

**A critical appraisal of “Afferent stimulation inhibits abnormal cutaneous reflex activity in patients with spinal cord injury spasticity syndrome”**

**By**

**Ryan Nielsen, SPT**

**In partial fulfillment of the  
requirements for the course:**

**PT 7240 Evidence-Based Practice in Physical Therapy**

**Department of Physical Therapy**

**Angelo State University**

**Member, Texas Tech University System**

**November, 2021**

## **Abstract**

A critical appraisal of “Afferent stimulation inhibits abnormal cutaneous reflex activity in patients with spinal cord injury spasticity syndrome”. Review of the methods used by Gomez-Soriano et al to assess the effects of Electrical stimulation on Spasticity. Critiquing the methods, results and discussion of their finding. Gomez-Soriano et al did an exceptional job of describing in detail their methods and reasoning behind them. Their results are sound and backed up by existing literature. Their exploration of the significance of their findings is in-depth and thorough. Limitations of their design and findings are outlined clearly. Conclusions are concise and appropriate to their results. The intervention used could potentially benefit many people in the future.

**Key words:** Spasticity, Spinal cord injury (SCI), electrical stimulation,

## **Introduction**

Gomez-Soriano et al’s research focused on the ability of electrical stimulation to inhibit abnormal neural spasticity in people with spinal cord injuries (SCI). The focus of the study was spasticity among spinal cord injury patients. They tested patients without a SCI, and those with a SCI that exhibited Spasticity and those that did not. I am interested in the ability of E-Stem to modulate neural abnormalities in patients with an SCI. This is an important subject. If there is a well-known modality that can benefit those with SCI’s, it should be shared with the Physical Therapy (PT) world.

## **Methods**

In my search for information regarding this subject I primarily used the PubMed Database. Using key terms including electrical stimulation, spinal cord injury, and neuropathy. I

was able to reduce my hits to about 500. At this time, I began narrowing down my search. To keep my findings relatively recent I limited my search to articles that were published in the last 10 years. I only included Full texts as I needed to have access to the entire paper for review. Once I found this article and few others, I briefly reviewed the abstracts and key points to determine which one I wanted to use.

I ultimately chose the article by Julio Gomez-Soriano, Diego Serrano-Munoz, Elisabeth Bravo-Esteban, Juan Avendano-Coy, Gerardo Avila-Martin, Iriana Galan-Arriero and Julian Taylor. It was published in 2018 in the Journal of Neuro Rehabilitation. The research was done in Toledo Spain. I chose this article because they applied E-Stem directly to a human patient to assess its ability to modulate spasticity. Most of the other articles I found didn't use human subjects. It would be very difficult to draw some clinical significance and application from a study done on rats.

## **Results**

### Summary of the study

This study addresses the need for inhibitory control over the cutaneous reflexes (CR) on the tibialis anterior (TA) and the soleus after an SCI. In a healthy person these reflexes are controlled by both passive and active movement. This control is decreased or lost after an SCI. The authors believe that "Inhibitory control of CR activity in subjects with spasticity...is an important clinical goal". To regain said control. The researchers applied two interventions to the subjects. Vibration and Electrical stimulation with a TENS machine. Subjects recruited for this study had to be between 18-75 years old. Subjects needed to score a C or D on the ASIA Impairment Scale (AIS). SCI needed to be at least 3 months old. Exclusions included: Pregnancy, supraspinal injury, lower limb or joint injuries, and lack of reflex response in the TA. All patients were assessed by a physiotherapist who was blinded to the design of the research.

The researchers established a reflex threshold for each of the participants. Subjects then participated in two randomized sessions. Each of the sessions included vibration and TENS unit stimulation. The sessions were separated by at least 24 hours. All reflex activities were measured by an EMG. They found that TENS stimulation was able to inhibit CR during Voluntary plantar flexion in subjects with SCI.

### Appraisal of the study introduction

The introduction does a very good job at setting the scene for this study. The authors do a very good job of giving us the background regarding SCI spasticity. During the introduction the authors do a very good job of using the existing literature to show the need for this study to take place. In fact, this study is a follow-up study addressing a question that was presented in one of the author's own studies from 2016. They prove through the literature that Loss of motor function due to spasticity is best assessed during active contraction of the effected muscles. The design of their study reflects this finding. From what I could tell, all the literature used in this study come from strong sources. Some of the articles referenced were rather old but they seemed to be the foundational studies in this field.

They talk about how the studies they referenced suggest that inhibition of cutaneous reflexes is an important clinical goal. They then introduce several new topics before elaborating on why this is an important goal. This makes the introduction feel a little disconnected. They used muscle spasticity as one of their key words. It appears once in the whole paper. In the title of another paper that they referenced.

### Appraisal of the study methods

This was a prospective longitudinal experimental study. There was only a single blind mentioned. The assessor was blinded to the design of the study. They did not say if the participants were blinded to their assignment or not. Each subject was asked to attend two separate sessions with a random time between of no less than 24 hours. They recruited 39 participants. 11 in the control groups and 14 in each of the testing groups. They didn't report any attrition. Though they did remove some of the results from the analysis. Due to the failure of said results to meet the inclusion criteria for the study. Results were compared between groups. The methods for this study are very well defined. Anyone with access to the proper Equipment could easily replicate this study. To analyze the results, they authors chose to use the Wilcoxon test and the Spearman's rank test. They chose these tests because the data was not normally distributed.

It was not explicitly said that all groups received the same treatment. But they way the paper is written and how the experiment is designed it implies that all groups were treated in the same way. Aside from not explicitly saying that participants were all treated the same I didn't find any weaknesses in the methods of this study.

#### Appraisal of the study results

The result section is written very well. They have it divided by topic. And organized in order of questions addressed in the introduction. They also reported each of the different methods separately. All the tables and graphs presented by the authors give a clear visual of their measurements. Each of the methods was analyzed with a confidence interval of 0.95 and a p value of less the 0.05. They reported no significant differences between the groups. The Penn and Ashworth scores of the SCI with spasticity group were higher than those of the SCI without spasticity. This is an expected difference. Vibration was seen to increase the TA - CR in the uninjured control group. but it inhibited the TA - CR in the spasticity group. It only inhibited the

SOL -H reflex in the control and non-spasticity groups. TENS was only effective in the Spasticity group during the hold phase of the contraction. The authors indicate that the comparison of the Ashworth and Penn scores with the outcomes of the different stimuli have no correlation or a negative correlation.

The results are organized well. They are written in the same order as the methods, so it is easy to find each section. I found the descriptions of the figures to be rather wordy and confusing. It took several times reading through it to fully understand what they were trying to say.

#### Appraisal of the study discussion

Each of the findings was discussed thoroughly. They stated what they observed comparing it to previous findings from other studies. They then briefly explained what they meant. They also took time to explore what variables could be adjusted, (duration, intensity, frequency) and what those adjustments might change. The authors took care to explain some of the limitations of their study. They also addressed how they could have affected the results. The authors concluded that both vibration and TENS stimuli are effective in inhibiting the CR of plantar flexion. They are not capable of inhibiting the Soleus H-reflex. Their conclusions are sound and not overstated. In addition to their conclusion of this study they also identified the need for more information on how these techniques could be used for the management of SCI spasticity symptoms.

I did not find any weaknesses in the discussion of this study. The authors did a great job of clearly discussing their findings and comparing them to the existing information to then draw conclusions as to how effective their treatment would be.

## **Discussion**

Gomez-Soriano et al addressed the question of whether vibration and or electrical stimulation could inhibit the Spastic effects of a spinal cord injury. This is an important area of study because we see a lot of spinal cord injuries of varying degrees of damage. Some cause spasticity. Spasticity can be detrimental to regaining function in the effected limb. Fully functional limbs increase quality of life. If we can increase a patient's quality of life simply by apply an electrical stimulus, it could have exponential clinical importance. As a physical therapy tech, I applied electrical stimulation to several patients. I think it could be a great way for patients to be able to take back a measure of control in their lives.

I argue that this is a great intervention. The study showed that it was most effective during the hold phase of a contraction. They mentioned that in a different study they looked at the longevity of the effects after stimulation. The increased inhibition was not long lived, but it did increase with subsequent treatments. There are not many risks to using a TENS unit. A few people are allergic to the adhesive on the pads. And there is a possibility of sustaining an electrical burn if the stimulation is too high. But these are all factors that can be controlled. The author did not discuss the possibility of patients being able to apply the stimulus on their own. But a TENS unit can be inexpensive and portable. I feel there is a potential of having clients apply the stimulus daily at home.

As a future PT I see myself implementing this on my own patients. There were no methods used in this study that are outside the normal range of uses for a TENS unit. And as

discussed earlier there aren't any obscure risks beyond the normal risks of using electrical stimulation.

In conclusion, Gomez-Soriano et al did great work in designing and executing this experiment. It has the potential to lead to great advances in how we treat spasticity. I agree with the authors in their conclusion that electrical stimulation can be used to treat spasticity in patients with spinal cord injuries. More research needs to be done on other muscles and areas of the body. As well as looking at the longevity of the effects.