ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 10, Issue, 01, pp. 32963-32966, January, 2020

RESEARCH ARTICLE OPEN ACCESS

DETECTION OF BRAIN SIGNALS USING ELECTROENCEPHALOGRAM RECEIVED BY SILK ELECTROSPUN SHEET FOR THE MOVEMENT OF PARALYZED ANATOMICAL PARTS THROUGH TISSUE ENGINEERING

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ARTICLE INFO

Article History:
Received 19th October, 2019
Received in revised form
26th November, 2019
Accepted 10th December, 2019
Published online 29th January, 2020

Key Words:
Brain signals, Tissue engineering, Paralyzed patients, Signals connectivity, Anatomical parts, Silk electro-spun, Electroencephalogram (EEG)

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ABSTRACT

Silk is a natural bio polymer which contains many multifunctional management and administrative function that influence on human body like brain and different anatomy of body and osteotomy managements. There is a vast unknown challenges with silk and its performance till now on going research for future. In this paper, I attempted to show brain influence through modification of silk fibers by electro -spinning process and that will take a signal from brain and connect this signal to the anatomy of human body to work or make movement for paralyzed patients. Here the novel material silk is particularly used by tissue engineering through this process can connect the signal from human brain and that will be workable by paralyzed patient anatomical parts of the body. Paralyzed patient can move his paralyzed parts through his/her signals from brain and this signals will spread out through movement of paralyzed parts by tissue engineering. The future perspective and goals of this faithful project specially for paralyzed patients as well as the tissue engineering implantation on human body through brain connectivity with anatomy will discuss here.

Citation: ***Sourav Kumar Das.*** **2020.** "Detection of brain signals using electroencephalogram received by silk electrospun sheet for the movement of paralyzed anatomical parts through tissue engineering", *International Journal of Development Research*, 10, (01), 32963-32966.

INTRODUCTION

In this world, so many accidental incidents happen every day and due to this factor people become paralyzed. Beside that the brain stroke cases increasing day by day in hospital. Due to heart fail or improper blood circulation through the body patients also can make strokes and become paralyzed. The ILO estimates that some 2.3 million women and men around the world succumb to work-related accidents or diseases every year; this corresponds to over 6000 deaths every single day. Worldwide, there are around 340 million occupational accidents and 160 million victims of work-related illnesses annually. The ILO updates these estimates at intervals, and the updates indicate an increase of accidents and ill health [11]. Paralysis is dramatically more widespread than previously thought. Approximately 1.7 percent of the U.S. population, or 5,357,970 people reported they were living with some form of paralysis, defined by the study as a central nervous system disorder resulting in difficulty or inability to move the upper or lower extremities. The leading cause of paralysis was stroke (33.7 percent), followed by spinal cord injury (27.3 percent) and multiple sclerosis (18.6 percent).

People living with paralysis have households with lower incomes. Roughly 28% of households with a person who is paralyzed make less than $15,000 per year [12]. Neurons in the brain communicate mostly by ejecting neurotransmitter. The billions of nerve cells in your brain produce very small electrical signals that form patterns called brain waves. During an EEG, small electrodes and wires are attached to your head. In this experiment we use this neuron signal as electroencephalogram. The electroencephalogram (EEG) is a recording of the electrical activity of the brain from the scalp. (Figure-1) shows the brain signal activity.

The recorded waveforms reflect the cortical electrical activity. Signalintensity, EEG activity is quite small, measured in microvolts (mV). Usually in our brain there are five types of signals that is Delta, Theta, Alpha, Beta, Gamma. Delta, Theta, Alpha, Beta and Gamma brain waves. Each of these brain waves has a normal frequency range in which they operate. By connecting this signals from brain through silk electric sheet and this signals connect the anatomical parts of the human body through tissue engineering.

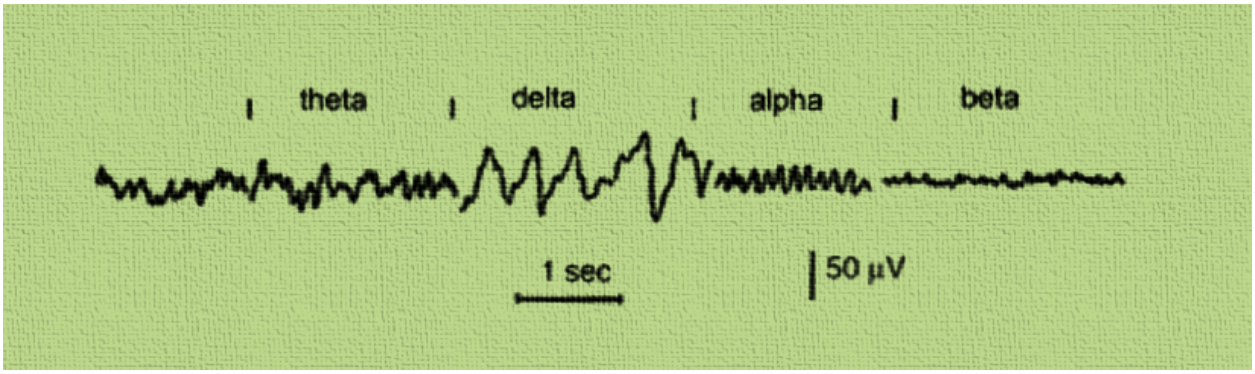

Figure 1. Signals of the brain through EEG

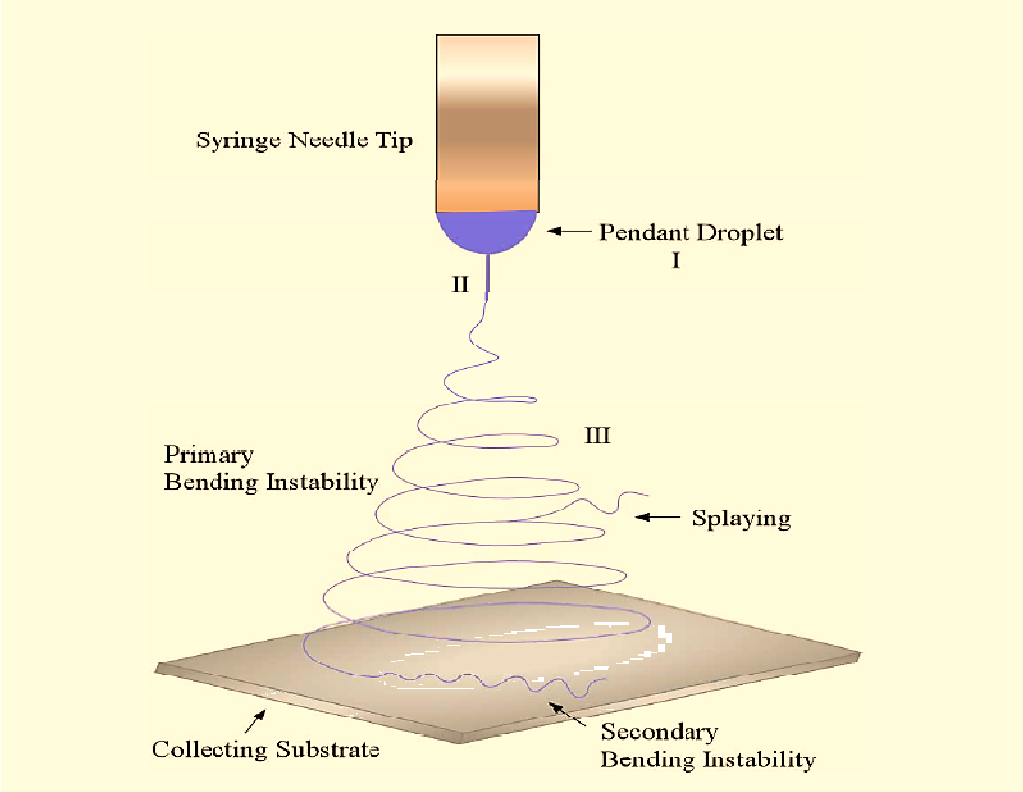

Figure 2.Electrospun Process

IMPLEMENTATION METHODS

Silk /PEO solution: Silk Nanofibers./PEO blending solution was used to generate stable, continuous spinning. PEO solution of 7wt% was prepared by directly adding the PEO to deionized water. Homogeneous solutions were obtained by stirring for at least 4 days at room temperature. The solutions were filtered through a 10 mm syringe filter to remove remaining insoluble materials. Silk/PEO blend solution was prepared by adding 20ml of PEO (7 wt%) solution directly into 6gm of silk nano-fibers solution (12wt%) and mixing with moderate stirring. The silk and PEO solutions were buffered with phosphate buffer (pH 6.8, 0.001M). Electrospun fibers were treated with 98% methanol for 7 min to induce a b-sheet conformational transition, which results in insolubility in water.

Electrospinning: It was discovered over a century ago that ultrathin fibers could be drawn from a viscoelastic fluid under the influence of a strong electric field. Known as continuous fibers with diameters down to tens of nanometers (Xue, 2017). Electrospinning was performed with a steel capillary tube with a 1.5mm inside diameter tip mounted on an adjustable, electrically insulated stand as described earlier. The capillary tube was maintained at a high electric potential for electrospinning and mounted in the parallel plate geometry. The capillary tube was connected to a syringe filled with spinning solution (silk:PEO [wt/wt] of 82:18 and total concentration of 7.86% [wt/v] (Li, 2006). A constant volume flow rate of 0.02 ml/min was maintained using a syringe pump. The voltage was kept at 15 kV and the distance between the capillary tube and the collection screen was 24cm. The electrospun fibers were collected on a collection plate covered with aluminum foil. Form this fibers turned in to sheet of silk electrospun natural bio polymer.Figure-2 SEM view of Silk electrospun fibers. One application of electrospunnanofibers investigated in this study is the development of coatings for neural probes that record and signal neurons in the brain (Lin, 2002).

Tissue Engineering: HEPM cells (American Type Culture Collection, ATCC,CRL-1486) were used for the initial assessment of attachment and migration on

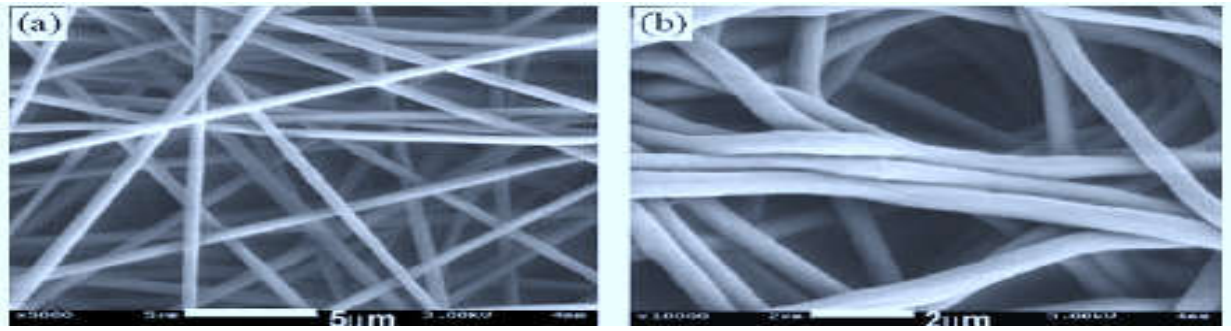

Figure 3. SEM view of Silk electro Spun fibers

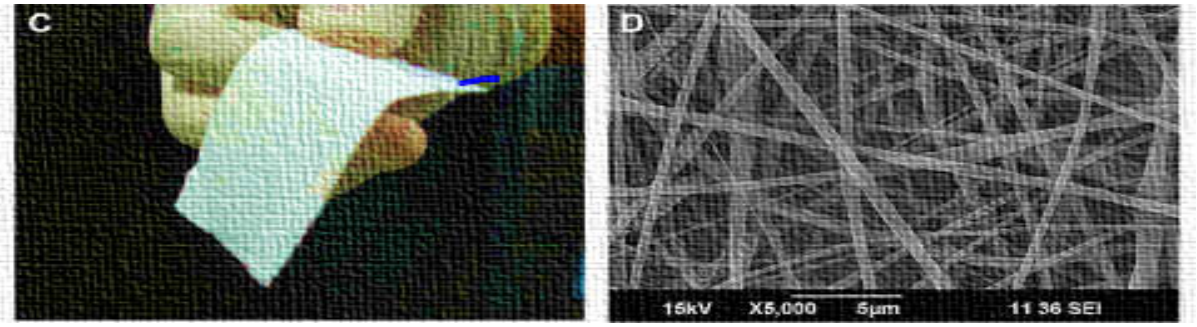

Figure 4. SEM view of Silk electro Spun Sheets

Figure 5. Surface diagram of Electro-Spun

Electrospunprotein fibers. These cells were routinely maintained in Eagle's MEM with Earle's salts supplemented with 10% fetal bovine serum (Hyclone), 2.0mML-glutamine, 1.0mM sodium pyruvate,0.1 mM non-essential aminoacids,1.5 g/L sodium bicarbonate at 37 degree celcius in a 5% CO2 incubator. Upon crosslinking, the scaffolds were sterilized in 70% ethanol for 1 h followed by three rinses with 1.phosphate buffered saline (PBS) (Li, 2005). HEPM cells were seeded onto the various fibrous scaffolds at a density of 20,000 cells/sample. Assessment of cell proliferation, the AB assay was performed for up to 6 days. After termination of each experiment, the samples were fixed with 10% buffered formalin for 1 h at room temperature and then left overnight in PBS at 4degree celcius. The samples were washed once, and the cells permeablized for 15 min in PBS containing 25 µm/ml digitonin (Sigma). Following a gentle wash in PBS, the samples were incubated for15 min in PBS containing 2 µm/ml digitonin (Sigma) (Li, 2005).

Cell out growth studies: As the NSCs play a unique and obligatory role in nerve repair, their morphology, phenotype, neurite out growth and cell interaction with the PLLA scaffolds were studied by various microscopic techniques, such as PCLM, LSCM and SEM (Yang, 2005). Although out growth was not affected by the fiber alignment at the initial period, they all turned through large angles in order to grow parallel to the fiber alignment, which suggests that the favorite growing direction of NSC neurites is parallel to the PLLA nano and micro fibers and the process is dynamically directed over time. The increased cell numbers might reflect the three dimensionality of the scaffolds and the fact that the cells grow not only on top of these scaffolds but also into them. As always, with these kinds of assays, we cannot rule out the remote possibility that an increase in AB fluorescence might not necessarily reflect merely a higher degree of proliferation but indicate also increased metabolic activity levels of the cells in response to the nature and topography of the fibrous scaffolds (Li, 2005).

Collection of cell conditioned medium: MSCs were seeded in 24-well plates at a density of 2.5×105cells/well. The control group, BDNF group and Akt inhibitor group were treated as above for 6 hours. After discarding the original supernatant, the adhesive cells were washed three times (He, 2014). The cells were continuously cultured in basic MSC medium for 48 hours, and then the supernatant was extracted as the MSC conditioned medium (MSC-CM), BDNF conditioned medium (BDNF-CM) and Akt inhibitor conditioned medium (Akt inhibitor-CM). MMP-9 inhibitor (abcam) and neutralizing antibodies against NGF and IL-8 (R&D) were added into BDNF conditioned medium in the MMP-9 inhibitor group, anti-NGF group and anti-IL-8 group respectively (He, 2014).

Cell Implantation on paralyzed anatomical parts: Collected cell will be implanted on healthy rat body paralyzed anatomical parts which is allows to grip the signals from brain and give effectual responses for movement of the paralyzed parts. One of the major limitations of currently used polymeric biomedical implants is their inability to provide sufficient contrast (magnetism or x-ray absorption) for medical imaging methods such as MRI or CT. Once implanted in the brain, it is desirable to have non-invasive imaging of the implant to estimate acute toxicity, edema, inflammation, immune reactions, implant degradation and brain clearance (Ramachandran, 2017). Cellular therapy has evolved quickly over the past decade with valuable experience gained in both preclinical research and clinical trials. Both embryonic and nonembryonic stem cells have been explored as potential therapeutic strategies for a number of diseases. One group of adult stem cells, mesenchymal stem or stromal cells (MSCs), has generated great interest in the fields of regenerative medicine and immunotherapy due to their unique biologic properties (Sharma, 2014).The Implantation process sequence is given below: Figure-5

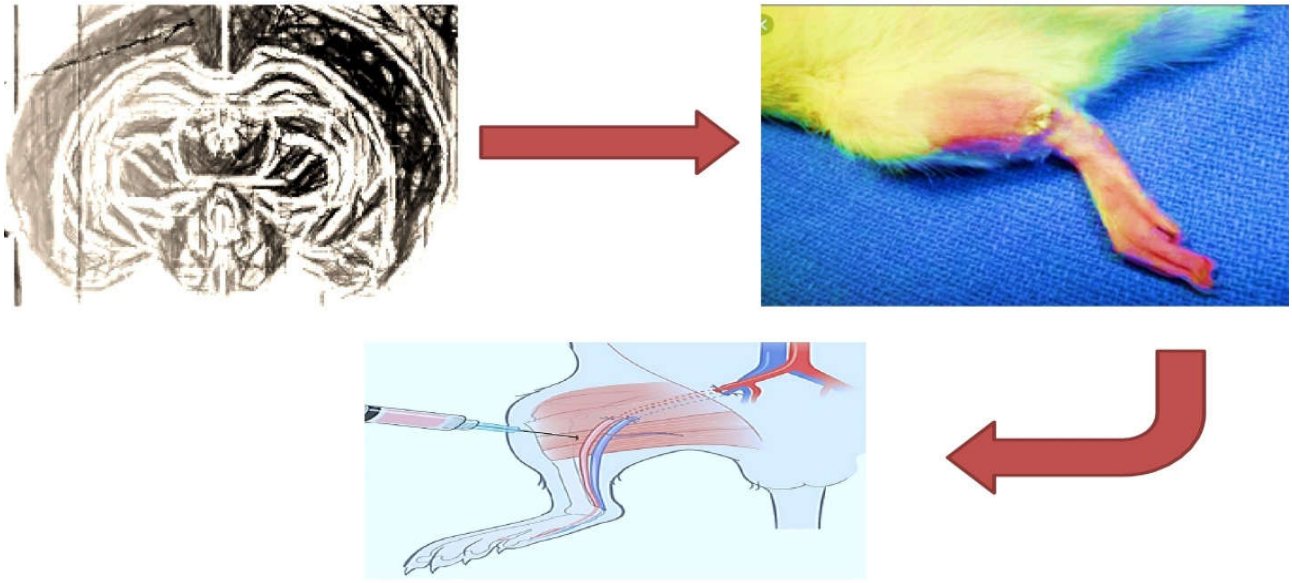

Figure-6:The Implantation process sequence

electrospun sheet applied and it will receive signals from brain and there is implanted cell culture on paralyzed part of the rat body will connect the brain signal and based on this signals rat anatomical paralyzed part will move. This implanted cell will response as a responsible connecting workable cell for movement of paralyzed anatomical part of rat. Cellular therapy has evolved quickly over the past decade with valuable experience gained in both preclinical research and clinical trials. Both embryonic and non embryonic stem cells have been explored as potential the rapeutic strategies for a number of diseases. One group of adult stem cells, mesenchymal stem or stromal cells (MSCs), has generated great interest in the fields of regenerative medicine and immunotherapy due to their unique biologic properties (TERMIS, 2017). TERMIS. The sustained delivery of biochemical cues and synergistic topographical signaling from electrospunnanofibrous scaffolds may be a potential strategy to enhance neuronal differentiation of stem cells for therapeutic purposes (Low, 2015).

Motivation and Support: This research works is a novel one for paralyzed patients all over the world. Further research necessary for obtaining this work which will be effectual symbol on medical science development for man kind all over the world. Need support and fund for releasing this research for mankind on medical science.

Conclusion: In medical science through human body, the paralyzed or damaged cell possible to fill by new cell culture on human body. By this work, the human brain will give signal to electrospun sheet and this electrospun sheet can be shaped as cap for user friendly and easy to bear and handling for patients. In future, need to give more concentrations on tissue engineering and faithful research for mankind development. Through this research can play a vital role for medical field.

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