Urodynamic Effect of Percutaneous Posterior Tibial Nerve Stimulation for Urinary Incontinence in Paraparetic Patients

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Abstract

The **purpose** of this study is to evaluate the effectiveness of Percutaneous Posterior Tibial Nerve Stimulation (PPTNS) in treatment of Urinary Incontinence in Paraparetic Patients. Dorsal level from T_7 to T_{12}. **Thirty** traumatic Paraparetic patients of both sexes were selected for this study. Their age ranged from 25-40 years, their weight ranged from 60 to 88kg and their height ranged from 155-180. They were randomly divided into two equal groups; **GI** is a control group was treated by physical therapy program for bladder training and placebo PPTNS, **GII** is an experimental group was treated by the same physical therapy program in addition to PPTNS. All subjects received the **treatment** program for 40 minutes, three days per week day after day for 12weeks. All patients were **assessed** by Modified Ashworth Scale for muscle tone grade3, biofeedback for pelvic floor muscle, Electromyography for detrusor and pelvic floor muscles, urine testing and bladder residual volume measured by cystometry, testing in all patients were done before initiating conservative treatment and after the end of treatment program. Electrical stimulation was applied to posterior tibial nerve stimulation. **The results** showed that, there was a statistically significant improvement in GII than GI, regarding all variables (*P* <0.001). **Conclusion:** PPTNS is an effective method in treating urinary incontinence in Paraparetic patients and consider as a treatment modality filling the gap between conservative and surgical therapies in patients with certain types of urinary incontinence.

Key words:

Percutaneous Posterior Tibial Nerve Stimulation, Cystometry, Biofeedback, Electromyography, Urinary Incontinence, and Paraparesis.

Introduction

Paraparesis refers to partial loss of voluntary motor function in the pelvic limbs. Paraparesis generally results from spinal cord lesions caudal to the second thoracic spinal cord segment. Trauma and neoplasia are the most common spinal cord diseases. Urinary and fecal incontinence often occur concomitant with paresis, general concepts relating to disorders of micturition[1].

After spinal cord injury the bladder, along with the rest of the body, undergoes dramatic changes. Since messages between the bladder and the brain cannot travel up and down the spinal cord, the voiding pattern described above is not possible. Depending on the type of spinal cord injury, your bladder may become either "floppy" (flaccid) or "hyperactive" (spastic or reflex) [2].

The detrusor muscles in a hyperactive bladder may have increased tone, and may contract automatically, causing incontinence (accidental voiding). Sometimes the bladder sphincters do not coordinate properly with the detrusor muscles, and medication or surgery may be helpful. Also, the bladder cannot be able to empty when it becomes full. The problem is that person cannot feel or control this reflex, so either leak urine or urinate involuntarily (urinary incontinence), this one typically occurs when the SCI is above the T12 level[3].

With a flaccid or non-reflex bladder, the reflex that triggers the bladder to empty is either non-existent or sluggish at best. When this happens, the bladder may become so distended that urine backs up into the kidneys, which can cause a kidney infection or the bladder may not empty completely and retain urine, this type usually occurs when the SCI is at or below the T12-L1 level[4].

Incontinence has several subtypes: stress incontinence, mixed urinary incontinence, overflow incontinence, and transient incontinence[5]. Transient incontinence may be related to delirium, infection, atrophy, pharmaceuticals, psychologic factors, excess urine output, restricted mobility, or stool impaction[6]. More than 40% of people with overactive bladder have incontinence[7].While about 40% to 70% of incontinence is due to overactive bladder[8], it is not life-threatening. Most people with the condition have problems for years.

Individual with SCI and associated bladder problems will need a urinary catheter to manage their bladder problems[9]. Someone who has a spastic bladder may use a single-use, intermittent catheter or indwelling (Foley) catheter[10]. Males may choose to use an external condom catheter instead. Those with a flaccid bladder typically self-cath with intermittent catheters[11]. Complications of bladder problems resulting from SCI include urinary tract infections, sepsis, dyssynergia, kidney stones or bladder stones and bladder cancer in those who use indwelling catheters for a long period of time[12].

Fortunately, treatment of urinary incontinence decreases the incidence of urinary tract infections and skin irritation and infection. Recently, intermittent percutaneous posterior tibial nerve stimulation was introduced as a treatment modality filling the gap between conservative and surgical therapies in patients with certain types of lower urinary tract dysfunction[13].

The pelvic floor consists of the bony pelvis, endopelvic fascia, and muscle. From a urodynamic perspective, the pelvic floor muscles contribute directly to continence by assisting with urethral closure during bladder storage, and indirectly by providing support for the lower urinary tract and adjacent organs, including the rectum and the uterus and vagina in women[27]. The primary pelvic floor muscle is the levator ani, which is sometimes subdivided into the pubococcygeus and ileococcygeus. Other pelvic floor muscles include the urethrovaginal sphincter, compressor urethrae muscle, ischiocavernosus, and bulbospongiosus[15].

The pelvic floor muscles serve as a dynamic backboard that along with passive support from the bony pelvis and endopelvic fascia, maintain the pelvic organs in their abdominopelvic positions. The pelvic floor muscles also contribute to continence by enhancing urethral closure via rapid contraction during coughing, sneezing, or physical activity. Nevertheless, the rhabdosphincter muscle is primarily responsible for urethral closure during bladder filling and storage[16].

Because of pelvic floor muscles contribution to continence, the measurement of pelvic floor muscle function is considered an integral component of a comprehensive urodynamics evaluation, especially when neurologic, gynecologic, or trauma-related factors impair lower urinary tract function, standard urodynamics testing uses EMG to evaluate pelvic floor muscle activity[17].

Biofeedback is a technique developed over the last three decades which is indicated to teach subjects to bring certain physiologic processes under voluntary control. Application of this technique primarily directed toward disorders that were thought to include a component of stress, psychosomatic or psycho physiologic features[18].

Many patients have difficulty identifying, controlling and co-coordinating the function of pelvic floor muscle group, when verbally instructed in pelvic floor exercises, patients may perform them ineffectively, with biofeedback these exercises are performed with simultaneous electromyographic feedback given to the patients to help facilitate awareness of the state of muscle contraction, therapy uses an electronic or mechanical devices to relay visual or auditory evidence of pelvic floor muscle tone to improve awareness of pelvic floor musculature to assist patients in the performance of pelvic floor muscle exercises. Biofeedback has proven helpful in addressing many conditions, among them high blood pressure, depression, headaches, chronic pain, and urinary incontinence[19].

Material and Methods

Subjects

Thirty Paraparetic patients of both sexes were selected for this study from the outpatient department Urology, Neurology and Neurological Rehabilitation, Armed Force hospital, Najran. Patients age ranged from 25-40 years, with a mean value of 35.2(±1.1) years, their weight ranged from 60 to 88kg, with a mean value of 75.4(±1.4) kg and their height ranged from 155-180cm, with a mean value of 164.6(±7.1) cm, the patients were randomly and equally divided into two groups .**Group (1)** : was a control group and consists of 15 patients of both sexes, was treated by physical therapy program for bladder training (strengthening exercises for abdominal and pelvic floor muscles, tapping, percussion pressure and scratching and brief icing on lower abdomen) and placebo PPTNS and **GII** is an experimental group was treated by the same physical therapy program in addition to PPTNS. All subjects received the treatment program for 30 minutes, three days per week day after day, for 12weeks. All patients were **assessed** by Modified Ashworth Scale for muscle tone grade3. Basic assessment includes investigations such as biofeedback for pelvic floor muscle, Electromyography for detrusor and pelvic floor muscles, urine testing by cystometry and bladder residual volume measurement, testing in all patients were done before initiating conservative treatment and after the end of treatment program. Electrical stimulation was applied from the medial malleolus and posterior to the edge of the tibia by using 200 microsecond pulses with a pulse rate of 20 Hz for 30 minutes. **Inclusion criteria**: Thirty Paraparetic patients of both sexes. All patients were medically stable by measuring vital signs which include (blood pressure, temperature, pulse rate and respiratory rate) .All patients were conscious, co-operative, medically, neurologically and psychologically normal, had no disability secondary to orthopedic problems or surgery. All patients had no impairment of general or special senses. **Exclusion criteria:** The exclusion criteria were detrusor sphincter dyssynergia, sacral peripheral nerve lesions, urinary tract infection, serious secondary disease, marked prostatic enlargement on digital rectal examination, bladder stones, pregnancy, diabetes mellitus, and severe cardiopulmonary disease. Patients with a history of previous continence surgery, current bladder malignancy, high-grade dysplasia, or carcinoma, severe degree of disabilities, patients having complications, psychological unstable , non co-operative patients during assessment of the research were excluded from the study.

Evaluation Procedures: A- EMG Neuropac. . B-Cystometry (MMS Solar Digital Urodynamic Device, Dover, N.H). C-Biofeedback. C-Lafayette tensiometer.

Electromyography (EMG) Unit: It contains of EMG apparatus, Disposable surface EMG electrodes and Data processing computer unit. The neuro pack S1 MEC-9400K, 4 channel EMG/EP system, disposable and radiolucent electrodes. **Electrodes:** The electrodes were self adhesive with active surface area of 1cm^2 in diameter. The electrodes consist of plastic foam material with a silver plate disc on one side and silver plate snap in the center on the other side. Early released protective sheet is placed over the electrode side to keep the electrolyte part of the disc in its position. The electrodes were connected to EMG apparatus channel. Evaluation procedures: Patient's preparation before putting EMG electrodes over the skin for each patient, it should be shaving the hair at the picking areas and cleaning it by alcohol to remove the dead layers of the skin in site of EMG electrodes (detrusor and pelvic floor muscles). Electrodiagnostic Test: Technical steps of application EMG including; electrode placement, skin temperature correction, determination of nerve stimulation intensity and analysis of the evoked neuro- electrical response. The system comprises an electronic monitor and a report generation system. The registry stores all electrophysiological data including raw wave forms and limited demographic information (age, height, weight and gender).

Pelvic floor muscle: Pelvic floor muscle EMG may also be measured by surface electrodes. The ideal surface patch for urodynamics testing will adhere to the anal mucosa, adapt well to the complex skin and mucosal surfaces of the anus.

Urodynamic Measurements (Incontinence testing):Cystometry: was performed with the patient in the supine position (MMS Solar Digital Urodynamic Device, Dover, N.H.). Intravesical and abdominal pressures were measured with double lumen 8F air-charged catheters with a rectal balloon (T-DOC Company, Wilmington, Del). Cystometry was performed with normal saline solution at room temperature. The filling rate was 50 mL/min. Volume at the first involuntary detrusor contraction and volume at maximum cystometric capacity (MCC) were noted. Second cystometry was performed immediately after posterior tibial nerve stimulation at a 50-mL/min filling rate. The detrusor pressure was calculated as the difference between the intravesical and abdominal pressure. A comparison was performed between volume at the first involuntary detrusor contraction and at MCC for standard Cystometry and for Cystometry during PTNS. MCC was defined previously for the patient with urge urinary incontinence[13]. Also, in our study the patient was taken to a point where he/she would leak urine, and volume infusion was not stopped when the patient was anxious. Routine Cystometry at 50 ml. per minute was done to select the patients with involuntary detrusor contractions appearing before 400 ml. maximum filling volume. Repeat Cystometry was performed immediately after the posterior tibial nerve stimulation. Volume comparison was done at the first involuntary detrusor contraction and at maximum cystometric capacity. The test was considered positive if volume at the first involuntary detrusor contraction and/or at maximum cystometric capacity increased 100 ml. or 50% during stimulation in compared with standard volumes.

Post-void residual volume: This test measures the amount of urine left after you empty your bladder.

Biofeedback: It is a teaching tool to help, learn, control and strengthen the pelvic floor area, so used to treat incontinence by helping and learning to control and strengthen pelvic floor muscles, which play a crucial role in bladder control. Incontinence can occur if those muscles are too weak to properly control bladder function or are not responding properly. The therapy begins by applying electrodes to the body, small sensors are placed near the anus, where the pelvic floor muscles are closest to the skin. Patients then begin performing a series of pelvic floor exercises designed to strengthen those muscles. The sensors provide feedback on a computer screen or through audio tones that tell you whether the patients are contracting the correct muscles. Biofeedback sessions that address urinary incontinence generally last about half an hour.

Treatment Procedures:

Electrical stimulation of the posterior tibial nerve is in aid of electrodes in the region of the posterior tibial nerve, this form of electrical stimulation inhibits bladder activity by depolarization of somatic afferent fibers and lumbar sacral, resulting in motor and sensory responses to stimulation of the posterior tibial nerve area. The technique consists of stimulating the nerve by surface electrode 4–5 cm cephalad to the medial malleolus. Once the current is applied, the flexion of the big toe or the movement of the other toes confirms the correct positioning of the electrode. The electric current is a continuous, square wave form with a duration of 200µs and a frequency of 20 Hz for 30 minutes. The current intensity is determined by the highest level tolerated by the patient. The stimulation sessions last for 30 minutes and are performed day after day in a week for 12 weeks.

The **Pelvic Floor Exercises** have as principle the repetitive voluntary contractions of the pelvic floor, increasing muscle strength and hence urinary continence by stimulating the activity of the urethral sphincter. The exercises are effective for urge incontinence because they reinforce the reflex contraction of the pelvic floor, causing inhibition of detrusor contraction. Pelvic floor exercises: Kegel exercises help to strengthen the pelvic floor, keep pelvic muscles, tissues strong which can prevent stress incontinence, can be done anytime as follow: a) Pretend you are trying to stop the flow of urine. B) Hold the squeeze for 10 seconds, c) then rest for 10 seconds. Do 3 or 4 sets daily. Timed voiding and bladder training. First, you complete a chart of the times you urinate and the times you leak. You observe patterns and then plan to empty your bladder before an accident would likely occur. You can also "retrain" your bladder, gradually increasing the time between bathroom visits. Kegel exercises are also helpful. It aims to increase the storage capacity of the bladder.

Voiding Exercises: is encouraged in one of several ways, such as: Anal or Rectal Stretch for relaxing the urinary sphincter is usually used along with an abdominal corset. Crede method involves manually pressing down on the bladder. Tapping area over the bladder is tapped with the fingertips or the side of the hand, lightly and repeatedly, to stimulate detrusor muscle contractions and voiding. Valsalva method involves increasing pressure inside the abdomen by bearing down as if you were going to have a bowel movement. Voiding Diary in the patient performs a self-monitoring data for at least 24 hours (can be made up to 3 days), recording the following information: time, volume and frequency of urination, incontinence episodes, frequency of use of absorbent (day, time and night), water intake and intestinal habits.

Statistical analysis: The results of two groups were statistically analyzed by t-test to compare the differences within each group and between the two groups. The statistical package of social science (SPSS version 10) was used for data processing the P-value 0.05 level significance.

Data Summarized by using: The arithmetic mean average describing the central tendency of observation where The standard deviation (S.D) used to measure to described the results around mean where paired and unpaired t-test was performed to determine the significance difference pre and post within the same group and the differences between the two groups.

RESULTS:

Thirty males and females subjects participated in the study, their ages ranged between (25–40) years with mean age (35.2±0.1) years, their weights ranged between (60–88) kg with mean weight (75±1.4) kg. The subjects were divided into two equal groups. Each group consisted of fifteen subjects. The characteristics of subjects in each group are shown in Table1 and Fig1.

Table1: Characteristics of age and weight in both groups.

	Group 1		Group 2		T	P	Sig.
	Mean	S.D	Mean	S.D			
Age (yrs)	35.2	±6.3	35.2	±6.3	0.45	0.81	NS
Weight (Kg)	75.3	±6.8	74.8	±8.7	0.67	0.87	NS

The independent t test between the two groups showed no significant differences between groups of age (Where P value was 0.81) and weight (where P value was 0.87), as shown in Table1andFig1.

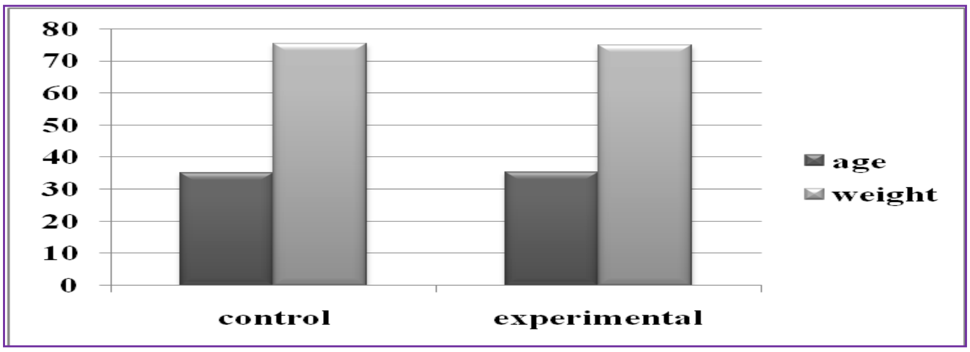

Figure (1): Characteristics of age and weight in both groups

Differences in EMG amplitude of detrusor muscle between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in EMG amplitude for detrusor muscle before the experimental trial where the t value was -0.374 , while P was 0.711, and moderate significant differences when measured post experimental trial where the t value was -15.19, while P was 0.002 as shown in Table 2 and Fig2.

Table2: T-test between the two groups of EMG amplitude of detrusor muscle before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	0.6	±0.1	-0.374	0.711
	GII	0.6	±0.1		
Post-test	G I	0.9	±0.1	-15.19	0.002
	GII	1.5	±0.1		

Differences in EMG amplitude of detrusor muscle within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in EMG amplitude of detrusor muscle where the t value was -15.9 while P was 0.01 and moderate significant differences between pre and post test of group II where the t value was -29.79, while P was 0.001 as shown in Table 3 and Fig2.

Table3: T-test within the two groups of EMG amplitude of Pelvic floor muscles before and after the experimental trial.

		Mean	SD	T	P
Group I	**Pre**	0.6	±0.1	**-13.26**	**0.01***
	Post	0.9	±0.1		
Group II	**Pre**	0.6	±0.1	**-20.58**	**0.001****
	Post	1.1	±0.1		

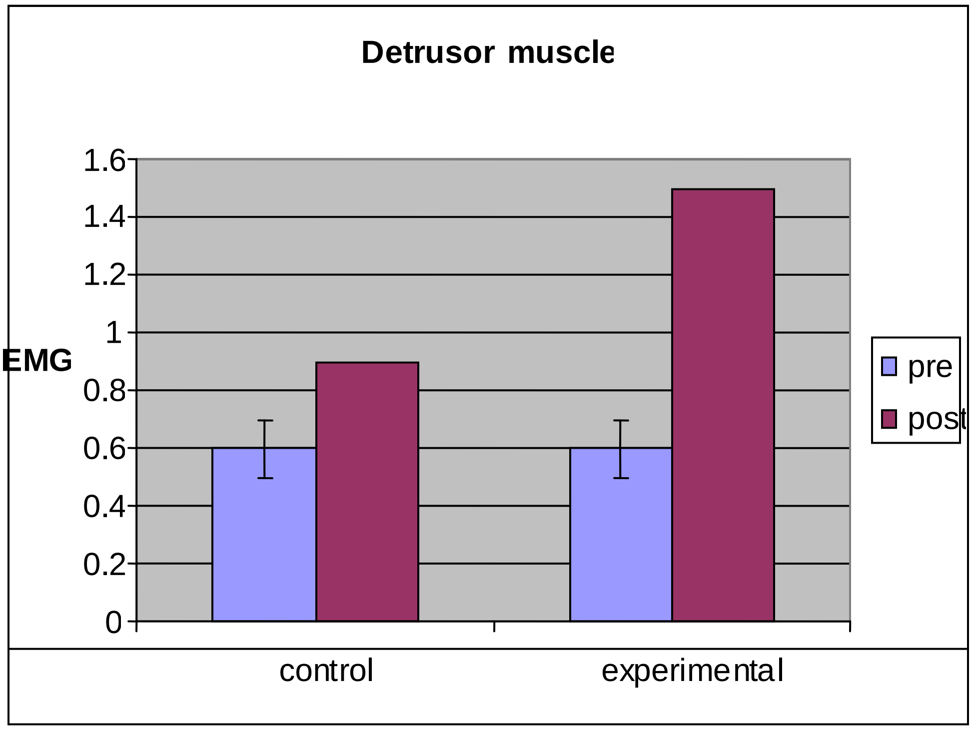

Fig2: Showing the results of EMG amplitude of detrusor muscle time in each group.

Differences in EMG amplitude of Pelvic floor muscle between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in EMG amplitude for Pelvic floor muscle measured before the experimental trial where the t value was -0.132, while P was 0.896 and moderate significant differences when measured post experimental trial where the t value was -2.93, while P was 0.007 as shown in Table 4 and Fig3.

Table4: Results of the t-test between the two groups of EMG amplitude of Pelvic floor muscle measured before and after the experimental trial.

		Mean	SD	T	P
Pre-test	**G I**	0.6	±0.1	-0.132	0.896
	GII	0.6	±0.1		
Post-test	**G I**	0.9	±0.1	-2.93	0.007**
	GII	1.1	±0.1		

Differences in EMG of Pelvic floor muscle within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in EMG amplitude for Pelvic floor muscle where the t value was -13.26 while P was 0.01 and moderate significant differences between pre and post test of group II where the t value was -20.58, while P was 0.001 as shown in Table 5 and Fig3.

Table5: T-test within the two groups of EMG amplitude of Pelvic floor muscles before and after the experimental trial.

		Mean	SD	T	P
Group I	**Pre**	0.6	±0.1	**-13.26**	**0.01***
	Post	0.9	±0.1		
Group II	**Pre**	0.6	±0.1	**-20.58**	**0.001****
	Post	1.1	±0.1		

Pelvic floor muscle

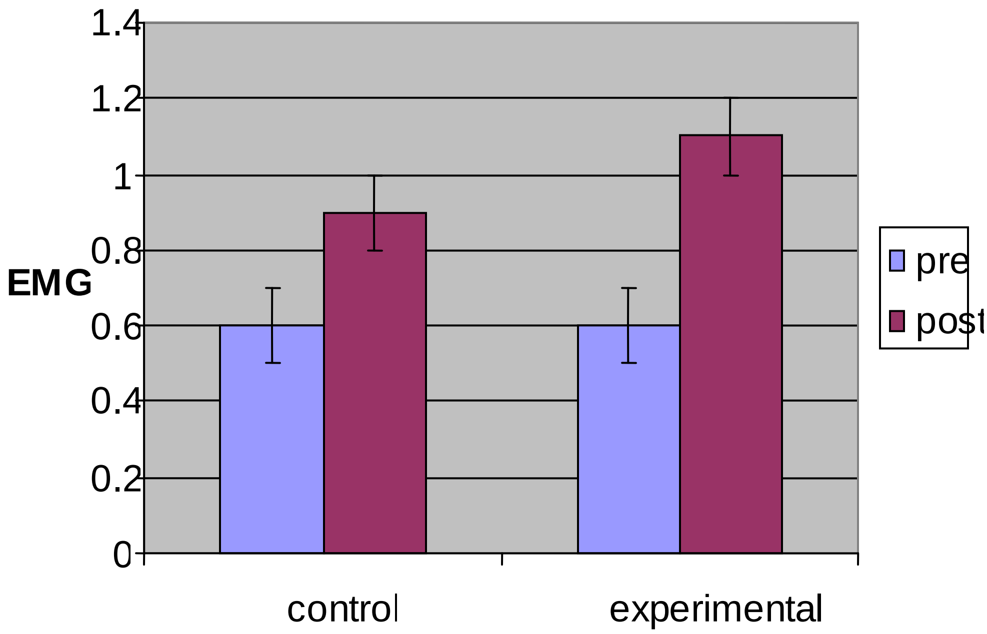

Fig3: EMG amplitude for Pelvic floor muscle in each group.

Differences in Cystometry test between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in the cystometry test measured before the experimental trial where the t value was -0.542, while P was 0.592, and moderate significant differences when measured post experimental trial where the t value was -15.944, while P was 0.001as shown in Table 6 and Fig4.

Table6: T-test between the two groups of Cystometry before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	117.3	±0.3	-0.542	0.592
	GII	118.3	±0.3		
Post-test	G I	160.8	±0.4	-15.944	0.001
	GII	196.8	±0.3		

Differences in Cystometry within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in cystometry test where the t value was -12.91, while P was 0.01, and moderate significant differences between pre and post test of group II where the t value was -23.44, while P was 0.001 as shown in Table7andFig4.

Table7: T-test within the two groups of Cystometry test before and after the experimental trial.

		Mean	SD	T	P
Group I	Pre	116.3	±0.3	-12.91	0.01*
	Post	160.8	±0.4		
Group II	Pre	118.3	±0.3	-23.44	0.001**
	Post	196.8	±0.3		

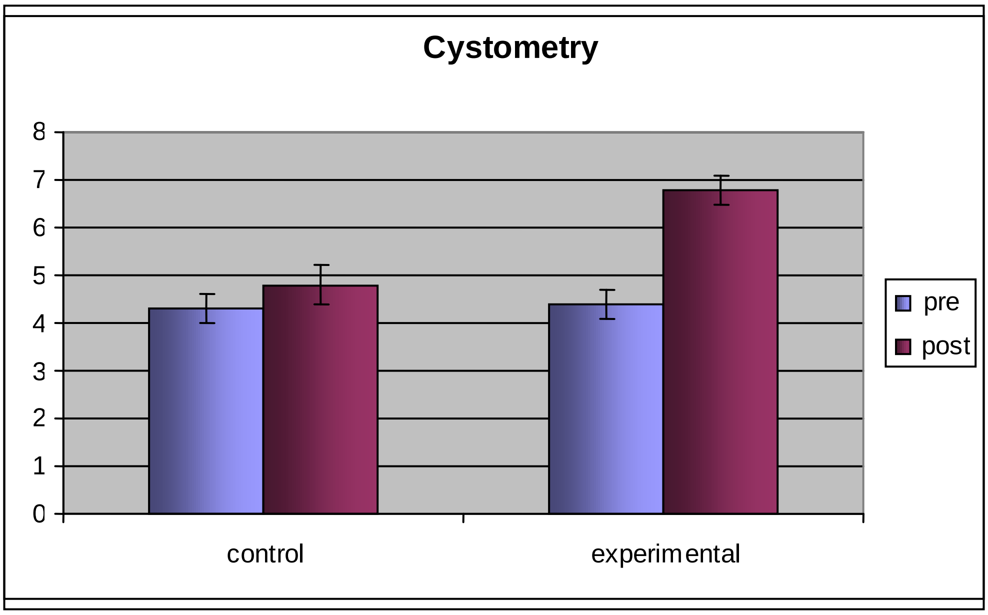

Fig4: The results of Cystometry in each group.

Differences in residual urine volume between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in the residual urine volume measured before the experimental trial where the t value was 0.6, while P was 0.97, and moderate significant differences when measured post experimental trial where the t value was -6.38, while P was 0.001as shown in Table 8 and Fig5.

Table8: T-test between the two groups of residual urine volume before and after the experimental trial.

		Mean	SD	T	P
Pre-test	**G I**	108.64	±0.3	0.6	0.97
	GII	108.04	±0.3		
Post-test	**G I**	82.4	±0.4	-6.38	0.001**
	GII	60.7	±0.3		

Differences in residual urine volume within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in residual urine volume where the t value was -9.51, while P was 0.01, and moderate significant differences between pre and post test of group II where the t value was -14.4, while P was 0.001 as shown in Table 9 and Fig 5

Table9: T-test within the two groups of residual urine volume before and after the experimental trial.

		Mean	SD	T	P
Group I	**Pre**	108.64	±0.3	**-9.51**	**0.01***
	Post	82.4	±0.4		
Group II	**Pre**	108.04	±0.3	**-14.4**	**0.001****
	Post	60.7	±0.3		

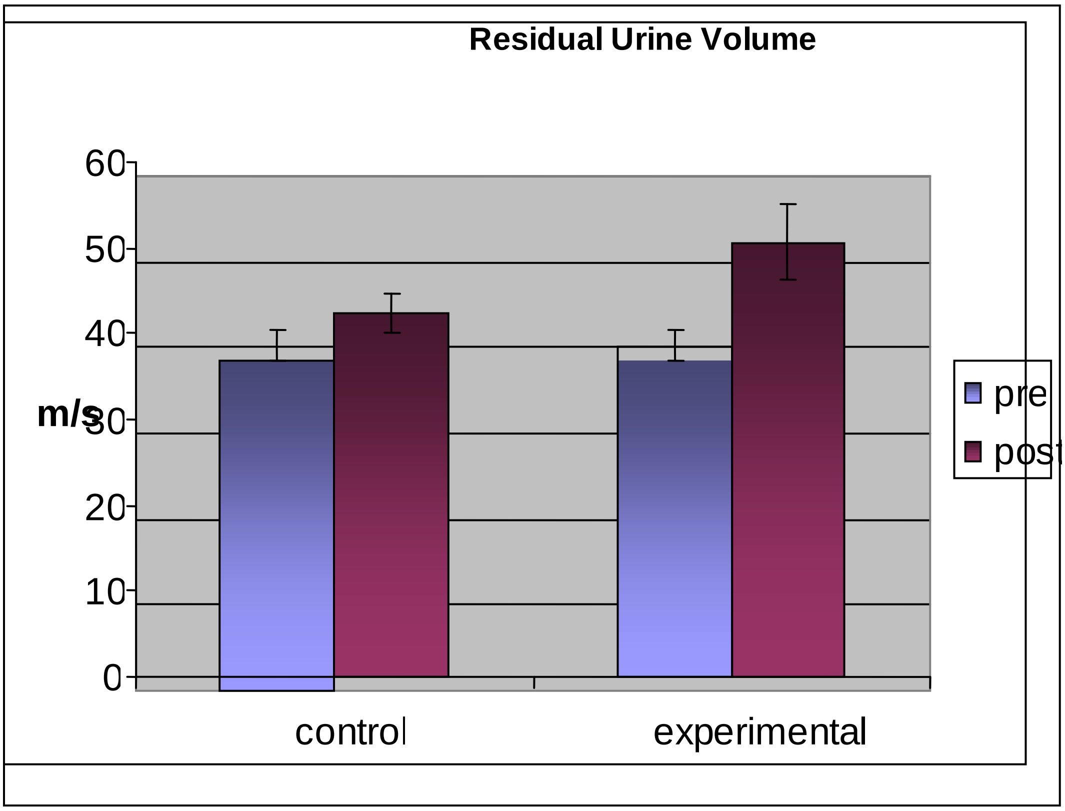

Fig5: Results of residual urine volume in each group.

Differences in biofeedback test for pelvic floor muscle between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in the Biofeedback test for pelvic floor muscle measured before the experimental trial where the t value was -0.38, while P was 0.707, and moderate significant differences when measured post experimental trial where the t value was 3.95, while P was 0.001as shown in Table10 and Fig6.

Table10: T-test between the two groups of biofeedback test for pelvic floor muscle before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	6.5	±0.5	-0.38	0.707
	GII	6.5	±0.5		
Post-test	G I	5.2	±0.5	3.95	0.001**
	GII	3.7	±0.3		

Differences in Biofeedback test for pelvic floor muscle within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in the Biofeedback test for pelvic floor muscle where the t value was 2.82, while P was 0.014, and moderate significant differences between pre and post test of group II where the t value was 10.46, while P was 0.001 as shown in table11 and Fig6.

Table11: T-test within the two groups of biofeedback test for pelvic floor muscle before and after the experimental trial.

		Mean	SD	T	P
Group I	Pre	6.5	±0.5	2.82	0.014 *
	Post	5.2	±0.5		
Group II	Pre	6.5	±0.5	10.46	0.001**
	Post	3.7	±0.3		

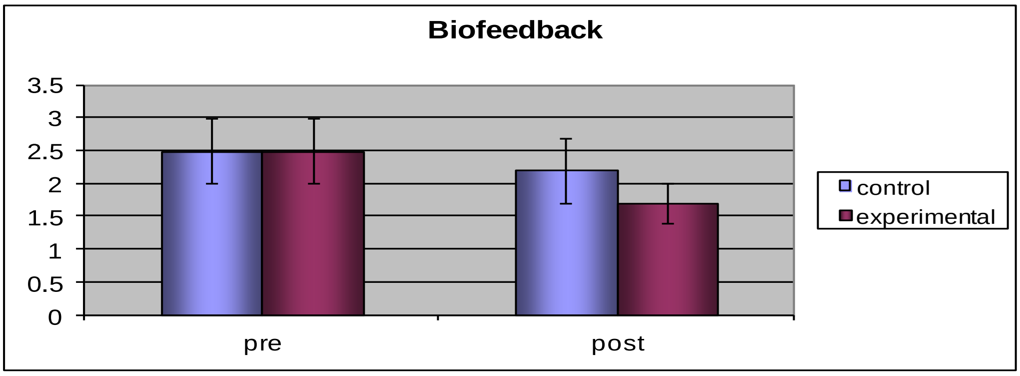

Fig6: Results of Biofeedback test for pelvic floor muscle in each group.

Discussion

Although there have been several recent clinical studies showing the positive effect of percutaneous posterior tibial nerve stimulation on urinary incontinence in Paraparetic patients, such treatment hasn't been widely used in clinical setting yet[20]

Recently, our study is in accordance with[21]who demonstrated the efficacy of transcutaneous tibial nerve stimulation with the use of external electrodes. It is believed that the electrical stimulation can penetrate the skin delivering tibial nerve stimulation in the same way, but without the need for a needle electrode. A study reported that based on 7 case series 48-68% of patients treated via transcutaneous tibial nerve stimulation (external stimulation) was a marked improvement or cure of their bladder irregularities (varying forms of incontinence). This is in contrast to the 60-80% success rate for treating overactive bladder using the percutaneous method (use of a needle stimulator). The study concludes that transcutaneous tibial nerve stimulation has a positive impact and an overall reduction in bladder weakness symptoms.

PTNS described by[22]for the treatment of overactive bladder syndrome, situated 4–5 cm cephalad to the medial malleolus, and has previously been acknowledged as a neural access point for the regulation of bladder and pelvic floor function. Furthermore, experiments on animals demonstrated that the electrical stimulation of the hind leg produces detrusor inhibition. Basing his research on these concepts, the transcutaneous electric stimulation of the posterior tibial nerve can suppress neurogenic detrusor overactivity.

Several studies[23] have been published evaluating the effects of PTNS on urinary incontinence. According to these studies, the overall percentage of patients classified as "successfully treated" was 54.5-79.5%. Of note, the definition of "success" differs among studies from the use of urodynamic data to clinical parameters and quality of life measures. In spite of these differences, the reported success rates are of clinical interest, especially because many results were obtained from a population of patients who were already non responsive to conventional therapies. Improvements are reported not only in symptoms, but also in urodynamic observations reported a reduction of detrusor overactivity and increase of the cystometric capacity and of the threshold of appearance of involuntary detrusor contractions[24].

Our study agree with[22] who mentioned that, the electrical stimulation was applied unilaterally from the medial malleolus and posterior to the edge of the tibia by using charge-compensated 200 microsecond pulses with a pulse rate of 20 Hz. Mean first involuntary detrusor contraction on standard cystometry was 138.34 ± 6.36 mL (60 to 225 mL), whereas it was 230.48 ± 8.89 mL (145 to 375 mL) during PTNS. Mean maximum cystometric capacity on standard cystometry was 193.93 ± 9.90 mL (110 to 304 mL), whereas it was 286.48 ± 9.09 mL (221 to 376 mL) during stimulation. The improvements in the first involuntary detrusor contraction and maximum cystometric capacity were statistically significant during stimulation (P <0.001). The difference of mean first involuntary detrusor contraction volume and mean maximum cystometric capacity at baseline and after PTNS was statistically significant (P <0.001).These results have demonstrated the objective effect of acute PTNS on urodynamic parameters. PTNS is effective to suppress detrusor overactivity in MS patients.

Selecting among needle, wire, or surface patch electrodes is the first step toward ensuring optimal EMG tracings. Several studies[25] have compared the accuracy of surface versus needle electrodes for assessment of pelvic floor EMG, compared concentric needles to surface patches for recording EMG activity during micturition in 22 women undergoing urodynamics testing. They reported that tracings generated by concentric needle EMG had higher interrater reliability than tracings generated by surface electrodes. Moreover[26] compared concentric needle to patch electrodes in 25 children undergoing urodynamics testing, including filling cystometrogram and an additional 12 children undergoing EMG with uroflowmetry only. They found a statistically significant correlation between EMG tracings generated by surface patch and needle electrodes, and concluded that surface electrodes were preferable because they allowed movement during urodynamics testing and avoided percutaneous needle insertion.

Our study is closely related to several studies[27] illustrating assessment of EMG during micturition focuses on the response of the pelvic floor muscles and rhabdosphincter to micturition. During normal voiding, these muscles reflexively relax in response to neural modulation by the pontine micturition center. Failure of this coordinated response is called detrusor sphincter dyssynergia (DSD). It is caused by a neurological lesion affecting spinal segments below the pontine micturition center and above the sacral micturition center. Diagnosis during urodynamics testing is essential because DSD causes functional obstruction of the bladder outlet that often leads to upper urinary tract distress. DSD must be differentiated from other factors leading to EMG activity during micturition, including voluntary contraction of the pelvic floor muscles, abdominal straining, or artifact[28].

Our study is agreeing with[28] when demonstrated that, the biofeedback has been proven effective in the treatment of urinary incontinence in numerous research studies. It can be used to help women learn to control and strengthen the pelvic floor muscles. The pelvic floor muscles (PFM) are a group of muscles that play an important role in bladder control. Weakness or dysfunction of the pelvic floor muscles can lead to problems with both bladder and rectal support and control. Because you cannot see the pelvic floor muscles, you may have found it difficult to locate them. Perhaps you are uncertain if you are doing the pelvic muscle exercises correctly. This is where biofeedback can help.

Our study is in accordance with the largest study[30]comparing the effect of biofeedback, recruited 135 women, most of women in the study had a diagnosis of stress incontinence, and however a few 12 had mixed incontinence. All patients were subject to treatment by biofeedback devices for encouraging contraction of pelvic floor and detrusor muscles for 25-30 at least12weeks, day after day. The major outcomes measure was patient self reported urine loss via a symptom diary, this outcomes was assessed each week during treatment 2weeks, 4weeks, 6weeks to 12weeks following the completion of treatment which show that, there was a significant improvement in all patients.

Also, this study agree with[29] when recruited44 patients with stress incontinence from urologist and general practioners, after one week diagnostic phase, 40 patients were randomized to EMG biofeedback, all patients received 3 sessions of instruction per week for a 4 week. Outcomes measures report include frequency of urine incontinence by a patient diary and standardized pad test. There were significant improvement of pelvic floor and detrusor muscles contraction and decrease frequency of incontinence.

CONCLUSIONS

These results suggest an objective effect of percutaneous posterior tibial nerve stimulation on urodynamic parameters. Improved incontinence bladder is an encouraging argument to propose posterior tibial nerve stimulation as a noninvasive treatment modality in clinical practice. Finally PTNS is safe, with no major complications reported in literature. In consideration, of these potentialities, as suggested by some authors PTNS could be offered early in the course of urinary incontinence treatment.

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الملخص العربي

تأثير التحفيز اليوروديناميكى لعصب الحس خلف عظمة القصبة عن طريق الجلد على سلس البول في مرضى الشلل النصفي السفلي

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كان **الهدف** من هذه الدراسة هو تقييم مدى تأثير فعالية التحفيز اليوروديناميكى لعصب الحس خلف عظمة القصبة عن طريق الجلد على السلس البولي في مرضى الشلل النصفي السفلى ولقد أجريت هذه الدراسة على 30 مريضاً مصابين بمرض السلس البولي من الرجال والسيدات، وتراوحت أعمارهم مابين 25 عاماً وحتى 40عاماً، قسموا عشوائياً إلى مجموعتين متساويتين، بالنسبة **للمجموعة الأولى،**هي مجموعة مراقبة من حيث تم علاجها ببرنامج العلاج الطبيعي لتدريب المثانة (تمارين تقوية لعضلات البطن والحوض، والضغط والخدش والجليد على أسفل البطن) دون أي تحفيز ،أما **المجموعة الثانية** فهي المجموعة التجريبية فقد عولجت بنفس البرنامج العلاج الطبيعي بالإضافة إلى تطبيق التحفيز الكهربائي من الكعب الإنسي والخلفية إلى حافة الساق باستخدام200 ميكروثانية مع التردد 10 هرتز لمدة 30 دقيقة وذلك على مدار اثني عشرة اسبوعا ، ثلاث مرات أسبوعيا يوم بعد يوم، وتم إجراء القياسات الحيوية لجميع المرضى مثل ضغط الدم ودرجة الحرارة ومعدل ضربات القلب ومعدل التنفس لجميع المرضى ثلاثة مرات لكل مريض قبل، أثناء وبعد العلاج في كل جلسة. كما تم **تقييم المرضى** قبل وبعد العلاج عن طريق اختبار البول عن طريق قياس المثانة و قياس حجم البول المتبقي والارتجاع البيولوجي ، والاختبارات في جميع المرضى تم القيام بها قبل البدء في العلاج وبعد الإنتهاء من البرنامج العلاجي.
وقد أوضحت **نتائج المعالجة والتحليلات الإحصائية** أن هناك تحسن إحصائي واضح ذو دلالة إحصائية لصالح المجموعة الثانية عن المجموعة الأولى ، فيما يتعلق بجميع المتغيرات (< 0.001). **الخلاصة:** التحفيز اليوروديناميكى لعصب الحس خلف عظمة القصبة عن طريق الجلد هو وسيلة فعالة في علاج سلس البول عند مرضى الشلل السفلي ويعد على إنه طريقة علاج لسد الفجوة بين العلاجات المحافظة والجراحية في المرضى الذين يعانون من أنواع معينة من سلس البول.

الكلمات الدالة:

تحفيز العصب ، المثانة، الارتجاع البيولوجي،رسم العضلات الكهربي، سلس البول، التوتر السطحي والشلل النصفى.