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PHYSIOTHERAPY AND ELECTROMYOGRAPHY IN MUSCLE CRAMP

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ABSTRACT

Four cases of muscle cramps, at a sports institute, are presented. Electric activity was increased in cramp due to overload. The influence of stretching, electro- and compression therapies on these increased Electromyographic (EMG) activities was studied. The registration was performed with an EMG-analyser combined with a recorder, using surface electrodes.

Key words: Muscle cramps, EMG activity, Physiotherapy, Stretching, Electrotherapy, Compression

INTRODUCTION

Stretching exercises, various forms of massage, heat, strength exercises, cooling treatments and other physiotherapeutic measures as well as drug therapy have been found to accelerate the healing of muscular injuries and disturbances of neuro-muscular function, provided that the dosage has been accurate (Cavagna et al, 1968; Ryan, 1969; Kvist et al, 1974; Järvinen, 1976).

Monitoring of such a healing process has previously been based on measurement of relevant joint range of movement corresponding to the muscle in cramp, muscle palpation, muscular strength — and the subjective assessment of the person affected.

A pilot study with an Electromyograph (EMG) analyser (Remes et al, 1984) showed highly increased EMG activities in muscles cramped due to overload. The aim of this study was to find out the short-term effects of certain treatment practices widely used in sports, on these EMG activities.

MATERIAL AND METHODS

The study was carried out at a sports institute (Kisakallio, Finland). The material consisted of students of a basic course for physical training instructors (male and female) with a mean age of 23 years. Both test subjects and controls had been exercising regularly.

The test group was formed by four students diagnosed by a physician as follows: (1) cramp in rectus femoris; (2) cramp in biceps femoris; (3) bursitis of the knee joint; (4) cramp in gastrocnemius. The controls were chosen among completely symptom-free students attending the same course.

This study was performed under laboratory conditions using an EMG-analyser (Mega Electronics, Kuopio, Finland; Remes et al, 1984) with ECG-electrodes (diameter 20 mm, Christian Nissen, Finland). The test electrode was placed to the middle of the muscle to be tested, the control electrode over the nearest bone, and the earth electrode 50-60 cm from the measuring point. The registration was accomplished by means of a x-t recorder, (Servogor 120, Austria). The mean values for the integrated EMG activity in microvolts were calculated from 10 second periods of the recordings. The EMG activities were recorded for 5 minutes

after discontinuation of the treatment at three different joint angles: at 60°, 90° and 180°.

The therapeutic measures comprised: passive stretching (Harre, 1975; Weineck, 1980), intensive manual compression of the pain site till disappearance of the pain sensation (Robertson, 1971), and electrotherapy (EST 201 S, Escotek, Oulu).

RESULTS AND DISCUSSION

Case 1

Cramp in the rectus femoris of a female athlete occurred due to an overload during training. Therapy consisted of passive stretching, compression and electrotherapy by galvanism, given to the prone lying patient with the leg at 180°.

The treatments were given consecutively immediately following the respective EMG-recording.

Passive stretching and compression of the pain site led to reduced EMG activity (Table I). Electrotherapy, applied after passive stretching and compression, increased EMG activity, especially with the knee at 180°. Passive stretching of the muscle after the electrotherapy again resulted in reduction of the muscular activity, and compression of the muscle after this did not bring further changes. Findings in the healthy control were similar to those in the cramped person.

Case 2

Cramp in the biceps femoris was diagnosed in a male athlete. Therapeutic measures consisted of electrotherapy (50% of the dosage used in case 1), compression and stretching, in prone lying with the leg at 160°.

Table II indicates a considerable decrease in the muscular EMG activity after the electrotherapy.

Stretching and compression of the muscle after electrotherapy only brought about minor changes in EMG activity, perhaps because the post-electrotherapeutic EMG levels were close to those in a resting muscle.

Case 3

A female athlete with muscle cramp was later found to have

TABLE I

Influence of consecutive physiotherapeutic measures on surface EMG activity of the cramped rectus femoris at different knee angles. (T) patient: a 20-year-old woman. (C) normal control of the same age and sex.

EMG activity (μ V)												
Knee angle	Before therapy		After (a)		After (b)		After (c)		After (d)		After (e)	
	T	C	T	C	T	C	T	C	T	C	T	C
60°	12.5	0.5	7.8	0.2	7.0	0.0	15.5	0.5	6.3	0	5.5	0
90°	12.0	0.5	7.8	0.2	6.5	0.2	11.0	0.5	5.3	0	6.0	0
180°	11.8	0.5	7.8	0.2	6.5	0.0	21.8	0.6	6.0	0	5.5	0

(a) Passive stretching for 2 min

(b) Compression of the pain site till disappearance of the pain sensation

(c) Electrotherapy with the ESt 201 S-device of Escotek (Oulu, Finland), knee angle 180°, duration: 20 mins

— current intensity: 4 mA, pulse shape: , pulse spacing: 25 ms, pulse duration 15 ms, pulse repetition frequency: 58 Hz

(d) = (a) passive stretching for 2 min

(e) = (b) compression of the pain site

TABLE II

Influence of physiotherapeutic measures on surface EMG activity of the cramped biceps femoris at different knee angles in a 24-year-old man (T = test subject) and in a normal control of the same age and sex (C)

Knee angle	EMG activity (μV)							
	Before therapy		After (a)		After (b)		After (c)	
	T	C	T	C	T	C	T	C
60°	7.0	0.5	3.0	0.3	2.8	0.3	2.5	0.0
90°	7.5	0.8	2.5	0.5	2.5	0.3	2.3	0.3
180°	9.3	0.5	2.3	0.3	2.0	0.3	2.0	0.0

(a) Electrotherapy

— duration: 10 min, current intensity: 2 mA; other parameters as in case 1

(b) Compression as in case 1

(c) Stretching as in case 1

TABLE III

Influence of physiotherapeutic measures on bursitis-associated surface EMG activities in the biceps femoris. Patient: a 23-year-old woman (T = test subject) and in a female control (C) of the same age.

Knee angle	EMG activity (μV)					
	Before therapy		After (a)		After (b)	
	T	C	T	C	T	C
60°	4.5	0.5	2.0	0.3	2.0	0.3
90°	5.8	0.8	1.3	0.5	1.8	0.3
180°	5.8	0.5	1.5	0.3	1.3	0.3

(a) Stretching as in cases 1 and 2

(b) Compression as in cases 1 and 2

Note: This case, unlike the other three cases of "pure muscle cramp" was probably due to reflex spasm from an adjacent lesion, bursitis.

bursitis of the knee joint associated with it. Stretching was performed as in cases 1-2 followed by compression.

Table III shows a decrease in the EMG activity of the biceps femoris as a result of stretching. Manual compression of the painful site after stretching did not bring on any further changes.

Case 4

Cramp in the gastrocnemius was diagnosed in a female athlete. Stretching was applied as in cases 1 to 3 followed by compression as in cases 2 and 3.

CONCLUSIONS

From the present series of case studies it can be concluded:

As demonstrated in Table IV, stretching decreased the excess EMG activity. Further reduction was achieved in this case by manual compression of the painful site.

TABLE IV

Influence of physiotherapeutic measures on surface EMG activity of the cramped gastrocnemius in a 20-year-old woman (T) and in a normal female control (C)

Foot joint angle	EMG activity (μC)					
	Before therapy		After (a)		After (b)	
	T	C	T	C	T	C
minimum	4.5	0.0	2.3	0	1.8	0
90°	5.8	0.3	2.3	0	1.8	0
maximum	5.8	0.0	2.5	0	2.3	0

(a) and (b), see Table III

From the present series of case studies it can be concluded:

1. Passive stretching leads to a decrease in EMG activity in the muscle.
2. The compression of the pain site lowers the EMG activity, too.
3. Electrotherapy can alter EMG activity but dosage levels may be critical.

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