# The Relationship Between Myofascial Trigger Points of Gastrocnemius Muscle and Nocturnal Calf Cramps†

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**Abstract**

To support that myofascial pain syndrome (MPS) of gastrocnemius muscle is one cause of nocturnal calf cramps, quantitative assessment of the efficacy of trigger point (TrP) injection compared with oral quinine in the treatment of nocturnal calf cramps (NCC) associated with MPS of gastrocnemius muscle was designed. Twenty four subjects with NCC and gastrocnemius TrPs were randomly divided into two groups of twelve for each treatment. Patients in group 1 were treated with xylocaine injection at the gastrocnemius TrP, and 300 mg of quinine sulfate p.o. was prescribed for patients of group 2. The treatment period was four weeks with a follow-up 4 weeks later. Cramps were assessed quantitatively (in terms of frequency, duration, pain intensity, cramp index, and pain threshold of the gastrocnemius TrPs) before treatment, after treatment and at the end of the follow-up respectively. The outcome of treatment in both groups showed a statistically significant reduction in all quantitative aspects of cramps (95% confidence interval). Also the pain threshold of the gastrocnemius TrP was significantly increased in group 1 only when comparing the pre-treatment and at the end of follow-up. In comparing the two groups we found no statistical difference during the period of treatment. The benefit of both strategies lasted up to four weeks following cessation of the treatment but the outcome of all measures (except pain threshold) were found to be significantly better in the group treated with TrP injection. The results of this study support that gastrocnemius trigger point is one cause of NCC and show that the TrP injection strategy for NCC associated with myofascial pain is not only as effective as oral quinine during the treatment period but also better in the prolonged effect at follow-up.

**Key word :** Trigger Point, Cramp

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NCC are an extremely common complaint in the worldwide population especially in the elderly. It is characterized by painful, involuntary muscular contractions especially when recumbent[1]. The underlying cause of this condition is not well understood[2]. Careful elucidation of the clinical symptoms make history taking very important for correct diagnosis of this condition[3]. Many different treatment protocols, including both pharmacological and mechanical strategies, have been implemented. All, however, are prophylactic[4] or symptomatic treatments[5], not specific treatment. For instance, oral quinine has been suggested as the most effective pharmacological treatment but its use is controversial because of some serious side effects including hypersensitivity reactions, pancytopenia, cinchonism, and visual toxicity[2,4]. In addition, it is not approved by the FDA as an over-the-counter preparation[4]. Massage[2] and stretching of the affected muscle[6] have long been used as a mechanical means of treatment. Most of the outcomes are still controversial and inconclusive. Nonetheless, in many patients, relief of symptoms is realized with one or more of these treatments[7]. Positive association with a number of other medical conditions have been observed,[7,8] such as peripheral vascular deficiency, hypertension, diabetes mellitus, coronary artery disease, low back pain, kidney disease, and hypokalemia. Recently, a clinical observation has noted that NCC are positively associated with MPS, a common painful muscle disorder due to myofascial TrPs,[9-12] and hypothesized that the presence of gastrocnemius TrPs is a common cause of NCC which is widely unrecognized[13].

A common specific treatment of MPS is TrP injection[14]. Therefore, based on the observation of a relation between NCC and gastrocnemius myofascial TrP, it seemed logical to do a comparative clinical study of the therapeutic outcome using TrP injection as a treatment for NCC comparing the results with the current standard treatment protocol of oral quinine sulfate.

## METHOD AND SUBJECTS

All subjects signed a document of informed consent and all procedures were approved by the Institutional Ethics Committee.

The inclusion criteria for all subjects were:
1) NCC experienced at least 4 times a month
2) On physical examination, a myofascial TrP was identified in the medial head of the gastrocnemius muscle (Fig. 1).

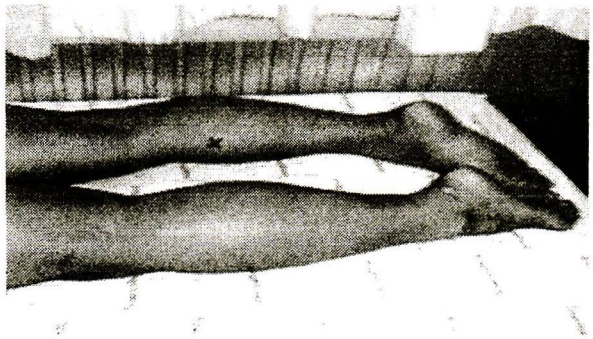

**Fig. 1. x = trigger point in the medial head of gastrocnemius muscle.**

The criteria for myofascial TrP in this study was based on Travell & Simons' criteria[12], which are

1) localized hyperirritable spot in a palpable taut band

2) spontaneous or reproducible referred pain recognized by the patient when the point was stimulated by pressure or needle injection.

3) palpable or visible local twitch response on snapping palpation or needle injection at the most sensitive spot in the taut band and

4) tightness of the muscle that restricted complete ankle dorsiflexion with the knee in full extension.

From January to March 1996, we surveyed 161 outpatients in the Geriatric Clinic, Diabetic Clinic, Hypertension Clinic and Rehabilitation Department, Faculty of Medicine, Siriraj Hospital, Mahidol University. One hundred and forty seven patients (91.3%) had experienced NCC at least once in their lives. Twenty seven (16.8%) had experienced NCC at least four times in the recent month. Twenty four out of the twenty seven (88.9%) met the admission criteria of frequent NCC associated with myofascial pain of the calf muscle.

They were randomly divided into two groups of twelve for a single-blind comparative clinical study.

### Interventions

Subjects in group1 received specific treatment of the MPS by TrP injection with 1 per cent xylocaine without adrenaline, 1-2 ml in each TrP, using Travell & Simons' fanning injection tech-

nique[12]. This was repeated on the second and fourth week consecutively if the sign(s) and symptom(s) of the TrP were still active.

Subjects in group 2 received currently treatment protocol of NCC with oral quinine sulfate, 300 mg at bedtime.

All the subjects were assigned to do calf stretches, 10 repetitions 3 times a day throughout the study period.

The treatment period in both groups lasted four weeks with follow-up four weeks later. So the 4th and the 8th week of this study were referred to as the after treatment and the time of follow-up respectively.

### Assessment of the outcome

To quantitatively assess the effectiveness of treatment, the following measurements were performed before treatment, after four weeks of treatment and at the end of another four weeks of follow-up.

Frequency: the total number of cramp attacks at night over a four week period.

Pain intensity: the intensity of cramp pain was described by the patient on an 11-point (0-10) visual analog scale; 0 indicated no pain at all and 10 indicated the most severe pain ever experienced.

Cramp duration: how long did each attack last in minutes?

Cramp index: cramp index = intensity x duration.

Pain threshold. A manual algometer as described by Fischer[15,16] was used to measure pain threshold of the medial head gastrocnemius TrP in kg./cm$^2$. This TrP was considered to be the primary TrP that caused NCC. There were 24 TrPs in group 1 and 20 TrPs in group 2 to be measured in this study. The measurements in group 1 were performed before the TrPs were injected.

All measurements were performed by a trained physician who was blind to which group a particular subject had been assigned.

### Data Analysis

An ANOVA repeated measure was applied to compare measured values before, after treatment, and at the end of the follow-up within the same group. A *t* -test was used to compare measured values between the two groups. Using the data on individual patients for each study, a point estimate was calculated and 95 per cent confidence interval obtained to measure the efficacy. A p value less than 0.05 was considered statistically significant.

## RESULTS

Twenty two subjects (20 females and 2 males), twelve of group 1 (n=12) and ten of group 2 (n=10) completed the study. Two subjects in group 2 withdrew from the study due to cinchonism, a well-known side effect of quinine sulfate during the treatment period. In group 1; four subjects received a repeat injection at the second week and two subjects received repeat injections at the second and fourth week of the treatment period.

Between the groups there was no statistical difference ($p>0.05$) in the mean age (64.8 ± 7.3 *versus* 64.2 ± 8.6 years) and in the onset of symptoms (2.4 ± 1.8 *versus* 1.7 ± 1.6 years) respectively, as shown in Table 1.

**Table 1. Subject data.**

| Group | No. of Subjects | Age (yr.), Mean ± SD | Onset (yr.), Mean ± SD |
|---|---|---|---|
| 1 | 12 | 64.8 ± 7.3 | 2.4 ± 1.8 |
| 2 | 10 | 64.2 ± 8.6 | 1.7 ± 1.6 |

None of the subjects involved in the study had ever had a TrP identified in their calf muscles before.

Fifteen out of twenty two of the subjects had a positive association with clinical osteoarthritis of the knee 66.2 per cent (n=15), pes planus 63.6 per cent (n=14), low back pain 54.5 per cent (n=12), diabetes mellitus 36.4 per cent (n=8), anxiety neurosis 31.8 per cent (n=7), varicose veins of the lower extremity 27.3 per cent (n=6), hypertension 22.7 per cent (n=5), coronary artery disease 18.2 per cent (n=4) and hypercholesterolemia 18.2 per cent (n=4).

The outcome of treatment is shown in Table 2.

### Within-group differences

Change in cramp frequency (Fig. 2). In both groups, the mean cramp frequency after treatment and at follow-up was significantly reduced

**Table 2. Outcome of the treatments.**

| Assessments<br>Groups | Before treatment<br>Mean ± SD | After treatment (4 weeks)<br>Mean ± SD | Follow-up (8 weeks)<br>Mean ± SD |
|---|---|---|---|
| Frequency of Cramps per 4 weeks | | | |
| Group 1 (n=12) | 18.8 ± 15.9 | 3.1 ± 3.4* | 0.4 ± 0.7* |
| Group 2 (n=10) | 14.3 ± 18.0 | 2.7 ± 2.8* | 3.1 ± 2.6* |
| Pain Intensity (0-10) | | | |
| Group 1 (n=12) | 5.7 ± 1.6 | 2.5 ± 2.4* | 0.4 ± 0.7*^ |
| Group 2 (n=10) | 7.1 ± 2.4 | 1.6 ± 1.8* | 2.8 ± 2.5* |
| Duration (min.) | | | |
| Group 1 (n=12) | 2.5 ± 1.5 | 1.0 ± 1.1* | 0.2 ± 0.3* |
| Group 2 (n=10) | 2.1 ± 0.9 | 0.5 ± 0.6* | 0.7 ± 0.6* |
| Cramp Index | | | |
| Group 1 (n=12) | 13.1 ± 6.9 | 4.0 ± 6.4* | 0.2 ± 0.4* |
| Group 2 (n=10) | 15.6 ± 8.1 | 1.4 ± 1.9* | 3.2 ± 3.9* |
| Pain Threshold ($kg/cm^2$) | | | |
| Group 1 (n=24) | 5.0 ± 1.6 | 6.4 ± 1.6 | 7.1 ± 1.9* |
| Group 2 (n=20) | 6.2 ± 2.7 | 6.5 ± 1.8 | 6.9 ± 1.6 |

Group 1: TrP injection with stretching protocol.
Group 2: Oral quinine with stretching protocol.
* Significant difference ($p<0.05$) from before treatment.
^ Significant difference ($p<0.05$) from after treatment.

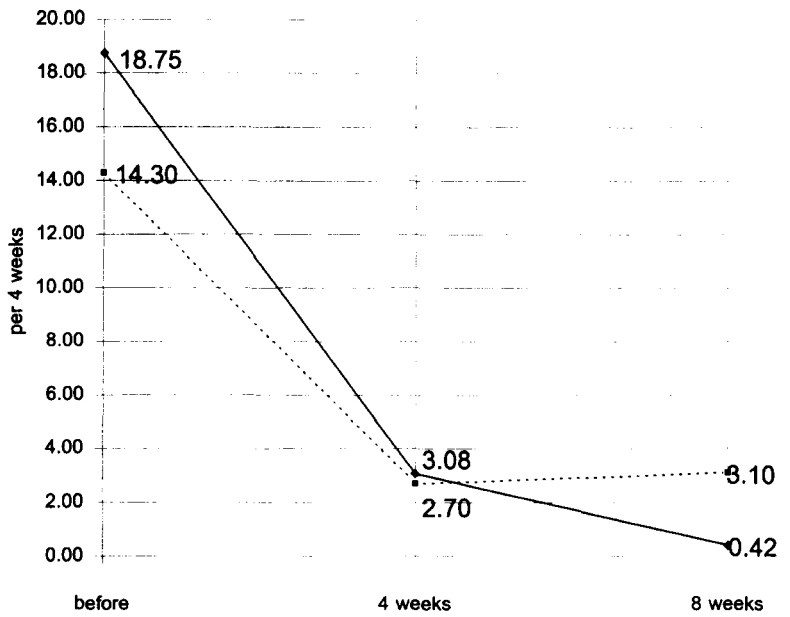


**Fig 2. Change in cramp frequency. ___ Group 1 (N=12); ..... Group 2 (N=10).**

($p<0.05$). Between after treatment and at the end of the follow-up, cramp frequency continued to decrease in group 1, whereas, in group 2 cramp frequency started to rise again. This difference was not statistically significant ($p>0.05$).

Change in cramp duration (Fig. 3). The mean cramp duration in each group was significantly lower ($p<0.05$) after treatment and at follow-up. Between the end of treatment and follow-up, the cramp duration continued to decrease in group 1,

whereas, it started to increase in group 2. The difference, however, was not statistically significant ($p>0.05$).

Change in pain intensity (Fig. 4). The mean pain intensity in each group was significantly reduced ($p<0.05$) after treatment and at follow-up. Between the end of treatment and follow-up there was a statistically significant regression ($p<0.05$) which was continuing to reduce for group 1, whereas group 2 was starting to increase. This, however, was

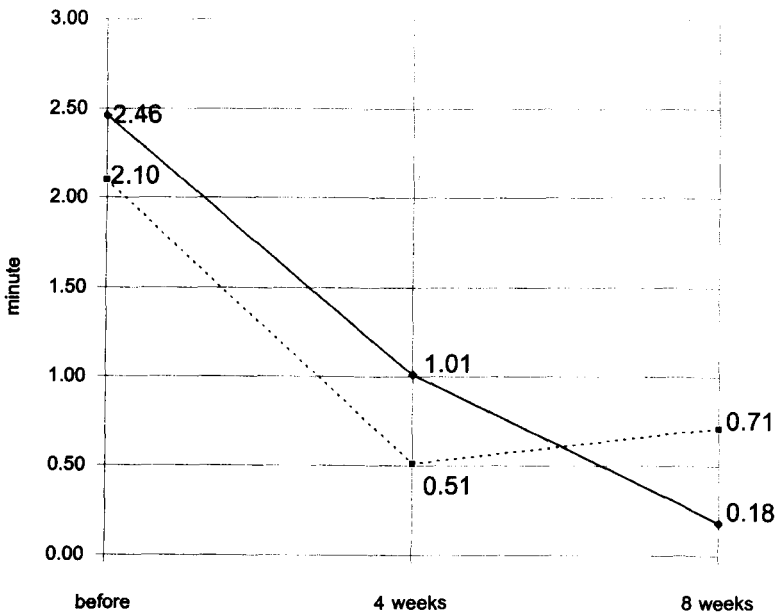


Fig 3. Change in cramp duration. ___ Group 1 (N=12); .... Group 2 (N=10).

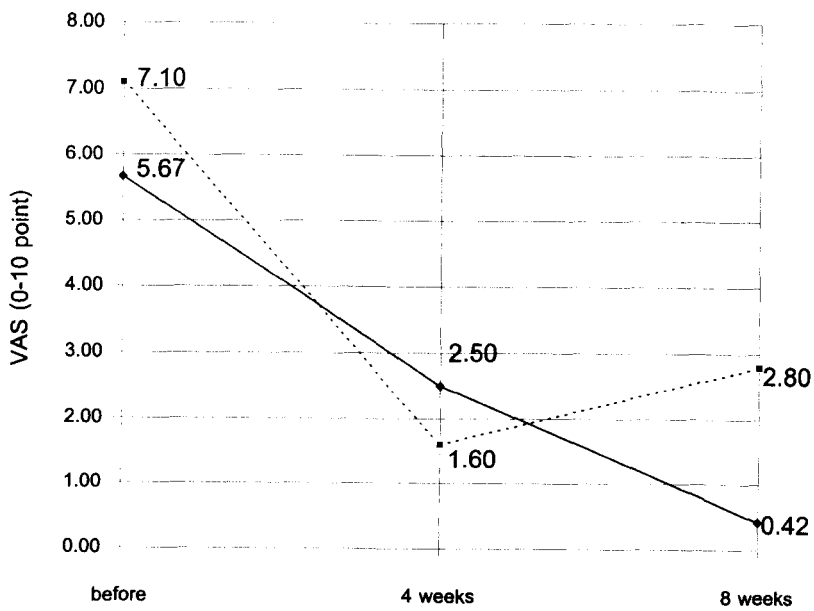


Fig. 4. Change in pain intensity. ___ Group 1 (N=12); .... Group 2 (N=10).

not statistically significant (p>0.05).

Change in cramp index (Fig. 5). The mean cramp index in each group was significantly reduced (p<0.05) after treatment and at follow-up. Between the end of treatment and follow-up, cramp index continued to decrease in group 1, whereas, in group 2 started to increase. This, however, was not statistically significant (p>0.05).

Change in pain threshold (Fig. 6). Both groups showed a similar pattern of progressively

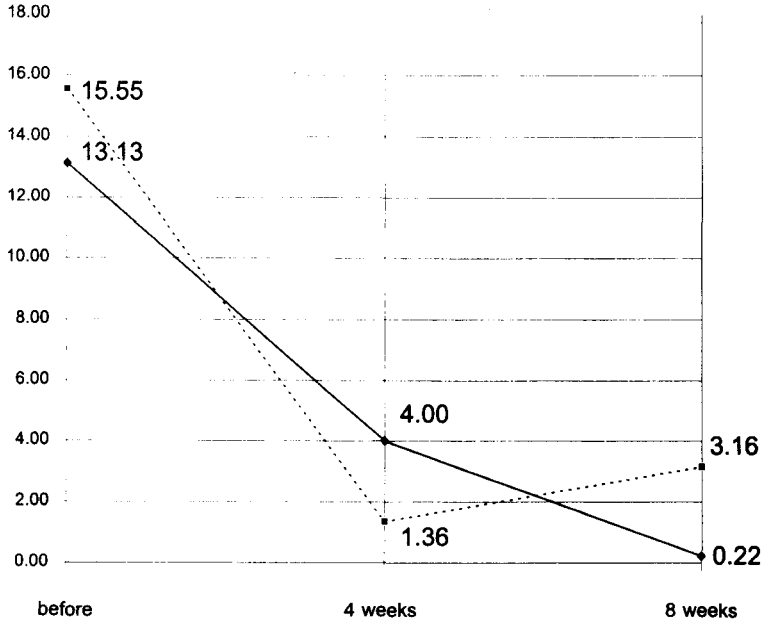


**Fig. 5. Change in cramp index. __ Group 1 (N=12); .... Group 2 (N=10).**

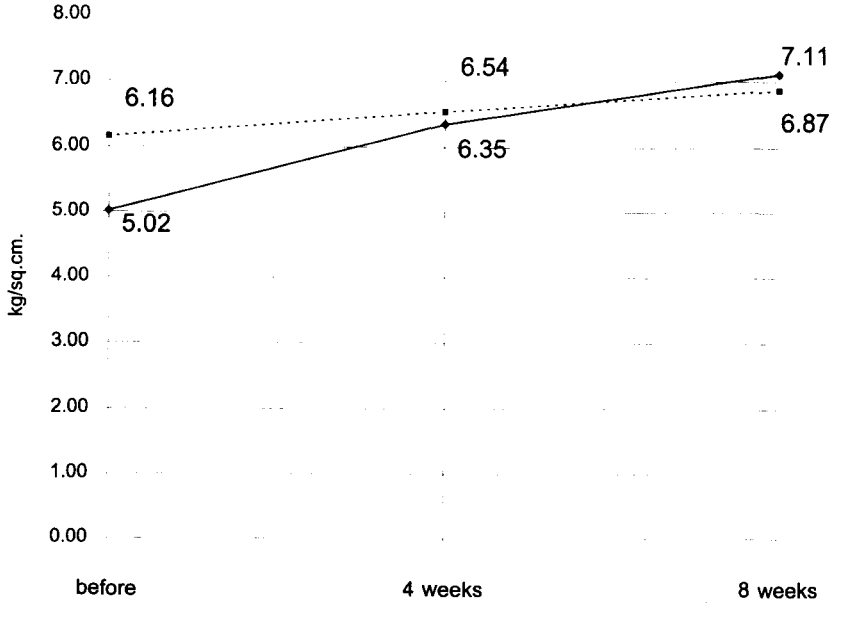


**Fig. 6. Change in pain threshold (kg/cm$^2$). __ Group 1 (N=12); .... Group 2 (N=10).**

increasing pain threshold from before treatment to after treatment and also at follow-up. The increment was significantly different ($p<0.05$) only in group 1 when comparing the pre-treatment period and follow-up.

**Between-group differences**

Before and after treatment (Fig. 2-6) there was no significant difference ($p>0.05$) between the two groups in any of the variables measured (frequency, duration, intensity, index of cramp and pain threshold).

In comparing the two groups at the 8th week (Fig. 2-6), group 1 had a significantly better outcome ($p<0.05$) as evidenced by decreased frequency, intensity and duration of cramps as well as a decreased cramp index. There was, however, no significant difference ($p>0.05$) in pain threshold between the two groups.

## DISCUSSION

In this study, the effectiveness of TrP injection protocol for the treatment of NCC associated with gastrocnemius MPS was as good as the current standard protocol (oral quinine sulfate at bedtime) during the treatment period and better at follow-up. Also no side effects were seen from the TrP injection protocol, whereas, cinchonism side effects of quinine developed in two subjects.

The result of the therapeutic outcome of this study substantiates the clinical impression that myofascial TrP in the gastrocnemius muscle is a common cause of NCC. A thorough retrospective review of the medical literature revealed at least one clue implicating myofascial calf TrPs as a widely unrecognized cause of NCC. That calf stretches, one of the specific treatments of gastrocnemius TrPs, have long been used as mechanical treatment.

A myofascial TrP is a hyperirritable focus with spontaneous electrical activity recorded as needle EMG activity[17]. It is possible to identify the cause of TrPs as dysfunctional endplates marked by excessive release of acetylcholine,[18]. This condition is likely to have a close relation to local twitch responses and cramps. The pharmacological property of quinine of decreasing the excitability at the motor endplate region, thereby reducing the muscle contractility and diminishing the response to acetylcholine,[19] which has been considered as a prophylactic or symptomatic treatment of NCC, may explain the benefit during the treatment period only.

Why does the benefit of quinine in this study still exist after the wash out period? This may be due to either the continuation of daily calf stretches or to a long-lasting effect of quinine itself which has been reported in a few papers[19,20].

Although the TrPs in the subjects studied are very common, this incidence of 88.9 per cent can not represent the incidence of TrPs in the general population with NCC because this study was conducted on a hospital population.

A further study in the general population with a larger sample size and follow-up without calf stretches in order to evaluate the long term effects of oral quinine and TrP injection independently is recommended.

In conclusion, the therapeutic outcome of this study supports the clinical impression that gastrocnemius TrPs are one cause of NCC that is widely unrecognized. This result suggests that injection of the TrPs has a more lasting effect on the TrP mechanism than treatment with quinine. This is consistent with the identification of contraction knots as the likely pathogenesis of TrPs[21].

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# ความสัมพันธ์ระหว่างกลุ่มอาการมัยโอแฟสเซี่ยล เพนของกล้ามเนื้อแกสทร็อกนิเมียส กับภาวะตะคริวที่น่องที่เกิดเวลากลางคืน

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เพื่อเป็นการสนับสนุนว่ามัยโอแฟสเซี่ยล เพนของกล้ามเนื้อแกสทร็อกนิเมียสเป็นสาเหตุหนึ่งของภาวะตะคริวที่น่องที่เกิดเวลากลางคืนจากผลการรักษา จึงได้ทำการศึกษาเปรียบเทียบผลการรักษาด้วยวิธีการฉีดยาที่จุดกดเจ็บกับการกินยาควินีนในผู้ป่วยตะคริวที่น่องที่เกิดเวลากลางคืนที่มีจุดกดเจ็บในกล้ามเนื้อแกสทร็อกนิเมียส ผู้ป่วย 24 คนถูกแบ่งเป็นสองกลุ่มกลุ่มละ 12 คน กลุ่มแรกได้รับการรักษาด้วยการฉีดยาที่จุดกดเจ็บในกล้ามเนื้อแกสทร็อกนิเมียสด้วยยาไซโลเคนในขณะที่กลุ่มที่สองได้รับยาควินีนซัลเฟต 300 มิลลิกรัมรับประทาน ระยะเวลาในการรักษาคือ 4 สัปดาห์และติดตามผลต่อไปอีก 4 สัปดาห์ ภาวะตะคริวถูกประเมินเชิงปริมาณ (ในรูปแบบของ ความถี่ เวลา ความรุนแรงของอาการปวด ดัชนีของตะคริว และค่าความทนทานต่ออาการปวดที่จุดกดเจ็บของกล้ามเนื้อแกสทร็อกนิเมียส) ก่อนการรักษา หลังการรักษา และหลังการติดตามผลตามลำดับ ผลการรักษาของทั้งสองกลุ่มแสดงให้เห็นว่ามีการลดลงทางสถิติอย่างมีนัยสำคัญในทุกรูปแบบของการประเมินเชิงปริมาณ (ที่ความเชื่อมั่น 95%) ยกเว้นค่าความทนทานต่ออาการปวดที่จุกกดเจ็บของกล้ามเนื้อแกสทร็อก-นิเมียสในผู้ป่วยกลุ่มที่ 1 ที่เพิ่มขึ้นทางสถิติอย่างมีนัยสำคัญเมื่อเปรียบเทียบระหว่างก่อนการรักษากับหลังการติดตามผล ในการเปรียบเทียบระหว่างสองกลุ่มจะไม่พบความแตกต่างทางสถิติในช่วงของการรักษา ผลดีของการรักษาทั้งสองวิธีจะคงอยู่ถึงช่วงติดตามผล 4 สัปดาห์หลังการรักษา แต่ผลการรักษาในกลุ่มที่ได้รับการฉีดยาที่จุดกดเจ็บพบว่าดีกว่าอย่างมีนัยสำคัญในทุกกรณียกเว้นความทนทานที่จุดกดเจ็บ ผลการศึกษานี้สนับสนุนว่าจุดกดเจ็บในกล้ามเนื้อแกสทร็อกนิเมียสเป็นสาเหตุหนึ่งของภาวะตะคริวที่น่องในเวลากลางคืน และพบว่าการรักษาภาวะตะคริวที่น่องร่วมกับมัยโอแฟสเซี่ยล เพนด้วยวิธีฉีดยาที่จุดกดเจ็บไม่เพียงแต่มีประสิทธิภาพเท่าเทียมกับการทานยาควินีนในระยะช่วงทำการรักษาเท่านั้นยังได้ผลดีกว่าในช่วงติดตามผลอีกด้วย

**คำสำคัญ** : มัยโอแฟสเซี่ยล เพน, ตะคริว

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