



Medical Policy

Functional Neuromuscular Electrical Stimulation

Table of Contents

- [Policy: Commercial](#)
- [Policy: Medicare](#)
- [Authorization Information](#)
- [Description](#)
- [Policy History](#)
- [Information Pertaining to All Policies](#)
- [References](#)
- [Coding Information](#)

Policy Number: 201

BCBSA Reference Number: 8.03.01 (For Plans internal use only)

Related Policies

- Microprocessor Controlled Prostheses for the Lower Limb, #[133](#)
- Myoelectric Prosthetic Components for the Upper Limb, #[227](#)
- Powered Exoskeleton for Ambulation in Patients with Lower-Limb Disabilities, #[718](#)

Policy

Commercial Members: Managed Care (HMO and POS), PPO, and Indemnity

Neuromuscular stimulation is **INVESTIGATIONAL** as a technique to restore function following nerve damage or nerve injury. This includes its use in the following situations:

- To provide upper extremity function in patients with nerve damage (eg, spinal cord injury or post-stroke), or
- To improve ambulation in patients with foot drop caused by congenital disorders (eg, cerebral palsy) or nerve damage (eg, post-stroke, or in those with multiple sclerosis), or
- As a technique to provide ambulation in patients with spinal cord injury.

Functional electrical stimulation devices for exercise in patients with spinal cord injury is considered **INVESTIGATIONAL**.

Prior Authorization Information

Inpatient

- For services described in this policy, precertification/preauthorization **IS REQUIRED** for all products if the procedure is performed **inpatient**.

Outpatient

- For services described in this policy, see below for products where prior authorization **might be required** if the procedure is performed **outpatient**.

	Outpatient
Commercial Managed Care (HMO and POS)	This is not a covered service.
Commercial PPO and Indemnity	This is not a covered service.

CPT Codes / HCPCS Codes / ICD Codes

Inclusion or exclusion of a code does not constitute or imply member coverage or provider reimbursement. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage as it applies to an individual member.

Providers should report all services using the most up-to-date industry-standard procedure, revenue, and diagnosis codes, including modifiers where applicable.

The following codes are included below for informational purposes only; this is not an all-inclusive list

The following HCPCS codes are considered investigational for Commercial Members: Managed Care (HMO and POS), PPO, and Indemnity:

HCPCS Codes

HCPCS codes:	Code Description
E0764	Functional neuromuscular stimulation, transcutaneous stimulation of sequential muscle groups of ambulation with computer control, used for walking by spinal cord injured, entire system, after completion of training program
E0770	Functional electrical stimulator, transcutaneous stimulation of nerve and/or muscle groups, any type, complete system, not otherwise specified

Description

Functional Electrical Stimulation

Functional electrical stimulation (FES) is an approach to rehabilitation that applies low-level electrical current to stimulate functional movements in muscles affected by nerve damage. It focuses on the restoration of useful movements, like standing, stepping, pedaling for exercise, reaching, or grasping.

FES devices consist of an orthotic and a microprocessor-based electronic stimulator with 1 or more channels for delivery of individual pulses through surface or implanted electrodes connected to the neuromuscular system. Microprocessor programs activate the channels sequentially or in unison to stimulate peripheral nerves and trigger muscle contractions to produce functionally useful movements that allow patients to sit, stand, walk, cycle, or grasp. Functional neuromuscular stimulators are closed-loop systems that provide feedback information on muscle force and joint position, thus allowing constant modification of stimulation parameters, which are required for complex activities (eg, walking). These systems are contrasted with open-loop systems, which are used for simple tasks (eg, muscle strengthening alone); healthy individuals with intact neural control benefit the most from this technology.

Applications, described in more detail in the Rationale section, include upper-extremity grasping function after spinal cord injury and stroke, lifting the front of the foot during ambulation in individuals with foot drop, ambulation, and exercise for patients with spinal cord injury. Some devices are used primarily for rehabilitation rather than home use. This evidence review focuses on devices intended for home use.

Summary

Functional electrical stimulation (FES) involves the use of an orthotic device or exercise equipment with microprocessor-controlled electrical muscular stimulation. These devices are being developed to restore function and improve health in patients with damaged or destroyed nerve pathways (eg, spinal cord injury [SCI], stroke, multiple sclerosis, cerebral palsy).

For individuals who have loss of hand and upper-extremity function due to SCI or stroke who receive FES, the evidence includes a few small case series. Relevant outcomes are functional outcomes and quality of life. Interpretation of the evidence is limited by the low number of patients studied and lack of data demonstrating the utility of FES outside the investigational setting. It is uncertain whether FES can

restore some upper-extremity function or improve the quality of life. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have chronic foot drop who receive FES, the evidence includes randomized controlled trials (RCTs), meta-analyses, and a longitudinal cohort study. Relevant outcomes are functional outcomes and quality of life. For chronic poststroke foot drop, 2 RCTs comparing FES with a standard ankle-foot orthosis (AFO) showed improved patient satisfaction with FES but no significant differences between groups in objective measures such as walking. Another RCT found no significant differences between use versus no use of FES on walking outcomes. Similarly, one meta-analysis found no difference between AFO and FES in walking speed, and another meta-analysis found no difference between FES and conventional treatments. The cohort study assessed patients' ability to avoid obstacles while walking on a treadmill using FES versus AFO. Although the FES group averaged a 4.7% higher rate of avoidance, the individual results between devices ranged widely. One RCT with 53 subjects examining neuromuscular stimulation for foot drop in patients with multiple sclerosis showed a reduction in falls and improved patient satisfaction compared with an exercise program but did not demonstrate a clinically significant benefit in walking speed. Another RCT showed that at 12 months, both FES and AFO had improved walking speed, but the difference in improvement between the 2 devices was not significant. Another study found FES (combined with postural correction) and neuroproprioceptive facilitation and inhibition physiotherapy did not differ in walking speed or balance immediately or 2 months after program end. A reduction in falls is an important health outcome. However, it was not a primary study outcome and should be corroborated. The literature on FES in children with cerebral palsy includes a systematic review of small studies with within-subject designs. Further study is needed. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have SCI at segments T4 to T12 who receive FES, the evidence includes case series. Relevant outcomes are functional outcomes and quality of life. No controlled trials were identified on FES for standing and walking in patients with SCI. However, case series are considered adequate for this condition because there is no chance for unaided ambulation in this population with SCI at this level. Some studies have reported improvements in intermediate outcomes, but improvements in health outcomes (eg, ability to perform activities of daily living [ADL], quality of life) have not been demonstrated. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have SCI who receive FES exercise equipment, the evidence includes prospective comparisons. Relevant outcomes are symptoms, functional outcomes, and quality of life. The evidence on FES exercise equipment consists primarily of within-subject, pretreatment to posttreatment comparisons. Evidence was identified on 2 commercially available FES cycle ergometer models for the home, the RT300 series and the REGYS/ERGYS series. There is limited evidence on the RT300 series. None of the within-subject studies showed an improvement in health benefits; however, improvement in body fat was found in a small group of patients when FES high intensity interval cycling was added to nutrition counseling compared to nutritional counseling alone. One analysis of use for 314 individuals over 20,000 activity sessions with a Restorative Therapies device showed that a majority of users used the device for 34 minutes per week. Two percent of individuals with SCI used the device for an average of 6 days per week, but caloric expenditure remained low. Compliance was shown in 1 study to be affected by the age of participants and level of activity prior to the study. Studies on the REGYS/ERGYS series have more uniformly shown an improvement in physiologic measures of health and in sensory and motor function; however, a small comparative study found arm cycling to improve exercise energy expenditure and cardiorespiratory fitness to a greater extent than FES leg cycling. A limitation of these studies is that they all appear to have been conducted in supervised research centers. No studies were identified on long-term home use of ERGYS cycle ergometers. The feasibility and long-term health benefits of using this device in the home is uncertain. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

Policy History

Date	Action
4/2022	Annual policy review. Description, summary, and references updated. Policy statements unchanged.
4/2021	Annual policy review. Description, summary, and references updated. Policy statements unchanged.
1/2021	Medicare information removed. See MP #132 Medicare Advantage Management for local coverage determination and national coverage determination reference.
7/2020	Annual policy review. Description, summary, and references updated. Policy statements unchanged.
10/2019	Annual policy review. New investigational indications described. Functional electrical stimulation devices for exercise in patients with spinal cord injury. Clarified coding information. Effective 10/1/2019.
9/2017	New references added from Annual policy review.
10/2016	Annual policy review. New references added
3/2015	Annual policy review. New references added
5/2014	Updated Coding section with ICD10 procedure and diagnosis codes, effective 10/2015.
5/2014	Annual policy review. New references added.
8/2013	Annual policy review. New investigational indications described. Effective 8/1/2013.
11/2011-4/2012	Medical policy ICD 10 remediation: Formatting, editing and coding updates. No changes to policy statements.
6/2011	Reviewed - Medical Policy Group – Orthopedics, Rehabilitation and Rheumatology. No changes to policy statement.
1/2011	Reviewed - Medical Policy Group – Neurology and Neurosurgery. No changes to policy statements.
7/2010	Reviewed - Medical Policy Group – Orthopedics, Rehabilitation and Rheumatology. No changes to policy statements.
7/1/2010	Medical Policy 201 effective 7/1/10 describing ongoing coverage and non-coverage.

Information Pertaining to All Blue Cross Blue Shield Medical Policies

Click on any of the following terms to access the relevant information:

[Medical Policy Terms of Use](#)

[Managed Care Guidelines](#)

[Indemnity/PPO Guidelines](#)

[Clinical Exception Process](#)

[Medical Technology Assessment Guidelines](#)

References

- Centers for Medicare & Medicaid Services. Decision Memo for Neuromuscular Electrical Stimulation (NMES) for Spinal Cord Injury (CAG-00153R). 2002; <https://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=55>. Accessed January 19, 2022.
- Mulcahey MJ, Betz RR, Kozin SH, et al. Implantation of the Freehand System during initial rehabilitation using minimally invasive techniques. *Spinal Cord*. Mar 2004; 42(3): 146-55. PMID 15001979
- Mulcahey MJ, Betz RR, Smith BT, et al. Implanted functional electrical stimulation hand system in adolescents with spinal injuries: an evaluation. *Arch Phys Med Rehabil*. Jun 1997; 78(6): 597-607. PMID 9196467
- Taylor P, Esnouf J, Hobby J. The functional impact of the Freehand System on tetraplegic hand function. *Clinical Results*. *Spinal Cord*. Nov 2002; 40(11): 560-6. PMID 12411963
- Venugopalan L, Taylor PN, Cobb JE, et al. Upper limb functional electrical stimulation devices and their man-machine interfaces. *J Med Eng Technol*. 2015; 39(8): 471-9. PMID 26508077
- Alon G, McBride K. Persons with C5 or C6 tetraplegia achieve selected functional gains using a neuroprosthesis. *Arch Phys Med Rehabil*. Jan 2003; 84(1): 119-24. PMID 12589632

7. Alon G, McBride K, Ring H. Improving selected hand functions using a noninvasive neuroprosthesis in persons with chronic stroke. *J Stroke Cerebrovasc Dis.* Mar-Apr 2002; 11(2): 99-106. PMID 17903863
8. Snoek GJ, IJzerman MJ, in 't Groen FA, et al. Use of the NESS handmaster to restore handfunction in tetraplegia: clinical experiences in ten patients. *Spinal Cord.* Apr 2000; 38(4): 244-9. PMID 10822395
9. Jaqueline da Cunha M, Rech KD, Salazar AP, et al. Functional electrical stimulation of the peroneal nerve improves post-stroke gait speed when combined with physiotherapy. A systematic review and meta-analysis. *Ann Phys Rehabil Med.* Jan 2021; 64(1): 101388. PMID 32376404
10. Nascimento LR, da Silva LA, Araujo Barcellos JVM, et al. Ankle-foot orthoses and continuous functional electrical stimulation improve walking speed after stroke: a systematic review and meta-analyses of randomized controlled trials. *Physiotherapy.* Dec 2020; 109: 43-53. PMID 33120054
11. Hachisuka K, Ochi M, Kikuchi T, et al. Clinical effectiveness of peroneal nerve functional electrical stimulation in chronic stroke patients with hemiplegia (PLEASURE): A multicentre, prospective, randomised controlled trial. *Clin Rehabil.* Mar 2021; 35(3): 367-377. PMID 33103916
12. Bethoux F, Rogers HL, Nolan KJ, et al. The effects of peroneal nerve functional electrical stimulation versus ankle-foot orthosis in patients with chronic stroke: a randomized controlled trial. *Neurorehabil Neural Repair.* Sep 2014; 28(7): 688-97. PMID 24526708
13. Kluding PM, Dunning K, O'Dell MW, et al. Foot drop stimulation versus ankle foot orthosis after stroke: 30-week outcomes. *Stroke.* Jun 2013; 44(6): 1660-9. PMID 23640829
14. O'Dell MW, Dunning K, Kluding P, et al. Response and prediction of improvement in gait speed from functional electrical stimulation in persons with poststroke drop foot. *PM R.* Jul 2014; 6(7): 587-601; quiz 601. PMID 24412265
15. Berenpas F, Geurts AC, den Boer J, et al. Surplus value of implanted peroneal functional electrical stimulation over ankle-foot orthosis for gait adaptability in people with foot drop after stroke. *Gait Posture.* Jun 2019; 71: 157-162. PMID 31071538
16. Prokopiusova T, Pavlikova M, Markova M, et al. Randomized comparison of functional electric stimulation in posturally corrected position and motor program activating therapy: treating foot drop in people with multiple sclerosis. *Eur J Phys Rehabil Med.* Aug 2020; 56(4): 394-402. PMID 32383574
17. Renfrew LM, Paul L, McFadyen A, et al. The clinical- and cost-effectiveness of functional electrical stimulation and ankle-foot orthoses for foot drop in Multiple Sclerosis: a multicentre randomized trial. *Clin Rehabil.* Jul 2019; 33(7): 1150-1162. PMID 30974955
18. Barrett CL, Mann GE, Taylor PN, et al. A randomized trial to investigate the effects of functional electrical stimulation and therapeutic exercise on walking performance for people with multiple sclerosis. *Mult Scler.* Apr 2009; 15(4): 493-504. PMID 19282417
19. Esnouf JE, Taylor PN, Mann GE, et al. Impact on activities of daily living using a functional electrical stimulation device to improve dropped foot in people with multiple sclerosis, measured by the Canadian Occupational Performance Measure. *Mult Scler.* Sep 2010; 16(9): 1141-7. PMID 20601398
20. Cauraugh JH, Naik SK, Hsu WH, et al. Children with cerebral palsy: a systematic review and meta-analysis on gait and electrical stimulation. *Clin Rehabil.* Nov 2010; 24(11): 963-78. PMID 20685722
21. Chaplin E. Functional neuromuscular stimulation for mobility in people with spinal cord injuries. The Parastep I System. *J Spinal Cord Med.* Apr 1996; 19(2): 99-105. PMID 8732878
22. Klose KJ, Jacobs PL, Broton JG, et al. Evaluation of a training program for persons with SCI paraplegia using the Parastep 1 ambulation system: part 1. Ambulation performance and anthropometric measures. *Arch Phys Med Rehabil.* Aug 1997; 78(8): 789-93. PMID 9344294
23. Jacobs PL, Nash MS, Klose KJ, et al. Evaluation of a training program for persons with SCI paraplegia using the Parastep 1 ambulation system: part 2. Effects on physiological responses to peak arm ergometry. *Arch Phys Med Rehabil.* Aug 1997; 78(8): 794-8. PMID 9344295
24. Needham-Shropshire BM, Broton JG, Klose KJ, et al. Evaluation of a training program for persons with SCI paraplegia using the Parastep 1 ambulation system: part 3. Lack of effect on bone mineral density. *Arch Phys Med Rehabil.* Aug 1997; 78(8): 799-803. PMID 9344296
25. Guest RS, Klose KJ, Needham-Shropshire BM, et al. Evaluation of a training program for persons with SCI paraplegia using the Parastep 1 ambulation system: part 4. Effect on physical self-concept and depression. *Arch Phys Med Rehabil.* Aug 1997; 78(8): 804-7. PMID 9344297
26. Nash MS, Jacobs PL, Montalvo BM, et al. Evaluation of a training program for persons with SCI paraplegia using the Parastep 1 ambulation system: part 5. Lower extremity blood flow and

- hyperemic responses to occlusion are augmented by ambulation training. *Arch Phys Med Rehabil.* Aug 1997; 78(8): 808-14. PMID 9344298
27. Graupe D, Kohn KH. Functional neuromuscular stimulator for short-distance ambulation by certain thoracic-level spinal-cord-injured paraplegics. *Surg Neurol.* Sep 1998; 50(3): 202-7. PMID 9736079
 28. Brissot R, Gallien P, Le Bot MP, et al. Clinical experience with functional electrical stimulation-assisted gait with Parastep in spinal cord-injured patients. *Spine (Phila Pa 1976).* Feb 15 2000; 25(4): 501-8. PMID 10707398
 29. Sykes L, Ross ER, Powell ES, et al. Objective measurement of use of the reciprocating gait orthosis (RGO) and the electrically augmented RGO in adult patients with spinal cord lesions. *Prosthet Orthot Int.* Dec 1996; 20(3): 182-90. PMID 8985998
 30. Davis JA, Triolo RJ, Uhler J, et al. Preliminary performance of a surgically implanted neuroprosthesis for standing and transfers--where do we stand?. *J Rehabil Res Dev.* Nov-Dec 2001; 38(6): 609-17. PMID 11767968
 31. Rohde LM, Bonder BR, Triolo RJ. Exploratory study of perceived quality of life with implanted standing neuroprostheses. *J Rehabil Res Dev.* 2012; 49(2): 265-78. PMID 22773528
 32. Triolo RJ, Bailey SN, Miller ME, et al. Longitudinal performance of a surgically implanted neuroprosthesis for lower-extremity exercise, standing, and transfers after spinal cord injury. *Arch Phys Med Rehabil.* May 2012; 93(5): 896-904. PMID 22541312
 33. U.S. Department of Health and Human Services Office of Disease Prevention and Health Promotion. Physical activity guidelines, second edition. <https://health.gov/paguidelines/second-edition/>. Accessed January 19, 2022.
 34. Hunt KJ, Fang J, Saengsuwan J, et al. On the efficiency of FES cycling: a framework and systematic review. *Technol Health Care.* 2012; 20(5): 395-422. PMID 23079945
 35. Ralston KE, Harvey L, Batty J, et al. Functional electrical stimulation cycling has no clear effect on urine output, lower limb swelling, and spasticity in people with spinal cord injury: a randomised cross-over trial. *J Physiother.* Dec 2013; 59(4): 237-43. PMID 24287217
 36. Dolbow DR, Gorgey AS, Ketchum JM, et al. Home-based functional electrical stimulation cycling enhances quality of life in individuals with spinal cord injury. *Top Spinal Cord Inj Rehabil.* 2013; 19(4): 324-9. PMID 24244097
 37. Dolbow DR, Gorgey AS, Ketchum JM, et al. Exercise adherence during home-based functional electrical stimulation cycling by individuals with spinal cord injury. *Am J Phys Med Rehabil.* Nov 2012; 91(11): 922-30. PMID 23085704
 38. Johnston TE, Smith BT, Mulcahey MJ, et al. A randomized controlled trial on the effects of cycling with and without electrical stimulation on cardiorespiratory and vascular health in children with spinal cord injury. *Arch Phys Med Rehabil.* Aug 2009; 90(8): 1379-88. PMID 19651272
 39. Dolbow DR, Credeur DP, Lemacks JL, et al. Electrically induced cycling and nutritional counseling for counteracting obesity after spinal cord injury: A pilot study. *J Spinal Cord Med.* Jul 2021; 44(4): 533-540. PMID 31971487
 40. Sadowsky CL, Hammond ER, Strohl AB, et al. Lower extremity functional electrical stimulation cycling promotes physical and functional recovery in chronic spinal cord injury. *J Spinal Cord Med.* Nov 2013; 36(6): 623-31. PMID 24094120
 41. Griffin L, Decker MJ, Hwang JY, et al. Functional electrical stimulation cycling improves body composition, metabolic and neural factors in persons with spinal cord injury. *J Electromyogr Kinesiol.* Aug 2009; 19(4): 614-22. PMID 18440241
 42. Farkas GJ, Gorgey AS, Dolbow DR, et al. Energy Expenditure, Cardiorespiratory Fitness, and Body Composition Following Arm Cycling or Functional Electrical Stimulation Exercises in Spinal Cord Injury: A 16-Week Randomized Controlled Trial. *Top Spinal Cord Inj Rehabil.* 2021; 27(1): 121-134. PMID 33814890
 43. Kressler J, Ghersin H, Nash MS. Use of functional electrical stimulation cycle ergometers by individuals with spinal cord injury. *Top Spinal Cord Inj Rehabil.* 2014; 20(2): 123-6. PMID 25477734
 44. National Institute for Health and Care Excellence (NICE). Functional electrical stimulation for drop foot of central neurological origin [IPG278]. 2009; <http://www.nice.org.uk/nicemedia/pdf/IPG278Guidance.pdf>. Accessed January 19, 2022.
 45. Centers for Medicare & Medicaid Services. National Coverage Determination (NCD) for Neuromuscular Electrical Stimulator (NMES) (160.12). 2006; <https://www.cms.gov/medicare-coverage-database/details/ncd->

details.aspx?NCID=175&ncdver=2&DocID=160.12&SearchType=Advanced&bc=IAAABAAAA&. Accessed January 19, 2022.