



Measurement of Physiological Parameter with the Help Of different Types of Electrodes and Role of Wireless Communication in Measurement

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Abstract: *The present paper introduces the measurement of different kinds of physiological parameters by an application of electrodes in the biomedical field. These electrodes help in monitoring the bio-electric event occurring inside the human body, and provide medical information that can be utilized for the treatment of patients as well as in the research. The kinds of physiological parameter such as ECG (electrocardiogram), EMG (electromyogram), EEG (electroencephalogram) etc. are various types of parameters measured by an electrode.*

Keywords: *Electrodes, EMG, ECG, ENG, EEG, EOG, Bio-Potentials.*

I. INTRODUCTION

Due to the flow of ionic current in a body ionic potentials are produced and bio-electric potential gets generated. For the measurement of ionic potential as well as electric current in a body an interfacing is required between the body and electrical measuring instrument, this requirement is fulfilled by an electrodes. These electrodes monitor the potentials occurring at the surface of the metal and an electrolyte. Electrodes measuring the various physiological phenomena such as ECG (Bio-potentials that are produced due to the muscles of the Heart) EEG (Bio-potentials produced due to the neural action of the brain), EMG (Bio-potentials generated due to the muscular activity).

II. CLASSIFICATION OF ELECTRODES

2.1. Metal Plate Electrode:

This electrode consists of a metallic conductor in contact with the skin with a thin layer of an electrolyte gel between the metal and the skin, to establish such contact metal used in electrode includes silver, gold, and platinum. Electrodes are also made of a foil of the metal so as to make them flexible, and they are also made in the form of a suction electrode to make it easier to attach the electrode to the skin to make a measurement and then move it to another point to repeat the measurement. These types of electrodes are used primarily for diagnostic recordings of bio-potentials such as the electrocardiogram or the electroencephalogram. Metal disk electrodes with a gold surface in a conical shape such as showing are frequently used for EEG recordings. The apex of the cone is open so that electrolyte gel or paste can be introduced to both make good contact between the electrode and the head and to allow this contact medium to be replaced should it dry out during its use.

2.2 Needle And Wire Electrode:

For the measurement of bio-potentials from within the body, transcutaneous type of electrodes are used in which electrode or the lead wire are penetrated to the skin or may be implanted internally and connected to the electronic circuit such as radio transmitter etc.

Needles are mainly used for the acute measurements as they are uncomfortable for long term implantation. Transcutaneous types of electrodes are best suited for such situations.

2.3. Microelectrodes:

Microelectrodes are used to measure the potential difference across the cell membrane which is small as compared to cell dimensions, in order to avoid the injury of the cell. It must also be strong in order that it can penetrate the cell and mechanically stable. The tip size of microelectrodes ranges from .05 to 10mm.

2.4. pH Electrode:

Measurement of acid-base balance of a fluid is known as, the pH. Natural solution has a pH of 7. The pH of normal arterial blood ranges from 7.30-7.42. pH measurement is accomplished by making use of glass electrodes for the measurement of pH. The impedance of pH Electrode may vary from 50-500 milliohm.

2.5. Blood Gas Electrodes:

Blood gas electrode is utilized for the measurement of pressure level of oxygen and carbon-di-oxide in the blood. In this a high voltage is applied between platinum wire and reference electrode, reduction oxygen level at the cathode of platinum. This results in an oxidation-reduction current proportional to the partial pressure of the diffused oxygen that can be measured.

III. DIFFERENT TYPES OF ELECTRODES USED IN BIOMEDICAL FOR MEASURING VARIOUS PHYSIOLOGICAL PARAMETER

The different types of physiological parameters that are measured in order to detect the biological event inside the human body. For this purpose types of electrodes are used, some of the physiological parameters are discussed below.

3.1 EEG (Electroencephalography):

The type of physiological parameter adopted to measure the activity of the brain (electrical activity) for the period of time. EEG help to diagnose the patients suffering from problems such as sleep disorder, coma, brain tumours and kinds of brain disorder. Recording of an EEG is done by placing the electrodes on that part of the brain where actually problem occurs or directly from the cerebral cortex, the electrical activity of the brain differs in both frequency as well as in amplitude. Conductive gel or a paste is applied over the skin before placing the electrodes. The electrolyte paste or jelly serves as a conductive path between the metal and skin, Due to advancement in the biomedical field now caps are also available in which electrodes are embedded in it.

3.2. EMG (Electromyography):

Electromyogram is the type of physiological parameter that is adopted in the biomedical to measure the electrical activity produced by the muscles the device used for the measurement of EMG is known as Electromyography. Type of a device detects the bio-potentials generated by muscle cells. There are two types of EMG

1. SURFACE EMG
2. INTRAMUSCULAR EMG

3.2.1. Surface EMG:

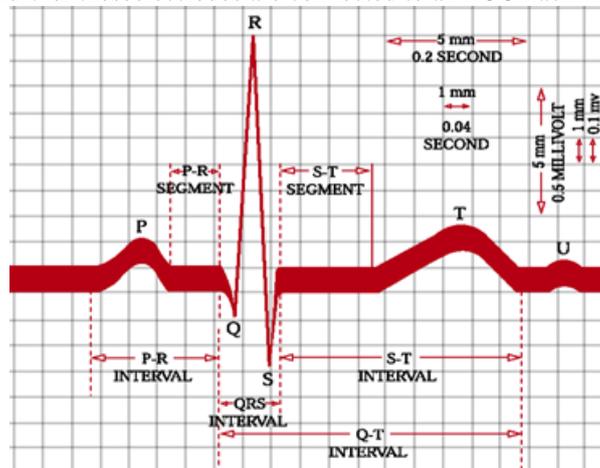
The type of physiological parameter detects the functioning of the muscle from the surface above muscle on the skin, medical data is recorded by a pair of electrodes.

3.2.2. Intramuscular EMG:

The physiological parameter measured in various kinds of technique but the most common method is needle electrode. Fine wire that is inserted into the muscle with surface electrode as a reference, and electrical activity is displayed on an oscilloscope.

3.3. ECG (Electrocardiography):

ECG is a periodic rhythmic repeating signal synchronized by the functioning of the heart which acts as a generator of a bioelectric events. The signal generated is compared to electric dipole, which generates a field vector nearly periodically in time and space. ECG is recorded by any number of electrodes, generally five electrodes are utilised that are placed into the patient's body and further these electrodes are connected to an ECG machine with the help of leads.



3.4. EOG (Electro-Oculography):

It is the technique adopted for the measurement of bio-potentials that exist within the human eye. The changes occur due to the measurement of the eye is known as electro-oculogram, the measurement is done by attaching pair of electrodes to the left and right of the eye.

3.5. ERG (Electroretinography):

The electroretinography measures the response of the retina of the eye to light that is the changes that occur in the resting potential of eye from darkness to fall of the light on the retina. The ERG signals are more complex and their amplitude varies from .05-1.0 mv and frequency from DC to 20 Hz.

IV. ROLE OF WIRELESS COMMUNICATION IN MEASUREMENT:

Communication had an important role in taking measurements. In biomedical communication can be utilised for the purpose of monitoring the patients activity from anywhere with the help of biosensors or by implanting wireless device internally or externally for the detection of biological events occurring in particular part of the body.

Wireless devices such as biomedical sensors also helps in measurement of patients ECG, EEG, temperature, blood pressure, blood oxygen saturation etc.and can be recorded for future use.

V. CONCLUSION

Electrodes play a vital role in the measurement of various physiological parameters. For such kind of measurement electrophysiology is done, in this technique pair of electrodes are used that are placed into various tissues or cells and bio-potentials gets recorded and displayed on the oscilloscope or any display devices. Electrodes that are utilised for the measurement of biological events include surface electrode, micro-electrodes, needle electrodes etc. These different types of electrodes are utilised for various types of measurement according to the need.

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