

Bluetooth Controlled Device to Treat Dysmenorrhea using TENS Technology

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Abstract - Menstruation is not a curse, not a taboo. Although menstruation is a normal part of a women's life, severe period pain need not be. Women don't have to simply put up with it, menstrual pain can be effectively treated. Dysmenorrhea is the clinical term of painful menstruation, experienced by one in five women. In order to treat this severe menstrual pain, we use TENS (Transcutaneous electrical nerve stimulation) technology. This TENS unit is designed to control via the Bluetooth low energy using smart phones. The main objective of this project is to create a portable device to treat Dysmenorrhea with no side effects and completely drug free. This is designed in such a way that it is suitable for all age groups by using flexible surface electrode.

Key Words: Dysmenorrhea, Bluetooth low energy, TENS, microcontroller, flexible surface electrode

1. INTRODUCTION

Most of the adolescent facing gynecological problems like irregular menstruation, excessive bleeding and Dysmenorrhea. Among these, Dysmenorrhea is experienced by all age groups of female. Dysmenorrhea is the medical term of medical cramps (painful sensation in the lower abdomen). Dysmenorrhea is classified into two types: primary Dysmenorrhea and secondary Dysmenorrhea. Primary Dysmenorrhea is a condition in which pain in the lower abdominal region caused by natural chemical called prostaglandin, this may also improves after giving birth. Secondary Dysmenorrhea causes severe pain more than primary Dysmenorrhea and last longer than the normal menstrual cramps. This is due to disorder in the reproductive system like endometriosis, adenomyosis and fibroids. Dysmenorrhea depends on women's age, length of menstrual cycle, age at menarche, parity, stress level and family history.

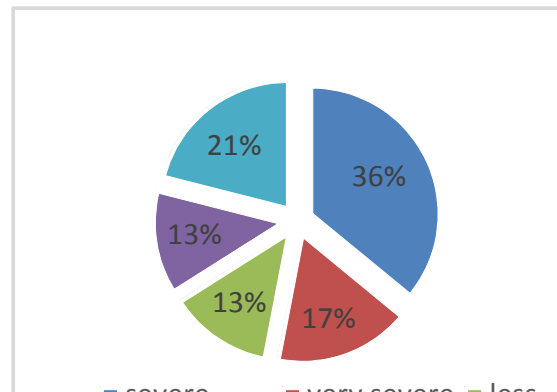


Fig -1: Statistics conducted by WHO

2. TENS

Transcutaneous electrical nerve stimulation is a non invasive nerve stimulation technique to relieve pain. In this pulsed electrical current is passed through the electrode which is placed over the target region. Usually pain signals are transmitted to the spinal cord and then to the brain. Gate control mechanism helps to block the pain signal reaching the brain.

This gating mechanism takes place in the dorsal horn of the spinal cord in which when the large diameter non noxious afferent nerve fibre are stimulated this cause the release of inhibitory neurotransmitter which reduce the activity of nociceptive input to the brain. This result in pain relief. TENS induced activity result in sensation of electrical paraesthesiae. High frequency TENS in the range of 80-100Hz are responsible for blocking pain whereas in low frequency TENS, it releases endorphins.

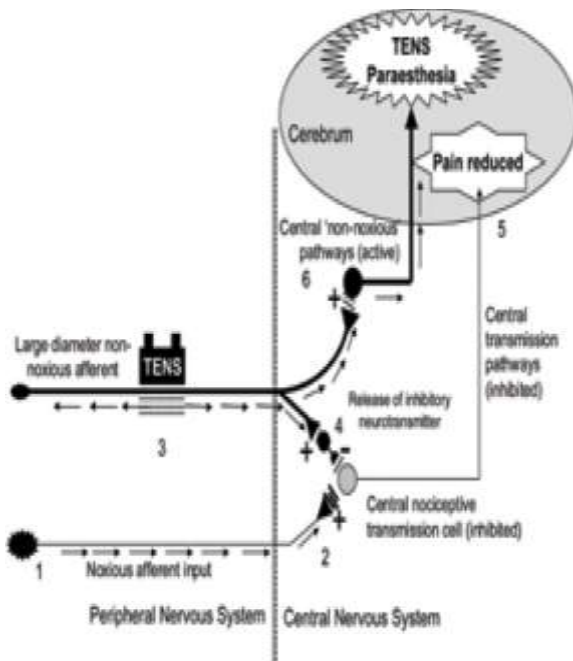


Fig -2: Gate control mechanism

3. METHODOLOGY

In the study of TENS and Dysmenorrhea shows that both high frequency TENS and low frequency TENS are found to be effective treatment modality, but it highly varies for each and every women. Other studies and experience show that TENS are found to provide effective result in both primary and secondary Dysmenorrhea cases. Since menstrual pain of each and every women is unique, special care has to be taken in the design of TENS unit and also this unit is going to be placed in the lower abdominal region hence controlling medium also play a very important role.

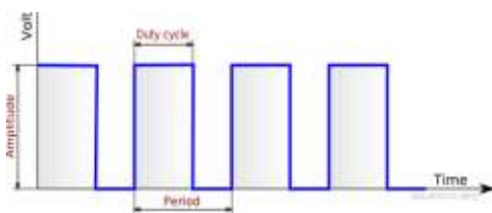


Fig -3: Pulse wave

In the project we designed a TENS unit by considering all the above factors. This unit is designed in such a way that the pulse frequency and pulse width can be varied according to the pain intensity of the individual women. Maximum frequency level is fixed in the device hence this helps to ensure that high frequency pulse doesn't enter the patient's body. The above parameters like pulse width and frequency can be controlled by the smart phones through Bluetooth medium.

In this we used Bluetooth version 4 which is low energy consumption communication technology. The pulse wave is produce with the help of timer (NE555/7555) astable mode and pulse frequency is controlled. The pulse width is controlled with the help of Operational amplifier. The pulse width and pulse frequency are varied with the help of digital potentiometer (MCP41XXX) and this is connected to the microcontroller (Atmega328p).

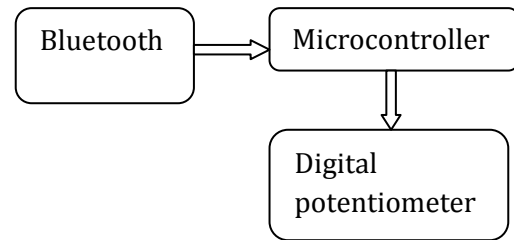


Fig -4: Connecting TENS with Bluetooth medium

The program is embedded in the microcontroller in order to control the digital potentiometer output. The Bluetooth module (HC-10) is connected to the microcontroller and this is paired with the smart phone through which the output of the TENS unit is controlled. This unit is battery powered with 5-9V, this voltage doesn't provide effective result hence the output of the TENS is increased with the help of step up transformer (Mode T). MOSFET (BC556) and diode (1N4004) are used for switching and to prevent back flow of current simultaneously. The Transformer output are connected to the probes through which electric current passes through the body. The electrode is interfaced with skin surface using gel in order to reduce skin resistance and also act as adhesive material.

The flexible body surface electrode is thin, easy to adjust to the different position of the body like sitting, walking etc. This is flexible and hence it can be used by all age groups. It remain at the particular place for long period. It also helps to prevent ulceration in the contact region.

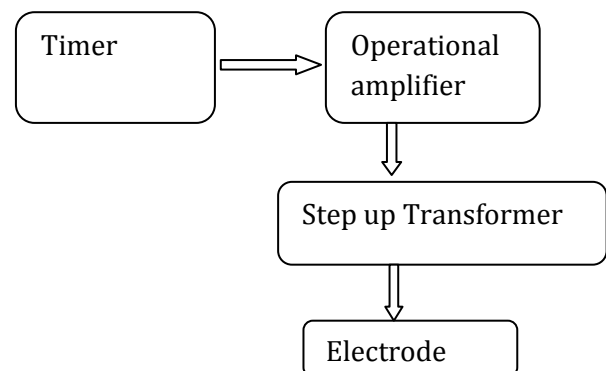


Fig -5: TENS unit

4. DESIGN

The very important part of our project is the design of the TENS unit since this unit is going to be placed in the lower abdominal region which contains belly fat and this varies for each and every women. The various types of belly fats in women are mommy belly, stressed belly, hormonal belly and bloated belly. Fat distribution differs in a person depending upon her position like sitting, lying or standing. Due to this action there is displacement of electrode from the position or chance of falling of the electrode. In order to overcome this problem, flexible body surface electrode can be used which can be able to adjust to the different body position. The TENS unit is placed 2inch forward to the electrode in order to avoid disturbance with the body surface.



Fig -6: Location of the TENS

5. CONCLUSION

Due to severe menstrual pain women are not able to do their routine activities, so most of the women prefer drugs like Ibuprofen, naproxen etc. This causes major side effects like hair fall and other gynecological problem. So that in our project we used a TENS technology to relive pain which is drug free, non-invasive and portable. This is designed in such a way that it is suitable for all age groups. The main feature is that the intensity can be adjustable based on the pain experienced by the user.

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