



كلية المستقبل الجامعة
قسم الفيزياء الطبية
المرحلة الثالثة

Medical Physics

Lecture 5

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Electromyogram (EMG) :

Electromyography (EMG) measures muscle response or electrical activity in response to a nerve's stimulation of the muscle. The test is used to help detect neuromuscular abnormalities . An audio-amplifier is used so the activity can be heard. EMG measures the electrical activity of muscle during rest, slight contraction and forceful contraction.



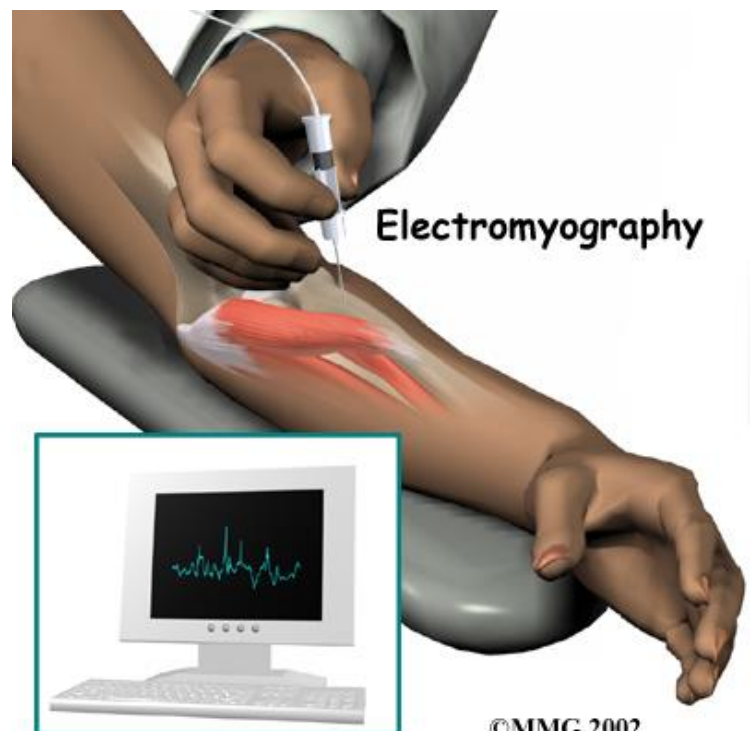
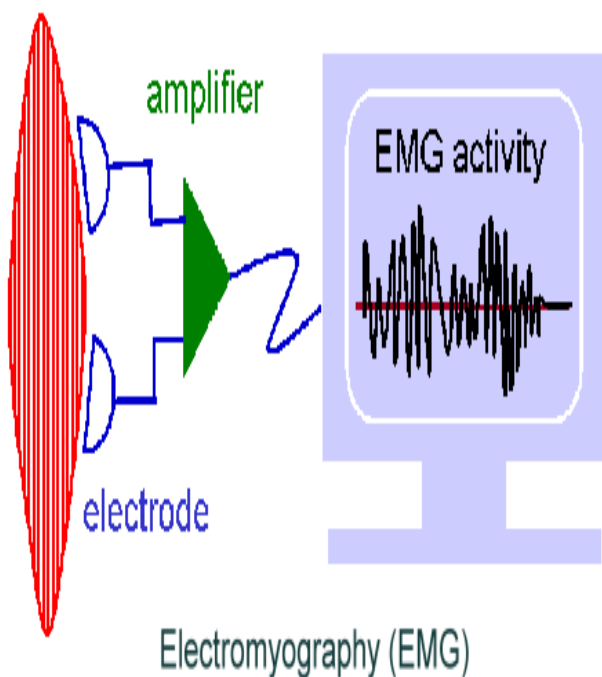
Muscle tissue does not normally produce electrical signals during rest. When an electrode is inserted, a brief period of activity can be seen on the oscilloscope, but after that, no signal should be present .

Test Requirements of EMG :

- 1- Generally, fasting is not required before the test. In some cases, cigarettes and caffeinated beverages, such as coffee, tea, and cola may be restricted two to three hours before testing .
- 2- Notify A doctor of all medications (prescribed and over-the-counter) and herbal supplements that you are taking .
- 3- Notify A doctor if you have a pacemaker .

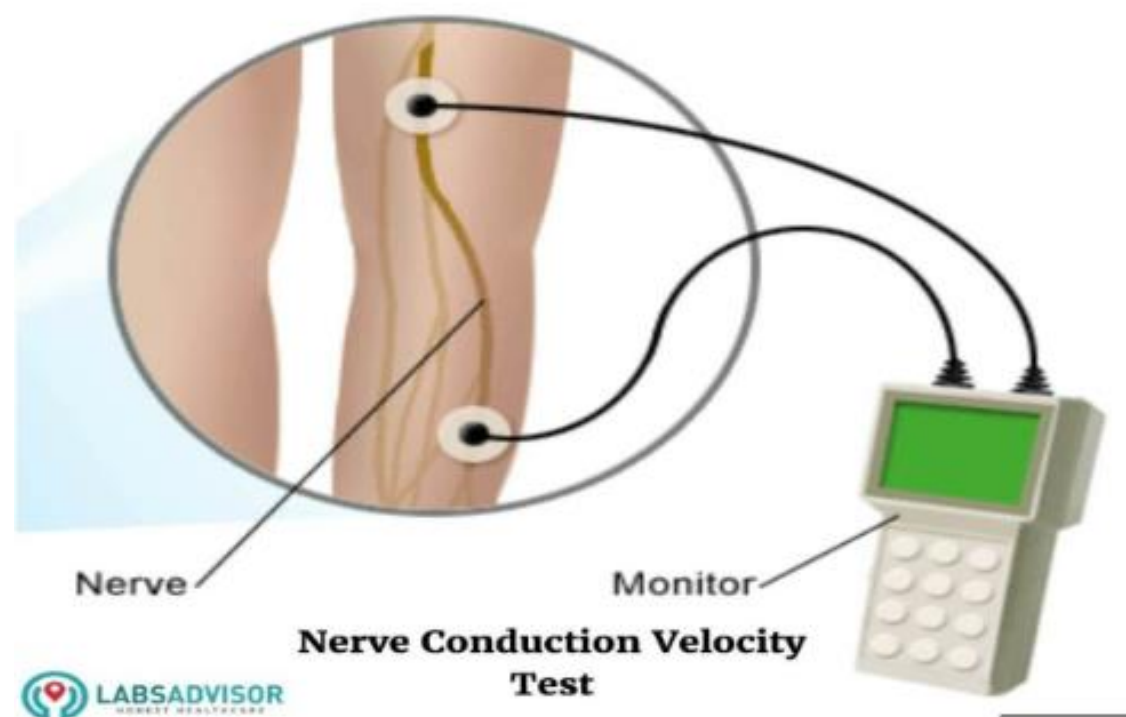
Mechanism of EMG :

- 1- You will be asked to remove any jewelry, hairpins, eyeglasses, hearing aids, or other metal objects that may interfere with the procedure .
- 2- The skin will be cleansed with an antiseptic solution. Next, a fine, sterile needle will be inserted into the muscle. A ground electrode will be positioned under arm or leg .
- 3- Five or more needle insertions may be necessary for the test. May be experience slight pain with the insertion of the electrode .
- 4- If the test is painful must tell examiner because this can interfere with the results .
- 5- The electrical activity from your working muscle will be measured and displayed on the oscilloscope .
- 6- An audio amplifier may also be used so that both the appearance and sound of the electrical potentials can be evaluated.



Nerve Conduction Study (NCS) :

NCS is a measurement of the amount and speed of conduction of an electrical impulse through a nerve. NCS can determine nerve damage and destruction, and is often performed at the same time as EMG. Both procedures help to detect the presence, location, and extent of diseases that damage the nerves and muscles . sometimes referred to as nerve conduction velocity (NCV) .



- **An EMG test:** looks at the electrical signals your muscles make when they are at rest and when they are being used
- **A nerve conduction study:** measures how fast and how well the body's electrical signals travel down nerves .

Risks : may be feel a little pain or cramping during an EMG test, may have a tingly feeling, like a mild electric shock, during a nerve conduction study.

When is EMG test done :

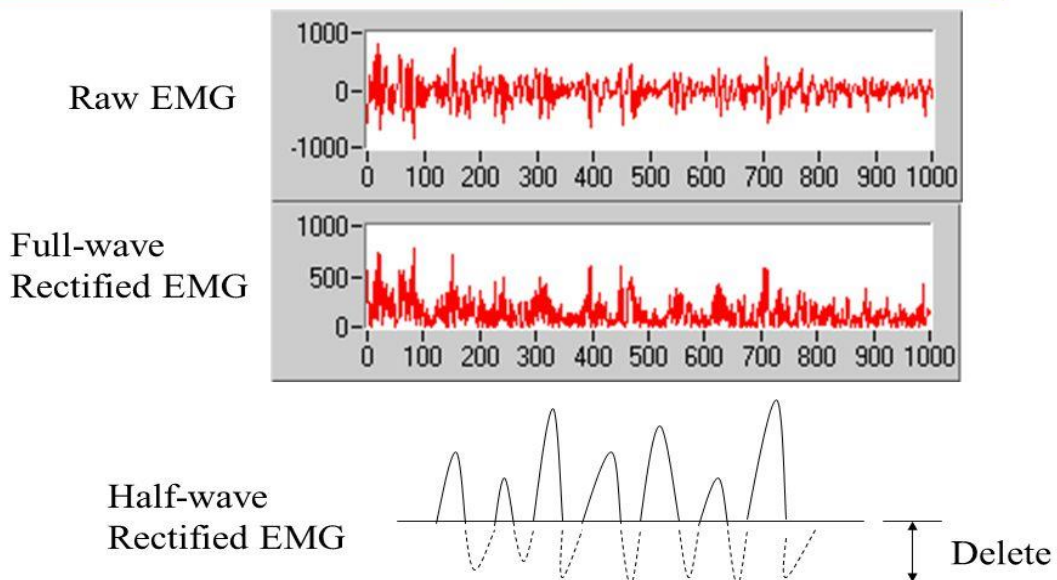
- 1- Muscle weakness .
- 2- Tingling or numbness in arms, legs, hands, feet, and face .
- 3- Muscle cramps, spasms, and twitching .
- 4- Paralysis of any muscles .

EMG Signal Processing :

The purpose of rectifying the signal is to ensure the signal does not average to zero, due to the raw EMG signal having positive and negative components, two types of rectification are used:

- **Full-wave rectification:** adds the EMG signal below the baseline to the signal above the baseline to make a conditioned signal that is all positive.
- **Half-wave rectification:** discards the portion of the EMG signal that is below the baseline. In doing so, the average of the data is no longer zero therefore it can be used in statistical analyses .

Rectification - Types



Results Taste of EMG :

If results were not normal, it can indicate a variety of different conditions. Depending on which muscles or nerves are affected, it may mean one of the following :

1- Carpal tunnel syndrome, a condition that affects nerves in the hand and arm. It's usually not serious, but can be painful .

2- Herniated disc, a condition that happens when a part of your spine, called a disc, is damaged. This puts pressure on the spine, causing pain and numbness .

3- Guillain-Barré syndrome, an autoimmune disorder that affects the nerves. It can lead to numbness, tingling, and paralysis. Most people recover from the disorder after treatment .

4- Myasthenia gravis, a rare disorder that causes muscle fatigue and weakness .

5- Muscular dystrophy, an inherited disease that seriously affects muscle structure and function .

6- Charcot-Marie-Tooth disease, an inherited disorder that causes nerve damage, mostly in the arms and legs .

7- Amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease. This is a progressive, ultimately fatal, disorder that attacks nerve cells in brain and spinal cord. It affects all the muscles use to move, speak, eat, and breathe .