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Effect of Sacral Nerve Stimulation on Detrusor Overactivity among Spinal Cord Injury

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Abstract

Background and aim: Spinal cord injury is still a leading cause of disability. Nowadays, there is a high level of illness and death. According to the National Spinal Cord Injury Statistical Centre, every year, 40 new instances per million people are documented. Over 80% of these people have some form of bladder dysfunction. Some studies suggest that sacral nerve stimulation can help with bladder dysfunction. Hence, this study was aimed to identify the benefit of sacral neuronal activity on detrusor over activity among spinal cord injury.
Material & methods: This pilot test was analysed at the Saveetha Institute of Medical Science and Technology (SIMATS). For a four-week period, 15 patients with post-spinal cord injury were chosen. Patients were evaluated with overactive bladder symptoms score before the initiation of treatment. The patients were given with sacral nerve stimulation for 4 weeks 2 sessions per day. After 4 weeks of intervention patients were assessed with overactive bladder symptoms score as a posttest value.
Result: The statistical analysis revealed a statistically significant improvement. The sacral nerve stimulation has been demonstrated to be efficacious in curing detrusor overactivity caused by spinal cord damage.
Conclusion: This study emphasizes that sacral nerve stimulation improves bladder function in people with spinal cord injuries.

Keywords

Detrusor overactivity, Overactivity bladder, Spinal cord injury, sacral nerve stimulation, overactive bladder symptoms score

Introduction

A spinal cord injury (SCI) is a spinal cord injury produced by an insult that impairs its function, either completely or partially. Most important duties (sensorimotor, autonomic, and motor response systems). Injury of spinal cord is still one of the leading risk factors. At recent times, there is a high level of illness and death. Approximately 8,000–10,000 persons are affected by traumatic SCI. In the U.s, each year Furthermore, the cost to the individual's health as well as the cost to the individual's physical well-being society and the healthcare system SCI has a huge financial impact. Primary injury has four distinct mechanisms; Impact with temporary deformation, loss of concentration, and transection are all examples of constant tension.

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Additional mechanisms comprise excitotoxicity, calcium-mediated supplementary damage and liquid abnormalities, immune cell injury, cell death, mitochondrion function disruptions, and other mechanisms (Dumont RJ, et al., 2001, Dumont RJ et al., 2001) Spinal cord injury (SCI) can occur as a result of occlusion or illness, or as a result of a spinal column fracture following a car accident or trauma. The most common urologic outcomes of SCI include urinary infection (UTI), upper and lower urinary tract degeneration, and bladder or renal stones. According to the National Spinal Cord Injury Statistical Center, every year, 40 new instances per million people are documented. Over than 80% of these persons have some sort of bladder impairment (Al Taweel W et al., 2015).

Detrusor overactivity is defined as uncontrollable detrusor twitches that occur spontaneously or in response to a stimulus since the filling phase, whereas DSD is defined as a detrusor response followed by spontaneous urethral and/or periurethral striated muscle spasms. SCI-related neurogenic urinary dysfunction (SCI) is a major health and psychosocial issue with no effective treatment. Following suprasacral SCI, cerebral regulation over the sacral reflexive micturition centre is disrupted and the vast majority of people develop neuropathic detrusor dysregulation (NDO) and/or DSD (Al Taweel W et al., 2005, Abrams P et al., 2002). Oral anticholinergic medications, such as oxybutynin and tolterodine, are often the first NDO treatments. To empty the bladder and reduce leftover urine, this therapy is frequently combined with sterile intermittent self-catheterization. However, many people develop tolerance to the drug or experience negative effects from the daily dosage. When traditional treatments fail, alternative remedies are tried. These treatments include -adrenoceptor antagonists taken orally, capsaicin or resiniferatoxin injected intravenously (Hesch K. et al., 2007), Injections of botulinum toxin into the detrusor muscle (Schurch Bet al., 2000), bladder augmentation cystoplasty (Quek ML, et al., 2003), and detrusor deafferentation (Hohenfellner M, et al., 2001) are all options.

Neurogenic detrusor overactivity is linked to suprasacral spinal cord injury (SCI) (NDO), and also motor and sensory impairment just under the level of injury (Taweel, W. A., et al., 2015). Most SCI patients undergo filling cystometry to evaluate functional capacity and intravesical stress in order to develop the bladder programme. Filling cystometry is used to examine the bladder's pressure/volume correlation during filling phase.The technique was carried out at a non-physiological rate using a Dantec Etude urodynamic device. The bladder was entered transurethrally with a double lumen 8F catheter. During terminal detrusor hyperactivation, cystometric potential (CC) and leak spot intravesical tension (Pves LPP) were measured (a single, involuntary detrusor contraction occurring at cystometric strain that can only be inhibited and results in incontinence) (Moslavac S, et al., 2008). Neurogenic overactive bladder (nOAB) has an unclear prevalence and incidence. This review of literature discovered nOAB survey data and measured the occurrence of urine incontinence (UI) and detrusor overactivity (DO) (Ruffion A,et al., 2013) in people with spinal injury (SCI), Parkinson's disease (PD) (Winge K,et al., 2006) , cerebrovascular disease, and spina bifida (vanGool JD, et al., 2001) .

The overactive bladder symptoms score is a tool for evaluating symptoms that uses a single score to characterise OAB symptoms. The questionnaire includes four questions about OAB symptoms, with maximum scores of between 0 to 5, as well as questions about daylight hours intensity (2 points), night-time intensity (3 points), urgency (5 points), and overactive bladder (5 points). The overall score ranges from 0 to 15, with higher numbers identifying more serious illnesses (Chuang FC, et al., 2018) . The Overactive Bladder Symptom Score (OABSS),

a single score used to characterise overactive bladder symptoms, was evaluated for sensitivity and minimal clinically significant change (MCIC) (Gotoh M, et al., 2019).

Several non-neurogenic complaints of the lower urinary tract, including overactive bladder syndrome, are treated by sacral nerve stimulation, notably of the S3 spinal nerve (Doherty, S., et al., 2019).

Methodology

Participants and selection criteria:
Inclusive criteria:

- GENDER: Both male and female
- AGE GROUP: 20 years and above.
- Patients with bladder dysfunction.

Exclusive criteria:

- Subjects with recent surgeries or injuries
- Subjects with infections.

This was a pilot study in which 20 patients with post-spinal cord injury were chosen based on sample selection. 15 samples were collected from the neuro IP and physiotherapy OPD. Study setup was Saveetha College Medical College and Hospital. The study included both men and women with bladder dysfunction. They were examined by using an overactive bladder symptoms score. The detailed procedure of treatment was explained to the patients. The patients were made to feel comfortable with procedure after explanation. The demographic details are collected with permission of the patients, who also provided a consent form for treatment. Transcutaneous electrical nerve stimulation was used to stimulate the sacral nerve for 4weeks 2 sessions per day. The electrodes were placed over the sacral foramen, with the patient positioned on prone lying and the intensity was given up to the patient's tolerance.

Results and Discussion

A group of 15 participants is being used as a test group for the study. The data's mean and standard deviation was determined. The paired t-test was used to compare the values in between sacral nerve stimulation. The frequency of urination was compared using overactive bladder symptoms score. A p-value slightly lower than 0.001 was deemed relevant. With a value of p=<0.001, the data obtained are statistically significant between pre-test and post-test. According to the result of statistical analysis of the quantitative data. Sacral nerve stimulation has been shown to aid patients suffering from urinary incontinence since a spinal cord injury. The test was evaluated by using overactive bladder symptoms score outcome measures, progress has been observed in all tests.

Table 1: Shows the comparison of pre-test and post-test values

	Mean	**SD**	**W-value**	**Z-value**	**P-value**
Pre-Test	10.00	13.00	-120.000	-3.430	<0.001
Post-Test	5.00	6.00			

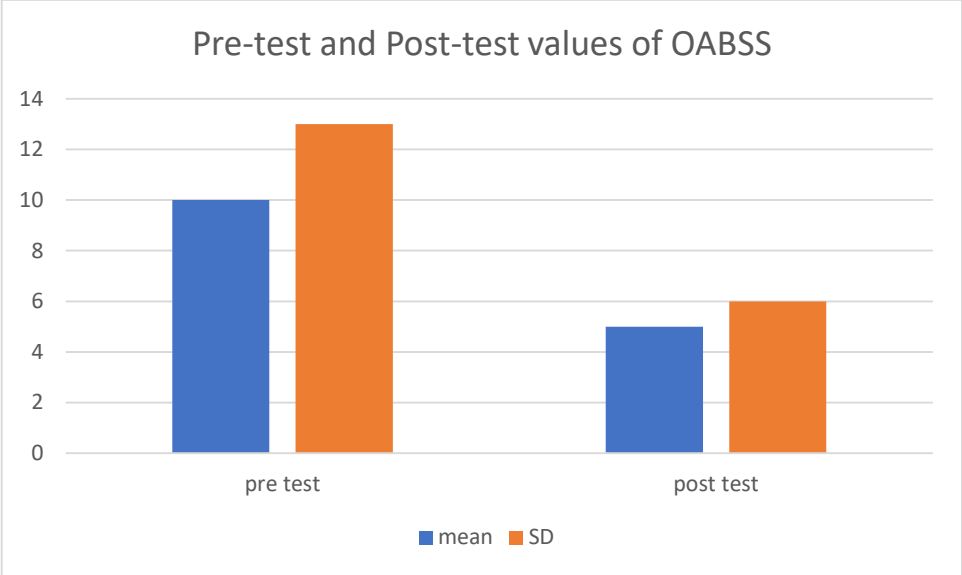

Figure 1: Shows the pre-test and post-test values overactive bladder symptoms score

The study assessed the impact of sacral neuronal activity on detrusor hyperactivation injury to the spinal cord patients, and found that there was a considerable reduction in bladder dysfunction. In this study, 15 participants including 7 males and 8 females aged 20 years and above, were chosen and considered with sacral nerve stimulation for 30 minutes alternate days of 4 weeks. The significance of transcutaneous sacral nerve stimulation in reducing the impact of detrusor overactivity was determined using paired t-test which revealed the significance of p= <0.001.

Sacral nerve stimulation is used to regain voluntary control over aberrant sensations and uncontrolled responses in the lower urinary system. Sacral nerve stimulation affects sacral afferents and modifies lower urinary tract reflexes and brain centres. The stimulator delivers charged particles to the sacral nerve. causing brain activity to change. The neuron is depolarized by this stimulation, which causes an action potential to travel down the axon. The SNS sends messages to the central nervous system by electrically stimulating cutaneous sensory nerves in a sacral nerve stem, which may aid in bladder regeneration (Malde, S., et al., 2017).

In 2001, Kamm MA, et al., conducted their research Sacral nerve stimulation can be used to treat faecal incontinence, especially urge faecal incontinence coupled with urine urgency. The effect of sacral nerve stimulation on striated sphincter function appears to be confirmed in this investigation.

In 2014, Shalom DF, et al stated that subjects with detrusor overactivity revealed considerably higher baseline urine nerve growth factor levels. Seventeen DO individuals received percutaneous nerve examination and were evaluated at the end of the testing period. Subjects' quality-of-life assessments improved significantly after PNE compared to baseline. uNGF levels also reduced considerably following PNE.

In 2010, Siddiqui NY, et al., performed a study According to observational data; sacral nerve stimulation appears to be effective in curing OAB in women. Adverse reaction rates are much lower with tined leads than with non-tined leads, according to previously published

estimates. High-quality research is needed to back up our findings and provide additional information on reconditioning, quality of life and efficiency in contrast to alternative therapies. Few limitations due to the study was done in a short time with a small number of subjects. No proper follow up data was collected. To make the study more valid, a long-term study with a large sample size is recommended. Further studies are recommended to analyze the effect of other modified exercise regimen such as functional electrical stimulation in the overall functional level of spinal cord injury (Suganthirababu at al.2023).

Conclusion

The study concluded that sacral nerve stimulation has provided a greater relief for patient suffering from incontinence after spinal cord injury.

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