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Detect Electromyograph Signals on Grasping Handgrip Movement

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Abstract
EMG signals are used to assist doctors in the diagnosis of a patient's muscle condition. The presence of anomalies in the EMG signal recording results indicate an abnormality in the patient's body muscle.In general, information obtained from EMG signals can be used to determine the time of muscle activation, to estimate the strength produced by muscles and to obtain index of muscle fatigue level through the analysis of frequency spectrum of EMG signal (Electromyography) is the result of measurement of electric current on the body or called by biolyte produced by muscle fibers when contractions occur as a result of neuromuscular activity.Excessive muscle activity in EMG (Electromyography) can cause pain and even pain in the arms can sometimes arise without any obvious cause, other than by accident or sudden injury. Sudden pain on one or both sides of the arm may confuse the person who is experiencing it, but there are various conditions that can cause it and most involve muscles.From the results of the MPF then When doing the movement of the palm of the hand muscle flexor carpi radialis has a mean frequency power value is always greater than the muscle extensor carpi Ulnaris for all respondents are not distinguished men and women of various ages.
Keywords: Electromyography, FFT

1. INTRODUCTION

In the field of medicine, EMG signals are used to assist doctors in the diagnosis of a patient's muscle condition. The presence of anomalies in the EMG signal recording results indicate an abnormality in the patient's body muscle. In general, information obtained from EMG signals can be used to determine the time of muscle activation, to estimate the strength produced by muscles and to obtain an index of muscle fatigue through signal frequency spectrum analysis (Carlo, 2002). However, from some studies that have been and are being done on EMG signals revealed that EMG signals are not solely used for diagnostic enforcement processes. Broadly speaking, EMG signals are used in various applications such as physical rehabilitation, urology, biomechanics and ergonomics (Florimond, 2010). In order to be used for measurements of muscle strength, a characteristic need for a frequency spectrum of specific and constant EMG signals is required. To obtain the characteristic spectrum of a specific and constant nature required a precise signal processing method, because the characteristics are mixed with noise and artefact derived from the electronic components of EMG signal detection and recording equipment, environment, movement and instability of the signal (Carlo, 2002).

In this study, the frequency spectrum of EMG signals is obtained when a number of naracoba perform grip movements handgrip tool. EMG signal recorded by surface EMG method by placing electrode on the surface of the skin (non invasive) and not directly from the muscle tissue (invasive), so there is no need for a surgery on the body of naracoba. Therefore this data Laying. The purpose of this research is detecting electromyograph signals on grasping handgrip movement.

2. RESEARCH METHOD

This research was experimental research that was conducted in the field with the design of posttest only control group. The subject of this research is grasping handgrip movement. The procedure of this research was descriptively measurement electromyograph signals on grasping handgrip movement.

3. RESULT AND DISCUSSION

Electrode and Configuration

Location of electrode laying is determined based on three important considerations, namely the ratio of signal and noise (signal to noise ratio), the stability of the recorded signal and the contamination of the signal from the surrounding muscles that do not want to be detected (crosstalk). Crosstalk contamination is an important consideration when using a surface electrode as it may affect the characteristics of the recorded signal and can eliminate the actual information coming from the muscle to be detected (Carlo, 2002).

Before determining the location of the laying of the electrode, it must be known first where the nerve entry in the muscle to be detected (innervation zone) and the location of the tendon. The electrode configuration used is a bipolar electrode consisting of positive, negative and reference electrodes. To minimize contamination of this crosstalk, preferably positive and negative electrodes are placed in the area between the innervation zone and the tendon. The reference electrode should be placed in a relatively neutral region far from the other two electrodes. This neutral region is a bony bulge area that contains very little muscle tissue. The distance between the reference electrode and the positive electrode is attempted almost equal to the reference electrode distance and the negative electrode while the distance between the positive and negative electrode is about 1 cm, as shown in Fig.1

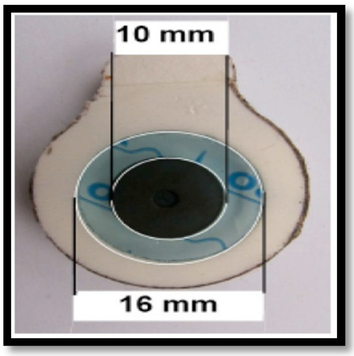

Figure 1 Distance of EMG surface electrode deployment

In the configuration of two surface electrodes, the detector (positive and negative) is used to detect two electrical potentials on the muscle tissue and one electrode is used as a reference. The two recorded signals are then passed to a differential amplifier that will reinforce the difference between the two. While the common mode components are removed. This component comes from a source relatively far from the point of detection, but also recorded, such as noise arising from the frequency of the nets of PLN. The accuracy of the differential amplifier to reduce the noise is measured from the CMRR value (common mode rejection ratio). A 32,000 or 90 dB CMRR value is generally sufficient to eliminate electrical noise (Carlo, 2002). Configuration of bipolar electrode with differential amplifier is shown in Figure 2

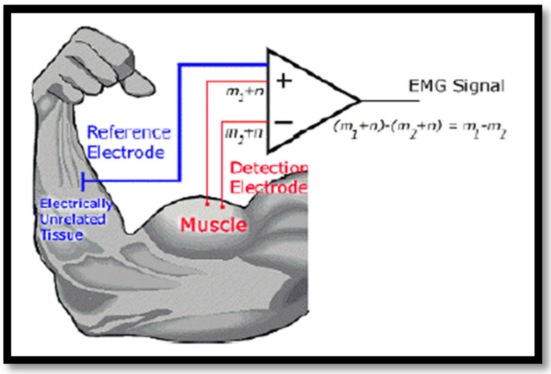

Figure 2 Differential bipolar electrode amplifier configuration

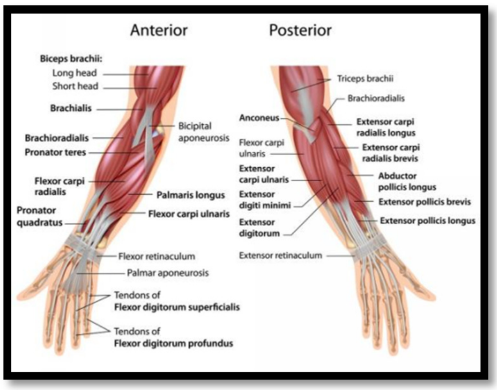

Figure 3 Position of surface electrode positioning on arm muscle (1) flexor carpiradialis (2) extensor carpi ulnaris

Factors Affecting the EMG Signal

The EMG signal is influenced by extrinsic and intrinsic factors. The effect of this factor must be controlled by the proper detection method, so as to obtain a good measurement result. Extrinsic factors relate to the structure and laying of surface electrodes on the skin that line the muscles. This factor consists of:

a. Electrode configuration, describes the shape and surface area of detection that determines the number of motor units detected.
b. Motor point connection with myotendonous junction (muscle relationship with tendon). This location determines the amplitude and frequency characteristics of the EMG signal.
c. The location of the electrode on the muscle surface, this position affects the possibility of EMG signals being affected by signals from the muscles that do not want to be detected (crosstalk). The effect of electrode laying on the amplitude and frequency of the EMG signal spectrum is shown in Fig 4

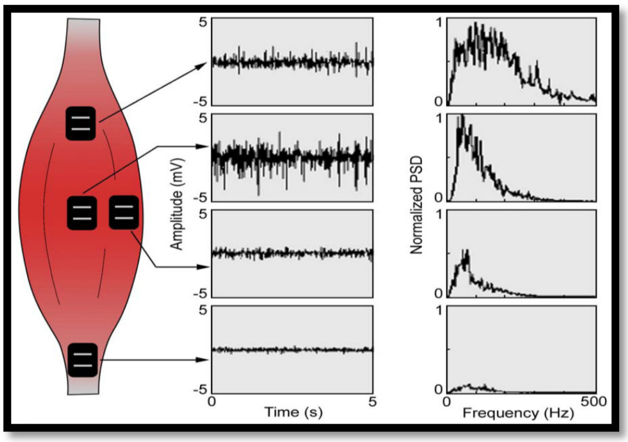

Figure 4 The amplitude and frequency spectrum of the EMG signal is affected by the location of the electrode

The signals recorded through the electromyographic system are derived from electrical activity generated by nerve cells when muscles contract and relax. The amplitude of the EMG signal is stochastic (random) which can be represented by the Gausian distribution function. The amplitude range of the EMG signal ranges from 0-10 mV (peak to peak) or 0-1.5 mV (roat mean square). While the frequency range recorded with surface electrode ranges from 0 to 500 Hz with a dominant frequency between 50 to 150 Hz. (Marco, 2005). Figure 2.5 is a display of the frequency signal spectrum.

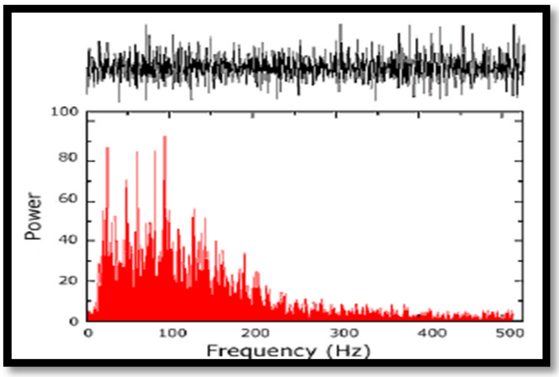

Figure 5 Spectrum of frequency signal.

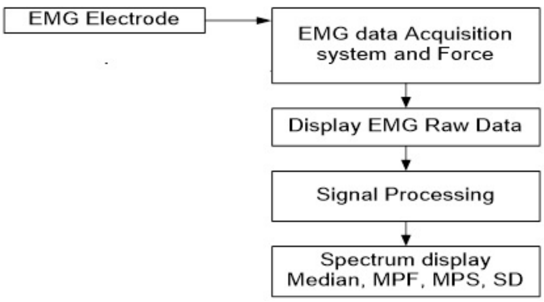

Figure 6. Block Diagram

In Figure we can see that the data acquisition system of Biosignal Measurement Instrument K & H Type KL710 gets 2 inputs of analog voltage from EMG electrode. In this data acquisition system the input signal from the EMG electrode is boosted by 20 times. The processed EMG electrodes are subsequently converted into digital data for later display on a computer screen. On the computer screen will appear 2 signals namely EMG signal coming from 2 pairs of electrodes mounted on the hands of naracoba. All signals displayed on the computer screen are signals in time domain.

Figure 7 Handgrip Tool

Biosignal Measurement Instrument K & H Type KL-710 is a data acquisition device in which there is software and hardware for the acquisition and analysis of biological signal data. Some biological signal measurement experiments can be performed with the device Biosignal Measurement Instrument K & H Type KL-710 is Electroencephalograph, Electrooculograf, Electromiograf, Electrocardiograph, Heartbeat and Sound, Blood Pressure, Respiration, Pulmonary Function. The following shows the Biosignal Measurement Instrument K & H Type KL-710 device. Results of EMG signal measurements at Naracoba After going through a testing phase aimed at ensuring that the K & H Type KL710 Biosignal Measurement Instrument and Handgrip Tool can work properly, it is then used directly on the naracoba to measure EMG signals and grip strength. Naracoba who participated in this study amounted to 20 people divided by age and gender. Figure 8. EMG signal measurement results on the palm of the hand

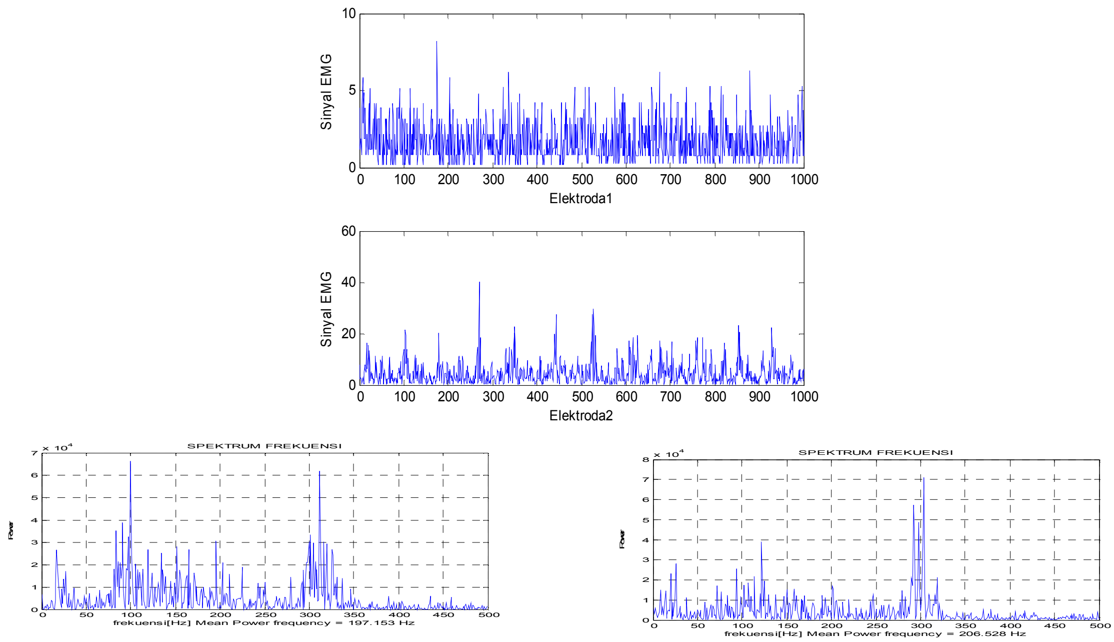

Figure 8. EMG signal frequency spectrum on the palm of the hand

When performing hand grip motion Muscle flexor carpi radialis MPF value (Mean Power Frequency) is always greater than the muscle extensor carpi ulnaris for all respondents or naracoba not distinguished men and women of various ages.

For reference derived from the value of MPF flexor carpi radialis, group naracoba men aged 20-40 years MPF value worth 198,302 Hz. Naracoba women aged 20-40 years have a value of MPF 189.611 Hz. In the age group above 40 years indicated MPF value of 210.591 Hz. in males and in females worth 176,578 Hz.

For reference derived from the MPF extensor carpi ulnaris value, the male group of 20-40 years old MPF value is 172,505 Hz. Naracoba women aged 20-40 years have MPF value 172.542 Hz. In the age group above 40 years indicated MPF value of 165.298 Hz. in men and in women is 170,658 Hz.

For reference derived from the MPS value of the flexor carpi radialis, the highest value lies in males between 20-40 years with a MPS value of 10.8 mV. Lowest value lies in Women between 20-40 years with MPS value 5,866 mV. groups of male naracoba over 40 years MPS value worth 5.95 mV and in women over 40 years worth

8.93 mV.

3. CONCLUSION

There is different Mean Power Frequency (MPF) of handgrip movements between male and female. There is also differs by age both in male and female.

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