop: a randomized controlled trial". *Physical Therapy* 88.4 (2008): 437-448.

23. Liu K., *et al.* "Foot Drop Caused by Lumbar Degenerative Disease: Clinical Features, Prognostic Factors of Surgical Outcome and Clinical Stage". *PLoS One* 8.11 (2013): e80375.

24. Melo PL., *et al.* "Technical developments of functional electrical stimulation to correct drop foot: sensing, actuation and control strategies". *Clinical Biomechanics* 30.2 (2015):101-113.

25. Mills KR. "The basis of electromyography". *Journal of Neurology, Neurosurgery, and Psychiatry* 76 76.2 (2005): 32-35.

26. Ninković M. "Neuromusculotendinous transfer: an original surgical concept for the treatment of drop foot with long-term follow-up". *Plastic and Reconstructive Surgery* 132.3 (2013): 438e-445e.

27. Nirmala and Kumari. "Foot drop after spinal anaesthesia: A rare complication". *Indian Journal of Anaesthesia* 55.1 (2011): 78-79.

28. Park., *et al.* "Common peroneal nerve palsy following total knee arthroplasty: prognostic factors and course of recovery". *Department of Orthopaedic Surgery Faculty Papers* 28.9 (2013): 1538-1542.

29. Ragnarsson KT. "Functional electrical stimulation after spinal cord injury: current use, therapeutic effects and future directions". *Spinal Cord* 46.4 (2008): 255-274.

30. Michael D Reife and Christopher M Coulis. "Peroneal neuropathy misdiagnosed as L5 radiculopathy: a case report". *Chiropractic and Manual Therapies* (2014).

31. Sackley C., *et al.* "Rehabilitation interventions for foot drop in neuromuscular disease". *Cochrane Database System Review* 8.3 (2009): CD003908.

32. Sawyer RJ. "Peripheral Nerve injuries associated with anaesthesia". *Anaesthesia* 55.10 (2000): 980-991.

33. Seidel JA., *et al.* "Surgical treatment of traumatic peroneal nerve lesions". *Neurosurgery* 62.3 (2008): 664-673.

34. Sheffler LR., *et al.* "Peroneal nerve stimulation versus an ankle foot orthosis for correction of footdrop in stroke: impact on functional ambulation". *Neurorehabil Neural Repair* 20.3 (2006):355-360.

35. Simpson DM., *et al.* "Therapeutics and technology assessment subcommittee of the American Academy of Neurology. Assessment: botulinum neurotoxin for the treatment of spasticity (an evidence-based review): report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology". *Neurology* 70.19 (2008): 1691-1698.

36. Steinau HU., *et al.* "Tendon transfers for drop foot correction: Long-term results including quality of life assessment, and dynamometric and pedobarographic measurements". *Archives of Orthopaedic and Trauma Surgery* 131.7 (2011): 903-910.

37. Stewart JD. "Foot drop: Where, why and what to do?". *Practical Neurology* 8 (2008):158-169.

38. van Swigchem R., *et al.* "Is transcutaneous peroneal stimulation beneficial to patients with chronic stroke using an ankle-foot orthosis? A within-subjects study of patients' satisfaction, walking speed and physical activity level". *Journal of Rehabilitation Medicine* 42.2 (2010):117-121.

39. Wade D., *et al.* "Walking after stroke; Measurement and recovery over the first 3 months". *Scandinavian Journal of Rehabilitation Medicine* 19.1 (1987): 25-30.

40. Westhout FD., *et al.* "Central Causes of Foot Drop: Rare and Underappreciated Differential Diagnoses". *The Journal of Spinal Cord Medicine* 30.1 (2007): 62-66.

41. Wilkenfeld AJ., *et al.* "Feasibility of functional electrical stimulation for control of seated posture after spinal cord injury: A simulation study". *The Journal of Rehabilitation Research and Development* 43.2 (2006):139-152.

42. Wilkenfeld AJL. "Review of electrical stimulation, botulinum toxin, and their combination for spastic drop foot". *Journal of Rehabilitation Research and Development* 50.3 (2013): 315-326.

43. Witzel II., *et al.* "Identifying Common Genetic Risk Factors of Diabetic Neuropathies". *Front Endocrinol (Lausanne)* 28.6 (2015): 88.

44. www.ahrq.gov/research

45. www.who.int/en/

46. South Norfolk CCG Report (2014).

47. South Norfolk CCG Report (2014).

48. www.stroke.org

Volume 2 Issue 10 October 2019