

**TRANSDERMAL MAGNESIUM SULPHATE SPRAY APPLIED PRE-AND INTRA  
TREATMENT SIGNIFICANTLY IMPROVES EFFECTIVENESS OF ELECTRICAL  
TWITCH OBTAINING INTRAMUSCULAR STIMULATION (ETOIMS) IN CHRONIC  
NEUROMUSCULAR PAIN****Chu J.<sup>1\*</sup> MD, Bruyninckx F.<sup>2</sup> MD and Goodman S. MD<sup>3</sup>**<sup>1</sup>Emeritus Associate Professor PMR University of Pennsylvania USA.<sup>2</sup>Emeritus Clinical Professor, Physical Medicine & Rehabilitation, University of Leuven, Belgium.<sup>3</sup>Goodman S., M.D. Consultant.**\*Corresponding Author: Chu J.**

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**ABSTRACT**

About 3 years ago a 59-year-old male developed slowly progressive pain in the right hand and forearm. There is also lower back pain and left gluteal pain, and in the past 1 year there is also right gluteal pain. He also complains of headaches.

The pain is described as sharp, aching and itching. The pain in the lower back alternates between the right and the left but recently it has become more pronounced on the right side.

Activities such as running on loose sand on the beach had to be temporarily discontinued due to the pain. He used to perform kettlebell swings which he had to abandon completely due to pain in the right forearm and wrist. He is right handed.

He can sit easily for 3 hours but he can stand upright only for about 1 hour due to lower back and gluteal pain. He can walk for more than 2 hours and walking generally does not inconvenience him. It is not necessary for him to use a cane on ambulation. He does not require handrails for going up and down stairs.

The headache worsens while flexing and rotating the head to the left. The right wrist, hand and hand and forearm pain exacerbate when performing squeezing and lowering weights while curling.

The lower back pain and gluteal pain are aggravated by back extension, kettlebell swings and running in soft sand.

Previous treatments comprised of therapeutic exercises, massages, chiropractor, electrical stimulation, braces, splints, cervical collar. He also received acupuncture.

Diagnostic medical tests that were performed on him include nerve conduction studies and needle-electromyography, and CAT scan and MRI scan of the spine.

Prior physical injuries include a fall on the left shoulder from the edge of a deck about four feet high with fall to the ground, eight years ago. He also had a roller skating accident roughly 19 years ago during which he sustained facial fractures mainly to the zygomatic arch and an orbital bone fracture on the right side. No musculoskeletal pain or other issues followed this event. He has had chronic neck pain, especially on the left side. Lower back pain and gluteal pain started about one year ago, and are according to the patient related to kettle bell swings. The lower back pain is mainly located on the right side (See enclosed photographs), occasionally pain shifts to the left side. There is no radiating pain down the limbs.

He felt much better after the first ETOIMS treatment.

He returned 1 month later for his second treatment and then he returned every 2 weeks due to far distance between the medical clinic and his home. For a brief description of the concept of ETOIMS treatment the reader is referred to the Discussion section and References.

**Table 1**

Treatment 3/28/24	R Before tx	R After tx	% Change	L Before tx	L After tx	% Change	Treatment 5/25/24
Neck lateral rotation (cm)	13	8	38.5	14	10	28.6	Neck lateral rotation (cm)
Shoulder external rotation (cm)	10	8	20	9	8	11	Shoulder external rotation (cm)
Shoulder internal rotation (cm)	28	28	0	29	30	-3	Shoulder internal rotation (cm)
Straight leg raising (degrees)	70	90	28.6	70	90	28.6	Straight leg raising (degrees)
FABERE (cm)	8	6	25	8	9	-12.5	FABERE (cm)

**Definition of range of motion measured**

**Neck lateral rotation**

Neck lateral rotation was measured by the distance (cm) between the middle of the chin and the opposite acromioclavicular joint when the patient rotates the neck to the opposite shoulder.

**Shoulder external rotation**

Shoulder external rotation was measured placing the supinated forearm behind the patient's neck and opposite ear. For example, the distance (cm) between the patient's right middle finger tip to the left angle of the lips is measured. The same procedure is followed for the left side measurements.

**Shoulder internal rotation**

Shoulder internal rotation was measured placing the supinated forearm behind the patient's midback. For example, the distance (cm) between the patient's right middle finger tip to midpoint of the left scapular spine is measured. The same procedure is followed for the left side measurements.

**Straight leg raising**

The patient lies supine on the examination table with the right knee bent and the right sole planted on the table.

Keeping the left knee straight, the left leg is lifted up as high as it can go up and measurement is made in degrees of the angle between the middle of the left thigh and surface of the bed,

**FABERE**

The patient lies supine on the examination table with the right knee straight and the hip in neutral position. He then places his externally rotated left hip and places the

left heel on the superior border of the right patella. The distance between the end of the left knee crease vertically down to the surface of the bed is measured.

**Abbreviations**

**R before tx:** Right side before treatment.

**R after tx:** Right side after treatment.

**% change:** Percentage change.

**L before tx:** Left side before treatment.

**L after tx:** Left side after treatment.

**RESULTS**

With the first treatment on 3/28/24 improvement of range of motion was noted especially for neck lateral rotation to both sides, as well as for external rotation of the right shoulder and in the FABERE testing on the right side.

Before starting the 4<sup>th</sup>. treatment on 5/25/24, it was noted that the improvements he obtained on 3/28/24 were all preserved for the different range of motions measured.

When magnesium sulfate was used before and during ETOIMS treatment the percentage improvements were noticeably more pronounced for bilateral shoulder internal rotation and left FABERE testing, when compared to the treatment on 3/28/24 which was performed without using magnesium sulfate during treatment.

Scatter plots of percentage improvements for measured range of motion on 3/28/2024 and on 5/25/2024. There were more percentage improvement of range of motions on 5/25/24.



3/28/2024

5/25/2024

Photographs of the patient's back on 5/25/24 before ETOIMS treatment: note the significant improvement in the swelling of muscles noted previously on the photograph on 3/28/24. Prior to the treatment on 5/25/24 he started to self-apply magnesium sulfate spray twice daily for about one week.

## DISCUSSION

The patient regularly used magnesium sulfate spray at least twice a day for a week prior to treatment on 5/25/24. The improvements noted on 5/25/24 were also attributable to the application of magnesium sulfate spray throughout the entire ETOIMS treatment on his muscles. The fact that magnesium sulfate is absorbed through the skin, eventually reaching the muscle (1-3), facilitates ETOIMS treatments. ETOIMS main actions are to relax shortened and tight muscles at the neuromuscular junctions. The combination of magnesium sulfate spray before and during ETOIMS treatment has cumulative effects for muscle relaxation.

Magnesium as a cream also has powerful anti-inflammatory and edema reduction effects (3) but could not be used with

ETOIMS treatment in this case because of the added oil in the manufacturing of magnesium sulfate cream which considerably reduces electrical conductivity (4).

Combined with ETOIMS, the use of magnesium sulfate in spray form significantly increases range of motion, resulting in overall substantial improvement of patients' quality of life.

## REFERENCES

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