

Reversing Paralysis Technology - Remarkable Breakthrough for the Treatment of Incurable Paralysis

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Abstract—This research has been developed to study on the Brain Computer Interface (BCI) technology - which is called a Reversing Paralysis Technology. It is a momentous innovation of medical sector for the treatment of Incurable Paralysis. The purpose of this study was to provide a high level of evidences of the effectiveness and the safety of this technology. The methodology of this study is using a qualitative systematic review method. It was followed by data collection and specific keywords based data searching method. Two renowned research papers indexing database have been employed for locating peer reviewed scientific papers such as Pub-Med Database and Google Scholar Database. Besides this database searching, the Google Search also performed for collecting scientific review news and informations regarding this technology. Researchers analysed all keyword based from the selected literatures, from the clinical trial results and from the new sources; and then summarizes the findings in respect of this technology. In this technology, the scientists have hypothesized that reversing of the paralyzed state of a patient is possible by creating Brain Computer Interfaces (BCIs) in the patient's body through two brain implants. One implant is placed on the surface of the brain or attached to the brain's cortex. Then, another one is implanted in the spinal cord by passing the injured lesion of spine. These two implants will act as a bridge between the command center (the brain) and the control center (the spine). When the regular communication is established between the brain and the spine, then the paralyzed

condition will reverse. The researchers, till to this date have analysed thirty seven (37) peer reviewed literatures, twelve (12) scientific/tech based news review sources and four (4) authentic clinical trial results which had been published in this context. Scientists claimed that this theory is effective and is safe for the treatment of paralysis based on successful clinical trials. Thus, from this extensive qualitative systematic review study, it established a theory that Reversing Paralysis Technology is working through Brain Computer Interfaces - Implants mechanism; and it is an effective and a safe process for patients' paralysis treatment.

Keywords—*Reversing Paralysis; Brain Computer Interface; Brain Implant; Paralysis - Neurological Disorder*

I. INTRODUCTION

World is changing in every seconds and minutes in the essence of technological advancement, and it changes our lives through exploding the speed of time. Whether this change is small or big, the incessant improvement of technology is conceptualized as the principal base and the fundamental propulsion of most of the world's globalization processes. This review study focused on how technology advancements has moving the world into a better healthy position through a remarkable medical invention because it has lessen the ratios of the incurable disease of paralysis in the world and at the same time, has improving the standards of living.

Paralysis is a neurological disorder that oftenly caused by the damage in the nervous system, especially in the spinal cord. Neurological disorders will badly affect the

activities of brain represents an enormous burden of the individuals, respective family and the society. This nervous system disorder paralysis has a broad impact on the future of human well-being. It is even likely has greater impact that will threaten the quality of human life, such as a crucial phenomenon on the sustainability of health systems [1].

Paralysis on the right or the left side of the body, or both sides will limit sternly the person's capability for daily living activities as well as their mobility in the community. The capacity of the paralyzed person is eventually got restricted either to school or to work. Patients faced problems with uncoordinated movements, rigidity or weakness [2]. Numerous unprecedented technological innovations in medical sectors are speedily revolutionizing human life. For decades scientists have been working on this incurable disease treatment or tried a lot of time to regenerate the neurons themselves. However they faced a grave challenges to further the degradation in the nervous tissue [3 - 5].

Later on, a team of researchers from École Polytechnique Fédérale de Lausanne (EPFL), a research institute of Switzerland made the first effort to work on this reversing paralysis technology. It is a comparatively new technology that allowed the brain to communicate with the patients paralyzed legs - bypassing the broken spinal cord pathways - after then patient would be able to receive signals from the brain navigated to surround area of the damaged neurons and acquire control over their limbs. So that the patient could once again regain the control over paralyzed organs [6 - 8]

Every year MIT Technology Review publishes the top 10 most promising technologies list of that specific year. The ranked inventions enlisted in the MIT review, usually are magnificent and a stand out inventions. These inventions will unbelievably give a revolutionary improvement in the overall of human life and also for the global sustainability. In 2017, MIT has published the top 10 most marvellous technologies list, among which some technologies were certainly noteworthy for the future development of global treatment

system, especially for the treatment of incurable diseases like cancer and paralysis. Based on the MIT list, the Reversing Paralysis Technology was one of that ten which focuses on hi-tech medical inventions. The rest are about green technologies, business and automotive technologies [9].

The Reversing paralysis is said by the scientists was the immense progress ever made to make the paralysis disease become a temporary problem and is curable by using brain implants, because it is already proven successful and passed in many clinical trials. In the reversing paralysis theory, the scientists' intentions are to bring back the usual movements of a paralyzed patient through a small brain implant (neuroprosthetic device) [10 - 12].

II. LITERATURE REVIEW

Technology interaction with the human life will rule the modern world. Government Office for Science (UK) has published a report on the future of technology advancements in medicine, health-care, business, communications, entertainment, construction, transportation and many other areas. In this digital age, a great deal of technologies will holding out the potentiality of greater health, immunation, safety and convenience. The fundamental elements of divergent innovations underpinning the world with more new medical technologies for better disease control and for better treatment management. World is stepping in a such golden age where it will easy to holding out total control on grievous health-care challenges through splendid innovation in gaining ability to make impermanent of the incurable diseases, regenerate tissue and the magnificent knowledge of gene editing and bio-computers to manipulate human bodies that giving emergence to disease-resistant crops [13].

In one side, this world is advance in technology but the other side states some health risks and challenges has exploding grievously. The environment where we are breathing in became a big risk and major factors for its inhabitants due to air pollution. The Lancet Commission reported that in 2017, the diverse forms of air pollution was responsible for 16%

of global death of 2015. Air pollution is one of the largest environmental cause of neurological disorders due to ceaseless exposure to harmful air pollutants on the brain. A neurological disorder is a kind of disorder in the nervous system. It may happen in many forms, such as in the form of structural, in the form of the electrical or biochemical abnormalities in the brain, or spinal cord or other nerves that can result a range of symptoms including muscle weakness, paralysis, poor coordination, loss of sensation, seizures, confusion, pain and altered levels of consciousness [14].

The World Health Organization (WHO) has taken an initiative effort for a global disability action plan 2014-2021. This is going to be an evidential step towards achieving the human rights for health and welfare especially for those who have disabilities or paralysis problems. The members of WHO countries had approved the action plan to broaden rehabilitation programs, to fortify all sorts of supports for disable peoples to enhance access into health programs and services, or to get the assistive devices, or where the disable to get related services. The action plan hopes to enable people with disabilities to effectuate their ambitions in all prospects of life [15].

A detailed review report by Deloitte renders a considerable understanding regarding the modes of how the latest innovations has modifying the health-care systems. It reviewed that technology assisted health-cares devices will enables patients, and will enable the care givers to access the information easily and to improve the overall quality of both human health and the social care. In their review, it showed that technology based health-care is advancing and its cost is dropping down exponentially. Since the demand for health-care and its cost is rising at the same time, which is a bad challenges for most health economies across the globe; and consequently, people must need to take over the health-care facilities but assisted by technology to meet and to handle these challenges [16].

From the global study reports regarding the burden of diseases, has highlighted that neurological diseases was the gravest threats

to public health. The incidences of neurological diseases is dangerously increasing globally due to various factors, and it leads to diverse types of trauma that affects the nervous system. These factors represent the actual and the future public health problems, especially in the developing countries. These neurological disorders causes various levels of aggressiveness and intolerance which are neurological disability, deficits, and mortality [17 - 19].

Modern technological advances for the treatment of neurological disorders diseases like disability (paralysis) has restore the hopes to treat the paralysis, which commonly known beforehand as incurable. This Brain-computer interfaces (BCI) technology will deals with the complex analysis of brain signals, training paralyzed patients to control these signals, and this advanced computing capabilities has enabled the patients suffered from severe motor disabilities to exercise their brain signals to control the objects in their environment and in their communication, thereby bypassing dysfunctional neuromuscular system. BCI has been and will continue to be implemented into the rehabilitation practices for paralyzed patients for more interactive and for speedy neurological recovery [20 - 22].

BCI devices are commonly known as brain implants that are implanted directly into the brain to get the highest quality signals. These devices are used to provide functionality and mobility to the paralyzed people. This technology stands for a flourishing tract of research with proper utilization systems. Its contributions in the medical fields has range from the prevention practice into a neuronal rehabilitation especially for the serious injuries. They have expedited restoring the motility for physically challenged peoples and replacing the lost motor activity. The promising future predicted for brain implants - BCI interfaces has encouraged further demand of extensive research for changing the life of millions of paralyzed humans through medical applications [23 - 24].

BCIs can be an invasive and a noninvasive types because it uses signal recordings from the nerve cells, the electrocorticogram and the electroencephalography which are working as a large neuronal pools, or function as a

magnetic resonance imaging (fMRI). The near-infrared spectroscopy shows its potentiality for the recovery of the communication in the locked-in syndrome patients and for the motion restoration in the patients' chronic stroke; but the clinical trials with a controlled phase III is urgently needed for bigger populations of severely paralyzed patients [25].

III. OBJECTIVE OF THE RESEARCH

This systematic review study is an advanced level research protocol which attempts to determine, to appraise and to examine all the experiential high quality research evidence broadly applicable to reversing paralysis theory, which meets some pre-specified qualifications criteria to answer and to render a superior finding. Researchers are carefully analyzed and summarized all the findings of the experiments regarding to this reversing paralysis technology to prove the solid efficacy of this medical treatment theory [26].

According to the methodology systematic review, the study has identifies, evaluates and synthesizes the research evidences from literature studies of numerous individual research papers which have strict protocol and as a result, these papers are considered a valuable sources of information. This study will help the future researchers who prefer protocol and proper analyzed successful clinical trials; as well as helping them to find evidences and to summarize the findings of the experiments on topic of reversing technology. The health-care professional of the global health sectors must need research evidences for both clinical practice and for public health decision making. These evidences must be from the authentic and from the quality systematic review studies which stands as a state-of-the-art creation of actual evidences on a given research question [27].

In addition to being employed as a future research evidence this study paper will help to visualize the future goal for medical investors to what extent that the existing research has been developed and to what extent it has been to carry out further medical analysis towards

achieving the final solution of a particular research problem. That ultimately will furnish broad implications for future practice and for the policy making to increase the investments. Since investments are needed to promote an advanced technology, a research initiate a collaboration among global health sector leaders to strengthen the health systems in nations and to boost their independence in decision making in many areas such as, to increase access for the expensive life-saving treatments, to enhance prevention, and to ensure delivering better coordinated care as well [28].

IV. RESEARCH THEORY

A. Is Paralysis Treatable?

This is a common question asked by the patients of spinal cord injury and paralysis patient. Once they realized where the injury is and how this injury may hamper their regular movements, then the next question come up that if the current state will be everlasting. These are tough questions for any doctor to answer, and the answers are even tougher for the sufferers to accept. Though some recovery is possible but the amount of recovery is very small and rare to happen because the recovery depend upon some critical factors as well as depends on the present treatment system capacity [29 - 30].

The cruellest truth is for the injured spinal cord patient because human could not heal by itself. That is being aforesaid by doctors, there is no real "cure" for spinal cord injury or paralysis. When the damage occurred in the spine, the damaged area of the spinal cord no longer has the power to convey messages between the brain and other parts of the body. But why these kind of injuries can't can heal by themselves, as some do in other parts of the body. This is mainly the point theory of this systematic review study. As mentioned before, injuries to the spinal cord are extremely complicated, and affect highly individual cells that are so specialized they are unable to repair or regenerate. So the spinal cord can't heal itself like the other parts of our bodies. Now a days advanced technologies such as Brain Computer Interfaces (BCI) helping to innovate scientific miracles, making lives easy

and leading the globe to a more sustainable earth for living [31 - 32].

B. How Paralysis Happens

When someone want to pick up a pen, the brain which is where the command center of the body sends the electrical signals to the subjects arm and it just follow the command to do that. At the same time, from the subject's hand, an electrical impulses or the response will go back to his brain to pass on the information about the weight, temperature, and texture of the cup. Finally this information allows the brain to realize the exact required grip strength, the amount of time it can be held and the ease of holding it which brain sends back the information to the hand again. But in case of people struggling with paralysis this scientific breakthrough is fascinating. Because this information exchanging is completely relayed back and forth through with the nervous system. When a spinal injury occurs it means a major break happened in the line of exchanging information's so that information's cannot be exchanging between brain and spine, therefore, victims hands or fingers or legs or toes do not know how to move so they turn to paralyzed. This Spinal cord injury caused paralysis can have a big destructive effect on individuals or on family relationships which later on lead to a higher rate of separation or divorce. Paralysis will affects the individual's genital and its sexual functioning. The partner tends to become frustrated with the continuation of a burden relationship over a period of time, especially when if he/she is playing the vital role of a caregiver too. This situations tends to destroy the family, the love relations for the individual with paralysis in many cases [33].

C. Reversing Paralysis - How It Works ?

This year, the scientists intended to build the re-bridging again to minimize the gap in the central nervous system between the brain and the spinal cord by using two implants (computer chip) one in brain another in spine cord.

- a. A person with spinal cord injury if thinks to about twisting his toes, this message travels from the brain down the spinal

cord, but fails to reach its destination.

- b. A brain implant of 16 electrodes implanted over the lower spinal cord awakening dormant neurons that carry the message to the lower spinal cord and stimulates the circuitry that controls the lower body zone.
- c. The wireless electrode arrays works from remotely by connected to the brain stimulator (small device like pager), implanted in the abdomen just below the skin.
- d. The brain stimulator contains programs that evoke various neural circuits. Different combinations of electrodes with different frequencies, voltages enable different movements.
- e. A hand-held remote allows the user to select which circuits he wants to stimulate through implant—for example, left toes or right leg. If this research methodology is found effective at treating paralysis, there are many diseases and conditions for which this method which it could brings hope [34 - 35].

V. RESEARCH METHODOLOGY

This research study has been followed by qualitative systematic research review methodology. Qualitative Systematic Reviews have achieved pertinence in the world due to its reliability in the investigation, arranging, assembling, and analysis of the information acquired from research about health interventions, during a period of time [36].

For research design of this systematic review, the researchers followed some steps to address some specific research problems by exploring and modifying of research questions, designing of literature inclusion and exclusion criteria, identifying evaluating and incorporating the findings of all high-quality literature of individual studies investigating one or more research questions. Systematic review can constitute the value to what stage present research has advanced towards elucidating a specific issue or problem; It explicate gross statements through right justification, measure

and extend, or constitute a theory, doing such things, furnish the significance for practice and policy [37].

D. Research Design

To conduct this qualitative systematic review study, a strong review protocol developed by PICO mnemonic concept with clearly research questions and inclusion criteria which will give a solid foundation for this review study. The following steps have designed to carry out the research to a possibly expected result.

1) Step: 1 - Identification of Research Question

To identify the research problem we have developed some research question based on PICO mnemonic concept:

- i. What is reversing paralysis technology?
- ii. How reversing paralysis works?
- iii. Is it effective in treatment of paralysis?
- iv. Is this technology safe for patients?

2) Step: 2 - Data Search Method

a) Keyword Search

For analysis of above research questions followed PICO concept regarding Reversing Paralysis technology and its successful clinical trial cases, a better conceptualized keyword based search strategy has been developed and employed to broaden the search results which is the core of any systematic review study. TABLE I represents the initial keywords logic grid for searching scientific literature's [38].

TABLE I. KEYWORDS CONCEPTS ALIGNED WITH PICO ELEMENTS

Population	Intervention	Comparison Intervention	Outcome Measures
Paralysis	Physiotherapy	Wireless Brain Implant	Improve voluntary movement
Neurological Disorder	Stem cell therapy	Brain computer Interface (BCI)	Regain muscle movement
Traumatic Brain Injury	Acupuncture	Brain-machine interface (BMI)	Regain lower extremity movement
Spinal Cord Injury	Assisted Mirror Therapy	Functional Electrical Stimulation (FES)	Weight bearing mobility
Hemiplegia/ Paraplegia	Oxygen Therapy		

b) Data Sources

For collecting of specific research papers or literature's based on genuine experimental data and clinical trial data's based on keywords database presented in Table-1, to find out answers of research questions we have carefully searched databases named as - MEDLINE Database, PubMed database, Google Scholar database, and Google Search.

3) Step: 3 - Inclusion, Exclusion, & Data Extraction

From searching of above mentioned databases researchers primarily identified 132 research papers related with keywords, from which after performing a comprehensive analysis, finally 52 research materials has been selected consisted of thirty Seven (36) peer reviewed literature's, twelve (12) scientific/tech based news review sources and four (4) authentic clinical trial results performed in the context of as whole Reversing Paralysis Theory.

VI. SUCCESSFUL CLINICAL TRIAL DATA COLLECTION

E. Clinical Trial Case Study-1:

The clinical trial report published in May 2011 in the British medical journal The Lancet. One (1) paralyzed male volunteer Rob Summers was involved in the trial. He was totally paralyzed below the chest since year 2006 before experiment. Through the clinical trial of 26 months, 170 locomotor training sessions given and a 16-electrode array was surgically placed on the dura (L1-S1 cord segments) to ensure a chronic electrical stimulation. Each stimulation session lasted up to 250 minutes, 29 experiments combined with several stimulation combinations and parameters employed on patient to make him able to reach a standing position, supplying the muscular push by himself. He can remain standing, and bearing weight, for up to four minutes at a time, patient can also willfully move his knees, ankles, toes, and hips on command [39].

The experiment was done through a continual epidural electrical stimulation given to patients lower spinal cord as same as how the

brain send signals to spine to initiate movement. Once signal is given by implant, the research shows, the neural network of spinal cord combined with the sensory input created from the legs to the spinal cord, is being capable to guide the muscle and joint motility necessary to stand and foot-step with assistance on a treadmill, "Fig. 1".



Fig. 1. Patient Rob Summers, Clinical, Source University of Louisville, UCLA

This clinical trial by BCI implants regain the lost connection between brain and spinal cord and established the brain - spinal cord communication that leads the patients move again. Here scientists claim for effectiveness of this theory proved. The research centre name was University of Louisville, UCLA, The California Institute of Technology & The Pavlov Institute of Physiology in St. Petersburg, Russia and was funded by The Christopher and Dana Reeve Foundation and The National Institutes of Health. Lead researchers was Susan Harkema (University of Louisville's Department of Neurosurgery, Kentucky Spinal Cord Research Center and Frazier Rehab Institute) & V. Reggie Edgerton (Division of Life Sciences and the David Geffen School of Medicine of University of Louisville, UCLA) [39 - 40].

F. Clinical Trial Case Study-2:

The clinical trial report published in Nature Journal in April, 2014. Four (4) paralyzed male volunteer patient name: Rob Summers (Poland);

Kent Stephenson (Mt. Pleasant, Texas); Andrew Meas (Louisville, Ky); and Dustin Shillcox (Green River, Wyo) was participated in this trial. Before starting experiment patient volunteers were classified as suffering from chronic, motor complete spinal cord injuries and were incapable to move their lower extremities [41]. In this trial the medical device used for the treatment was the same as the previous trial - epidural electrical stimulation, which implanted on spinal cord as a BCI interface. After receiving stimulation, four patients were able to perform voluntary movements instantly next to the implantation and activation of the stimulator. The observation was, four paralyzed patients started to move toes after the stimulation given. So the claim here that scientists made for effectiveness of this theory has proved successfully that BCI interfaces between brain and injured spinal cord of paralyzed patient can reverse the paralyzed condition, "Fig. 2".



Fig. 2. Four patients of clinical trial. Source University of Louisville, UCLA

The Research Centre Name: University of Louisville, UCLA, & the Pavlov Institute of Physiology, St. Petersburg, Russia. This research funded by: The Christopher and Dana Reeve Foundation and The National Institutes of Health. Lead Researchers: Susan Harkema (University of Louisville's Department of Neurosurgery, Kentucky Spinal Cord Research Center and Frazier Rehab Institute) & V. Reggie Edgerton (Division of Life Sciences and the David Geffen School of Medicine of University of Louisville, UCLA) [42].

G. Clinical Trial Case Study-3:

The clinical trial report published in Nature Journal in May 2016. Two (2) Rhesus macaque monkey was employed in the clinical trial. Research said spinal cord injury interrupts the connection between the brain and the spinal networks that initiates movement. Brain-computer interfaces (BCIs) able to connect to muscles by bypassing the lesion give electrical stimulation to create cortical activity therefore can restored the grasping ability of a hand paralyzed patient. Theoretically, this method could also able to restore the lost control over leg muscle activity for walking. [43]

An Intracortical microelectrode array were used as implant in Rhesus monkeys (*Macaca mulatta*) leg motor cortex area with a spinal cord stimulation system composed of an epidural implant and a pulse creator with real-time initiation capabilities. A wireless connection joined the two electronic devices of epidural implant integrated in the brain-spine interface connected for neural decoding of extension and flexion motor states with stimulation protocols arises these movements, "Fig. 3". These total brain computer interfaces allowed the monkeys to act freely with no limitation or restricting tethered electronics.

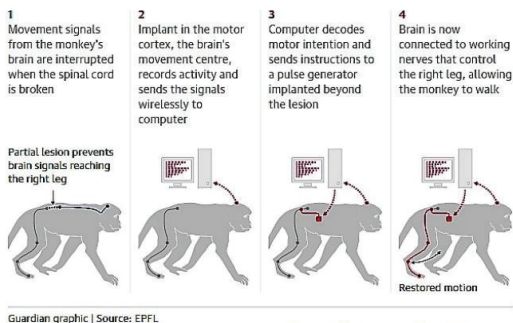


Fig. 3. Rhesus macaque monkey Clinical trial With Wireless Brain Implant and Spinal Implant. Source: EPFL

After validation of brain-spine interface in uninjured monkeys an unilateral corticospinal tract lesion created at its thoracic level. After six days of post-injury, researchers found that the brain-spine interface restored fully load-bearing mobility of the paralyzed Rhesus monkeys leg on a treadmill and over ground

without any early training and its achieved by wireless implant integrated in in brain-spine interface.

All components integrated to the implant in the brain-spine interface have all been authorized for similar research investigational applications in human. This trial suggesting a practical translational pathway for proof-of-concept studies in human subjects with spinal cord injury. Research Centre Name: École polytechnique fédérale de Lausanne (EPFL) Swiss Federal Institute of Technology Lausanne, Lead Researchers: Jocelyne Bloch & Gregoire Courtine [44].

H. Clinical Trial Case Study-4:

The clinical trial report published in Nature Journal in August 2016. The Research Centre Name is Duke University Medical Center. The researchers, led by neuroscientist Miguel Nicolelis, director of the Duke University Center for Neuroengineering. In this clinical trial eight paralyzed people were participated who got paralyzed due to spinal cord injury. They have retrieved muscle control over their lower limbs and partial sensation after training with brain-controlled robotics, reported to a new study.

The patients gone through a brain-machine interfaces (BMIs) as a part of trial, including a virtual reality system that used their own brain activity to simulate full control of their legs. Brain-machine systems established direct connection between the patients brain and computers and the robotic limbs.

Researchers working of this trial offers prospect to people of stroke, spinal cord injury, and other conditions to regain mobility, strength, and independence. Among the patient participatos of this trial five participants had been paralyzed at least five years; two had been paralyzed for more than a decade and one patient was paralyzed for 13 years who have experienced possibly the most dramatic changes [45].

Following 12 months of training in the clinical trial with setup, all eight patients experienced satisfactorily neurological betterment in pain determination, touch sensation, and proprioceptive sensing in multiple

organs. Patients also retrieved voluntary motor control in key muscles of paralyzed areas, resulting in marked improvement in their walking index. As a consequences, 50% of these patients were improved to an incomplete paraplegia stage.

Neurological recovery was paralleled by the emergence of lower limb motor imaging at cortical level. Researchers hypothesize that this unexampled neurological recovery results from both spinal cord and cortical sensitivity induced by long-term brain-machine interface usage, "Fig. 4" [46].



Fig. 4. Clinical Trial Lab Images, Duke University Medical Center.

VII. RESULTS & DISCUSSION

A. Results

Researchers have been able to achieve a clear understanding about the hypothesis of Reversing Paralysis Technology. From reviewing of the case based medical research literature's and clinical trials positive results, it has established primarily the fundamental proof-of-concept for Reversing Paralysis Technology as research question answers found satisfactory.

Results Summary:

Number of Successful Clinical trials presented in the study: 04

Success Rate: All hypothesis have proved successfully

Research Remarks: Clinical trial results are Successful

Evidence of effectiveness: Evidence of effectiveness and safety of hypothesis established.

B. Observations:

While analyzing the research literature's and news sources, and expert reviews regarding the overall BCI technology facts and findings, researchers have observed some censorious issues those must need to settle by BCI researchers before doing further research on Reversing Paralysis theory. Some issues are :

1) Brain Computer Interface Vs Brain Machine Interface

One issue regarding to the Clinical Trial Case Studies presented in this paper need more clarification. Among the four clinical trials first three clinical trials were performed by Brain Computer Interface technology where brain stimulation sent from brain implant and received by spinal implant in paralyzed individuals to re-establish the lost brain - spine communication and movements.

On the other side the forth clinical trial stated here were performed by Brain Machine Interface technology where extracellular brain activity recording (EEG signal) by computer and computers then sent control command to controlled robotic limbs that covered the paralyzed legs of patient and patients retrieved muscle control and sensation again.

Both idea connecting the human brain and artificial intelligence and working as supportive theory for reversing paralysis. One is wireless device (BCI), another is machine (BMI) to produce a successful connection between human brain . Brain-computer interfaces (BCIs) and Brain-machine interfaces (BMIs) both are potent ways to restore lost motor or sensory function. However, through Brain-computer interfaces (BCIs) technology several patients have been benefited till to date. Further extensive research required for both technology [47].

2) BCI Technology Is Challenging in Human than Monkeys

Applying the technology to humans will bring many more challenges than using it in monkeys. Because in BCI interfaces the signals stimulation need to travel a long way to go reach to brain implant because the exact

position of the brain area engaged in motor cortex or body movements is a is difficult to isolate in humans. The leg movement control region of the brain is much deeper inside the human brain in compared to monkeys. Since the body movement is not only controlling legs, but also a complex combination of brain with proper visualization for meaningful movement therefor enabling motility in the legs is also much more complex. Need advanced extensive study on this to resolve this [48 - 49].

3) *Protests against Animal Use in Scientific Experiments*

Experts agree on the need to acquaint more ethical standards for the use of animals as scientific experiments. The use of primates in scientific experiments still remains a major topic for discussion and litigious issue that raises serious ethical and practical concerns. Numerous animal rights activists groups are actively trying to enforce a ban on such scientific experiments in the united states and in Europe [50].

4) *Ethical Issues for Legal Use of BCI*

BCI researchers has been encountered some critical questions that go beyond strict regulatory matters, such as BCIs usage whether admissible to treat patients when their informed consent cannot be obtained.

A nother censorious issue is a student could use the BCI device for communication or think the answers of a quiz or exam and breach the role of public examination by letting other students hear the answers.

In addition with all issues presented above, BCI researchers also need to combat with this legal issue. BCI technology can be unfairly used in sports. Any person could also use this BCI device sports running by sending information's to players regarding plays or moves of other players giving them an apparent advantage in game-play [51 - 52].

VIII. DISCUSSION

C. *Evidence of Effectiveness & Safety Ensured*

Reversing paralysis theory has not established by one or few scientific research.

After a huge investment in clinical trials and limitless research efforts by world renowned neurosurgeons the evidence of effectiveness and safety of reversing paralysis technology has been established through Brain Implants - Brain Computer Interface experiments. By using brain computer interfaces as implants to brain and spinal cord, paralogics can move again after many years passing with spinal cord injuries [53]. This research of reversing paralysis showing lights of millions hope. Still it it highly needed to do further researches to bring this technology service in easy health-care access for millions of paralogic patients worldwide.

IX. CONCLUSION

Conducting a systematic review highlights the usefulness of bringing together a summary of many reviews in one place, where more than one review takes place foe a fixed important topic. The research method delineated here will avail health-care professionals to evaluate and review published literatures systematically, and assist them in evidence based treatment purpose. Future research should address several unresolved issues. This review has been developed on very limited clinical data's though it can be said undoubtedly that these clinical trial data's are extracted from authentic sources research papers and clinical trials.

Therefore this theory is going to be an extraordinary invention to treat paralysis within next 10-15 years. Though it would might be take another decade to be complete the technology and to come in full active treatment phase, but scientists are making consistent progress in this clinical research using wireless brain implants which are being used for the restoration of motion that lost by any injury to spinal cord. This qualitative systematic review study primarily establishes the efficacy and evidence of effectiveness of Reversing Paralysis Technology for the possible future treatment of Paralysis. More extensive scientific research are necessary in this context to achieve the research purpose completely and to establish the supreme efficacy of this treatment as if people can be befitted from this Reversing Paralysis Technology.

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