International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163
Issue 03, Volume 6 (March 2019) - Special Issue www.ijirae.com

DELAYING ONSET OF PARALYSIS AND TREATING DROP FOOT USING EMG

S.S.Monisha
Guided by
Muhammadu Sathik Raja M.S , HOD
M.E.-Medical Electronics, Sengunthar College of Engineering ,Tiruchengode.
scewsadik, monishassundaram{@gmail.com}

Manuscript History
Number: **IJIRAE/RS/Vol.06/Issue03/Special Issue/SI.MRAE10080**
Received: 20, February 2019
Final Correction: 05, March 2019
Final Accepted: 20, March 2019
Published: **March 2019**
Editor: Dr.A.Arul L.S, Chief Editor, IJIRAE, AM Publications, India

Abstract—The paper aims to help people affected by drop foot syndrome to walk efficiently without dragging their foot. This paper also suggests a method to keep the nervous system active, till professional medical help is administered, when a person is about to be attacked by paralysis.

Keywords—Stroke; drop-foot; paralysis;

I. INTRODUCTION

Problems in walking in humans have been investigated at least as early as in ancient Greece by Aristotle (384-322 BC). Interlimb coordination, particularly the maintenance of stability under environmental perturbations, is a problem. Coordination of limbs during locomotion is closely linked to rhythmic activity of circuits that control different muscles. On the other hand, it has been proven that sensory feedback not only assists the transition between the gait phases, but it also affects corrective responses to external perturbations. Indeed, interaction of sensory inputs with those circuits activity can determine the coordinated pattern of agonist and antagonist muscles. This sensory activity contributes to motor control. It might carry "error signals" following sudden external perturbations, and it may contribute to the pre-programmed motoneuronal activity such as the Hoffman reflex (H reflex) and cutaneous and stretch reflex responses. Various platforms have been used to investigate reflex mechanisms during different phases of the drop-foot with the majority of the experimental protocols focusing on overground walking and dropping the supportive surfaces at distinct gait phases . During posture maintenance, experiments with powerful unilateral displacement of one leg produced bilateral responses both in adults and in healthy human infants.

II. PARALYSIS

Paralysis is a condition of loss of muscle function in any part of our body. It can be localized or generalized, partial or complete, and temporary or permanent. Paralysis can affect any part of the body at any time. Generally no sensory organs functions in the affected area.

A. Causes

Paralysis is caused by stroke, spinal cord injury, cerebral palsy or multiple sclerosis. Stroke is a condition where blood clot or ruptured artery or blood vessel interrupts blood flow to an area in the brain.

B. Symptoms

1. Changes in level of consciousness.
2. Confusion.
3. Dzziness.
4. Loss of coordination.

5. Seizure.
6. Changes in vision.
7. Weakness in arms or legs on one side of your body.

III. DROP -FOOT

Drop-foot also known as foot-drop is the inability to lift the front part of the foot. These causes the toes to be dragged along the ground while walking. To avoid dragging the toes, people with foot-drop may lift their knee higher than the normal height. Foot-drop can happen to one foot or both feet at the same time. It can strike at any age. In general, foot-drop stems from weakness or paralysis of the muscles that lift the foot.

A. Causes

Causes of foot drop include: nerve injury, brain or spinal disorders, muscle disorders.
Neurological problems can contribute to foot drop. These include:

1. stroke
2. multiple sclerosis (MS)
3. cerebral palsy

B. Effects

Foot drop may occur without any symptoms of foot pain or leg pain. It may occur with pain and/or neurological symptoms such as tingling or burning. Foot drop may be accompanied by a loss of balance or lack of balance, making it difficult to walk without assistance. Foot drop may occur in only one or in both feet (bilateral).Key indicators of foot drop include a high stoppage gait and/or difficulty walking on the heels; Dragging of the foot and toes.

1. Scraping of the toes across the ground
2. Uncontrolled slapping of the toes against the ground

C .Treatment

Treatment for foot drop will depend on the cause. Early treatment may improve chances of recovery. Existing treatments may include:

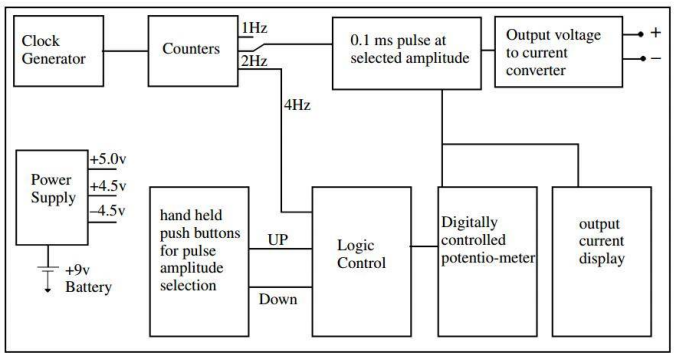
1. lightweight braces
2. shoe inserts (orthotics)
3. physical therapy/massage
4. surgery(Surgery may be recommended to try to repair or decompress a damaged nerve)

IV. NERVE STIMULATION

Electrical nerve stimulation is a procedure that uses an electrical current to treat chronic pain or to activate a nerve manually. Peripheral nerve stimulation (PNS) and spinal cord stimulation (SCS) are two types of electrical nerve stimulation. A small pulse generator sends electrical pulses to the nerves (in peripheral nerve stimulation) or to the spinal cord (in spinal cord stimulation). These pulses interfere with the nerve impulses that make you feel pain. In the other case, generates an electrical signal or activates a nerve. Functional electrical stimulation (FES) is a method that uses low energy electrical pulses to generate body movements in individuals who have been paralyzed due to injury to the central nervous system

A. Biological Aspect

Neurons are electrically active cells. In neurons, information is coded and transmitted as a series of electrical impulses called action potentials, which represent a brief change in cell electric potential. Nerve signals are frequency modulated: the number of action potentials that occur in a unit of time is proportional to the intensity of the transmitted signal. An electrical stimulation can artificially bring this action potential by altering the electric potential across a nerve cell membrane (also includes the axon of the nerve) by inducing electrical charge in the immediate vicinity of the outer membrane of the cell.



Electrical stimulation takes advantage of this property to electrically activate nerve cells, which then may go to activate muscles or to other nerves. The nerves are stimulated to generate localized activity of muscles, i.e., the stimulation is aimed at generating direct muscle contraction.

B. Surface Electrode

The surface electrodes are placed, generally using gel ,on the skin surface above the nerve or muscle that needs to be activated. They are noninvasive, easy to apply, and generally inexpensive.

IV. EXISTING SYSTEM

There is currently no cure for Paralysis. Also there is no existing system to delay the onset of paralysis. Doctors have aimed at helping people adapt to paralysis by making them as independent as possible.

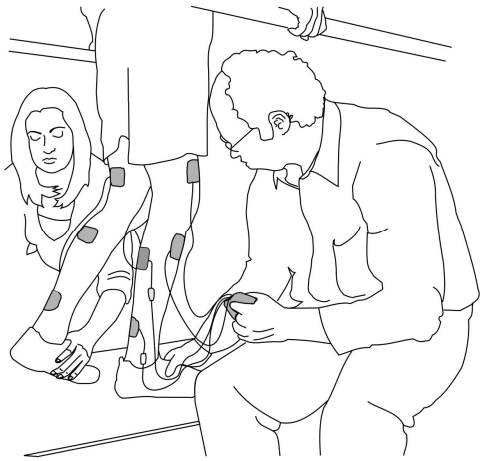
1. Mirror therapy
2. Mental practice
3. Oxygen therapy
4. Magnetic brain stimulation
5. Acupuncture
6. Affirmations

Physiotherapy needs to be administered to the patient regularly. It gives desired result only after a long time.
Ankle-Foot orthotics, a plastic strap is used. It just reduces the effect of drop foot and does not eliminate completely.

V. PROPOSED SOLUTION

A. For Drop Foot

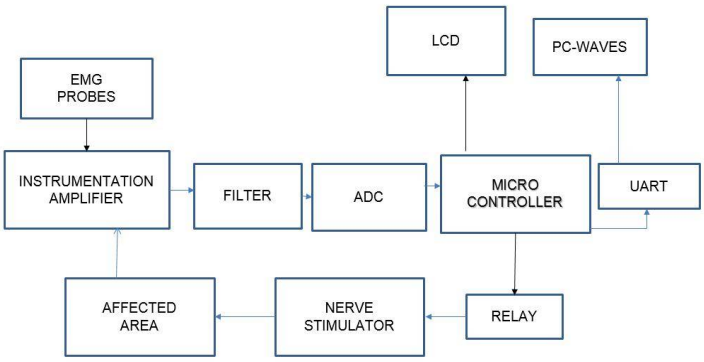
When a person tries to lift his foot, the EMG signals are measured using an EMG probe. When the signals are above a particular set threshold value, electrical pulses are generated. The magnitude of the electrical shock is set manually using the keypad in the board. The shock is administered to the calf muscles using probes. This shock contracts the muscles and helps in lifting the leg easily without dragging. It is hypothesized that regular use of this technique may help in doing away with this method completely.



B. Delaying the onset of paralysis

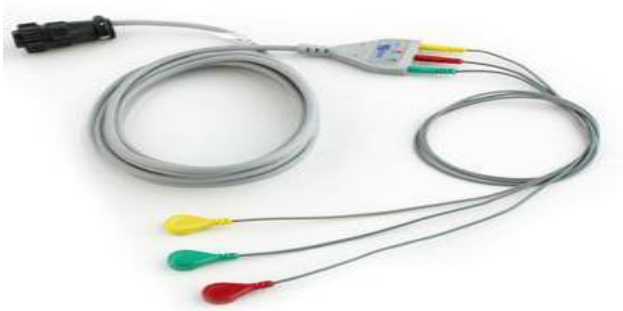
When a person is about to be seized completely by paralysis, the probes catch the hint of paralysis attack from the changes of values of EMG signals. When the probablity of paralytic attack in near future, is sensed, electrical pulses are given to the affected area(limbs). This can be administered by the patient himself. The shock keeps the nervous system active for a longer time. This helps the patient to move around easily till professional medical help can be given, or till reaching the hospital.

VI. BLOCK DIAGRAM



A. EMG Probes:

These are used to pick up EMG signals from the affected area.
Surface electrodes are preferred.



B. Instrumentation Amplifier

This is used to amplify the weak signals of EMG, which is in the order of volts ranging from (0.7 to 5) V.

C. Microcontroller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set.

D. Filter

A band pass filter is used to pass only the signals in the preferred range. Range varies when it is used for drop foot application and when it is used for nerve stimulation before complete paralysis attack.

E.ADC

Analog to Digital converter to convert the analog values of EMG signals and send it to the controller,to in turn display in LCD and PC.

F. Relay

Relay, an electromagnetic switch helps to operate nerve stimulator automatically without human intervention.

G. Stimulator

Nerve stimulator gives electrical pulses in the order of the magnitude set in the keypad using PWM (Pulse Width Modulation) techniques. The first key is set to 0.7 volt. The subsequent keys are increased by 1.5 volts.

H.LCD

To view the EMG values in the LCD screen. It also displays the key selected (out of the 5 keys) in the keypad.

I.PC

To view the waveform of the EMG using the software-Electrocardiography Analysis Module.

J.UART

To send the values of EMG serially to the PC.

VII. REFERENCE

1. http://sci-hub.cc/http://ieeexplore.ieee.org/document/7483378/
2. https://en.wikipedia.org/wiki/Extreme_learning_machine
3. http://www.biometricsltd.com/semg.htm
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1455479/
5. http://www.neurosignsurgical.com/kartush-blog/the-role-of-the-stimulating-probe-in-emg-monitoring
6. http://www.electroschematics.com/5758/electronic-nerve-stimulator/
7. http://www.nhs.uk/Conditions/paralysis/Pages/Treatment.aspx
8. https://en.wikipedia.org/wiki/Functional_electricalstimulation
9. http://www.webmd.com/back-pain/spinal-cord-stimulation-for-low-back-pain
10. R.S.Khandpur, Handbook of Biomedical Instrumentation

