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## ABSTRACTS: VOLUME 6, SPECIAL ISSUE

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### ABSTRACT

#### **Design and manufacturing of a Transcutaneous Electrical Stimulation System for Migraine Treatment**

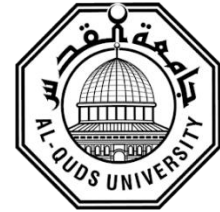
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**Background:** Migraine is a complex disorder that characterized by recurrent episodes of headache most often unilateral and in some cases associated with visual or sensory symptoms that unfold over hours to days and disrupts the daily life of the patient and makes him lose his ability to focus. Experts estimate that 18.5% of the general population get migraine headaches. Women are about three times more likely than men to experience migraines, especially women between the ages of 15 and 55.

**Objectives:** The aim of this study is to design and implement a non-invasive and drug-free with minimal side effects device that uses electrical impulses to stimulate the nerves responsible of migraines in the affected area to alleviate pain and reduce the frequency of migraines attacks.

**Methods:** An electrical unit that consists of multiple modules is designed and implemented. These modules are: a pulse generation module, which generates continues, asymmetric biphasic signals, a Step-Up DC-DC converter which amplifies the generated signal, a skin-electrode interfaces module that provides the appropriate method to deliver the generated signal to the subject's forehead where the Migraine affected nerves located using two surface electrodes and a unit case. The designed unit provides the user with the ability to control signal parameters (frequency, pulse width and voltage intensity) and therapy time and modulate them so that an optimum effect is achieved for the purpose of pain management. The proposed unit provides a frequency range of (1-



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150) Hz, a stimulation intensity of up to 40 V, a pulse width of (1-80) ms and a session time of (1-30) min. which is sufficient for many patients.

**Results:** The results show that the intensity of stimulation has the most significance in the process of Migraine relief and it varies according to the condition of each patient and the choice of Frequency and Duration varies depending on many different factors (gender , age, genetic factor). Also shows a significant reduction of attacks frequency per month. The range of the intensity for the tested cases was (1-40) V, which is also directly proportional to the severity of Migraine. Higher severity of Migraine required higher intensities of stimulation and vice versa.

**Conclusion:** It is believed that electrical stimulation is a safe, simple and reusable method of Migraine relief involving the use of low electrical current. The electrical impulses can reduce the pain signals going to the brain, which may help relieve pain. Based on the work done in the present study, the proposed TENS unit for Migraine is characterized by the following:

- It is a non-invasive system because of the choice of an appropriate type of surface electrodes, which makes it easier to be self-administered by the patients to manage their conditions.
- It provides a low cost system for controlling pain as opposed to pharmacological drugs, which can cost a lot of money, especially if needed for long periods of time.
- It is small and compact in size, which provides the patients with more comfort when using the unit.
- Regular use of the unit results in the following positive: decreased use of Migraine relief drugs, improved attitude and social life, and fewer trips to the doctor.
- It is safe and has no side effects as opposed to pain relieving drugs, which may cause side effects like nausea, vomiting or drowsiness.

**Keywords:** Migraine, electrical stimulation, surface electrodes, generated signal.