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PART 1:

Journal Name:	British Journal of Applied Science & Technology
Manuscript Number:	2015_BJAST_17820
Title of the Manuscript:	PHYSICOCHEMICAL AND RHEOLOGICAL STUDIES OF IRVINGIA GABONENSIS GUM EXUDATES
Type of the Article	Original Research Article

PART 2:

FINAL EVALUATOR'S comments on revised paper (if any)	Authors' response to final evaluator's comments
There is substantial improvement in language from the previous version. However, there are still many grammar errors, typos, missing words, and etc. Also many sentences do not conveying idea/concept well. The flow of writing still deserves significant consideration. If the authors intend to publish their work in an English language journal, help from English writing professional is a must. Reply to comments from the authors are hard to trace givens the extremely limited, non-informative responses. Also a few comments are left unaddressed. Further, the revision brings in a few new issues (see below). Introduction: 1) Some materials are identical to the Discussion section. Introduction usually provides only the major findings of the cited studies while in the Discussion section, you provide more details of the key cited studies and how your study is compared to them. Methods/Subjects 1) Table 1 is not inclusion criteria but rather exclusions if the word "No" is removed. Instead, the "Diagnostic steps" look more like the inclusion criteria. Methods/Equipment 1) Force platform: what is the significance of ± 1 cm in terms of "the substantial steps of experiments"? And what are "the substantial steps" and purposes with respect to sEMG data acquisition? 2) The custom-designed system is more important than the force platform as the system was the one actually used during sEMG data acquisition, not the force platform. As so, the custom-designed system should be the subheading for the section. Methods/Statistical Analysis 1) "$\leq$" or "$<$" 0.05? Results 1) Please remove all "$P > 0.05$". There is no need of them. 2) There is no need to have numbers listed in the text body again when you already presented them in figures. Among text/table/figure, you can only choose one to show your results. 3) Figure convention: Asterisk is only needed when there is statistical significance. It is unconventional to use "*" to describe insignificance. Also if there is no "*" in the figure, no need to mention "Asterisk". However, you did not draw any "*" in your figures?	1. I try to editing it and I asked a professor in London to read and to edit my manuscript. 1. I edited it. 1. I edited it. 1. I used this term "the substantial steps of experiments" for emphasis on ± 1 cm displacement before starting study. If displacement is up ± 1 cm, participants used of hip strategy instead of ankle strategy. 2. I corrected it. 1. $P < 0.05$ 1. I edited it. 2. I corrected it. 3. I corrected it.



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4) Because reaction time is a single value, it is no need to have a figure for it. Discussion: 1) The content seems reasonable but the flow of writing is really hard to follow. Asking one of your colleagues who has no idea of your study to read through your manuscript is very helpful to find out if you convey your idea clearly (I do it a lot). 2) Usually we don't introduce new concept (for example APA) in the Discussion section. It needs to be mentioned in the Introduction section.	4. I corrected it. 2. Thanks for your offer. To follow your idea, i asked a professor in London to read and to edit my manuscript. 3. I corrected it.
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Arm Flexion Influence on Muscle Reaction Time in Females with Active Myofascial Trigger Point

Abstract

Aim: To investigate arm flexion effect on reaction time in females with upper trapezius active myofascial trigger point(MTP).

Methods: Fifteen women (aged 24.5 ± 2.7 years) with one active MTP in the upper trapezius and fifteen normal healthy women (aged 23.30 ± 1.6 years) were participated in this study. Participants were asked to stand on the force platform for 10 seconds in an erect comfortable standing position. To investigate muscle reaction time, time interval of first stimulus presentation and muscle force generation onset were measured. The target muscles were anterior deltoid(AD), cervical paraspinal(CP) lumbar paraspinal(LP), upper trapezius(UT), sternocleidomastoid(SCM), medial head of gastrocnemius(GC). Participants were asked to flex their arms in response to a sound stimulus preceded by a warning sound stimulus.

Results: There were significant differences in reaction and motor time($P < 0.001$). There was not significant difference in premotor time.

Conclusion: The present study shows that patients with active MTP need more time to react to stimulus. Firstly patients had less compatibility with environmental stimulations, and secondly, they responded to a specific stimulation with variability in Surface Electromyography(SEMG).

Key words: Myofascial trigger point, Surface Electromyography(SEMG), Reaction Time.

Introduction

Mechanical pain is a general term referring to any type of back pain caused by placing abnormal stress and strain on muscles of the vertebral column. Typically, mechanical pain results from bad habits, such as poor posture, poorly-designed seating, and incorrect bending and lifting motions[1, 2]. Aetiology of mechanical pain is not well understood, but literature indicates that shoulder and cervical region myofascial trigger point (MTP) could be responsible for this category of mechanical pain [3]. MTP as a significant source of mechanical pain[1, 4] has a high prevalence among individuals with regional pain complaints[3]. The prevalence differs from 21 percent in patients perceived in general orthopedic clinics, to 30 percent in general medical clinic patients with regional pain and up to 85 - 93 percent of patients in specialty pain management centers [4]. The next paragraph relates to pain and its effect on motor and sensory function.

The mechanism of adaptation to pain consists of alterations in motor cortex, excitability and organization [5]. Furthermore, it comprise more complicated changes in sensory input and motor responses [6]. Changes in sensory function can deeply affect movement control of musculoskeletal system, especially in painful conditions [7, 8]. There are numerous studies about sensory changes following pain in shoulder[9], back[10] and cervical pain[11]. Changes include reduced sensory perception[12], increased repositioning errors[13], reduced responsiveness to sensory input[14], and restructuring of the somatosensory areas of the motor cortex[15, 16]. These studies indicate that pain induces changes in Central Nervous System(CNS), which possibly leads to complex changes in movement and postural control mechanism. The next paragraph refers to the reaction time and its assessment in this study.

Reaction time Includes two critical phases: the premotor time and motor time[17]. Premotor time, defined as the time between exhibition of a stimulus and the first noticeable muscle activity, incorporating perception, decision making, information processing and transfer[17, 18]. Motor time is so called electromechanical delay and is defined as time between muscle activity onset and force generation[17]. It is related to the rate of muscle force production and is also as an indirect amount of muscle–tendon unit stiffness[19].



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As there is no published paper about effects of MTP on muscle reaction time thus, the aim of the present study was to investigate effects of arm flexion on reaction time of muscles in females with active myofascial trigger point. Our primary hypothesis was MTP can effect on muscle reaction time. The secondary hypothesis was increase of reaction time due to pain.

Methods

Subjects

This study is an original research. A convenience sample of fifteen women(aged 24.5 ± 2.7 years) with one MTP accessible in upper trapezius muscle together with fifteen matching healthy control women(aged 23.30 ± 1.6 years) were recruited.

Subjects found suitable for participants in the study as per the inclusion and exclusion criteria (table 1,2) [20] were requested to sign the consent form approved by Tehran University of Medical Sciences ethics committee. The approval number is 92/D/130/297.

Table 1 Inclusion criteria

- Presence of a palpable taut band
- Local twitch response activated by snapping palpation of the taut band,
- Presence of at least one hypersensitive tender point In response to 250 N pressure on taut band
- Spontaneous referral pain pattern[21, 22].
- Visual Analogue Scale (VAS) is two or three centimeters during the experiment period.

A MTP was considered as active if all of the aforesaid criteria were present [22].

Table2 Exclusion criteria

- Severe postural disorders in clinical assessment.



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- History of epilepsy, depression, migraine, and other mental health disorders.
- History of surgery in the shoulder and cervical area during the past six months prior to these tests.
- Treatment of trigger point in the past month prior to experiment.
- Sign of headache, dizziness, squint, and nausea during the movement or in positions.
- Clinical symptom of arthrogenic pain, osteoarthritis and radiculopathy of cervical area and upper limb.
- Sign of fibromyalgia.
- Temporomandibular joint (TMJ) disorder in clinical assessment.
- Caffeine consumption on the test day.
- Participant in the menstrual cycle.
- Lack of appropriate report of SEMG.
- Lack of cooperation because of pain and exhaustion.

Equipment

SEMG

A SEMG equipment (Biometric Ltd, UK) with sampling rate: 1000Hz, Band pass filtered:20-450Hz and sensitivity: 100 μ v/div was used in this study. Placement of the electrodes followed the guideline of SENIAM: anterior deltoid(AD); lumbar paraspinal(LP) at the level of the iliac crest; upper trapezius(UT) at the midway between acromioclavicular joint and C7 and the medial head of gastrocnemius(GC) [23-25]. Cervical paraspinal(CP) at the level of the C4[26, 27] and sternocleidomastoid(SCM) a third of the distance from sternal notch to mastoid processes[26-29]

Surface electrodes(Biometrics Ltd, UK) were set at fixed positions on shaved and cleansed skin[24].They were mounted in bipolar pattern and were allied along the major axis of the muscle with a 2 centimeters inter-electrode distance. All recordings were made of the involved side in the MTP group, and from dominant hand in the control group. Both groups were matched in terms of dominant hand.

Procedure

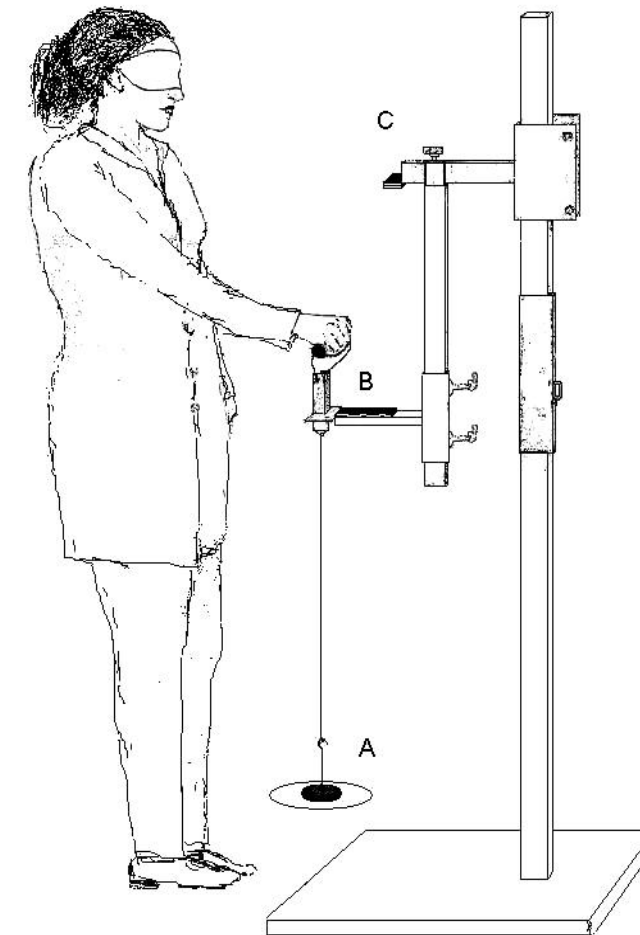
At first stage participants standing upright on force platform(BertecColumbus, Ohio, USA) for 10 seconds in an erect comfortable standing position with feet 10 centimeter apart. The Force platform only is utilized for monitoring centre of foot pressure (CFPy) displacement[24]. The test was started as soon as CFPy displacement was around ± 1 centimeter[24].

At next step, participants were asked to stand in front of the designed system for weight lifting. Subject's shoulder was flexed to 60 degrees[23], elbow was positioned extended and pronated.



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Weight set at 2% of body weight was hung from lower section of system.[23, 24]. A sensor was designed to examine the movement initiation. As soon as the weight was lifted off the sensor, a trigger was



recorded by SEMG signal. Range of arm motion was calculated from the first height of the hands to shoulder height[24].(Fig. 1)

Fig1. Experimental setup

A = weight site

B = Onset trigger or 60 degree sensor (blackened plate)

C = Offset or 90 degree sensor (blackened plate)



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Two different tones were used as warning stimulus(S1) and response stimulus(S2). The interval between stimulus fixed at two seconds, was introduced as preparatory period. The duration and frequency of auditory stimulus were equal to 100 milliseconds and 2 kHz, respectively. Intensity was set 50 dB higher than hearing threshold[23, 24].

Following three seconds quiet standing, S1 was presented followed by S2 after two seconds. Participants were asked to flex their shoulder as fast as conceivable to minimize the response time to onset of S2, stopping hand at shoulder level. This position was, then, held for three seconds. Speed of movement was accentuated over precision[23]. In order to record and quantifying the speed a sensor was placed on participant's shoulder. The initial position of the sensor was at 60 degrees shoulder flexion shown by an event marker on SEMG signal. After the shoulder was flexed to 90 degrees, end range of motion was detected by an external sensor in synchronized with SEMG after ten repetition, it was estimated that shoulder flexion speed would be about 100 signals.

Analysis and Interpretation of Data

SEMG Analysis

Following signal filtering, Root Mean Square(RMS) values were calculated. Average amplitude of baseline activation was calculated based on 500 milliseconds before S1. Afterwards average amplitude of baseline activity plus 3 standard deviations(SD) was used as activity threshold to determine the onset of muscle activation[30]. All stages were performed by data log software and finally the SEMG output data consisted of onset of preparatory muscle activity.

The interval between S2 and onset of motion considered as reaction time. It was motion onset calculated based on triggering signal synchronized with SEMG signal. This variable included premotor time (interval between S2 and onset of muscle electrical activity)

Statistical Analysis

A Kolmogorov-Smirnov (K-S) test was used to determine the normal distribution of each variable.

Independent *t*- test was used to investigate the matching accuracy of demographic criteria and to compare variables between two groups.

The confidence level was set at $\alpha < 0.05$ for statistical significance. All statistical calculations were accomplished by SPSS statistical software, version 17.0.

Results

K-S test result was not significant for all variables. Therefore, all variables were assumed as normal, and a parametric test could be used. No statistical difference was found between two groups for mean age, weight, and height. In other words, participants were matched. Anthropometric characteristics of participants are listed in table 3.

1. Premotor Time

There was no significant difference in premotor time in all muscles. Independent *t*-test results of SEMG premotor times are presented in (fig. 2).

2. Motor Time



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Except gastrocnemius, motor time in all muscles showed significant($P < 0.05$). Independent t -test results of SEMG motor times are presented in (fig. 3).

3. Reaction Time

There was significant difference in reaction time between two groups($P < 0.05$).

Table3 Anthropometric characteristics of participations in the control group (N=15) and MTP group (N=15)(mean $\pm$ SD)

	N	Age(y)	Weight (Kg)	Height (cm)
Control	15	23.30 $\pm$ 1.6	56.53 $\pm$ 6.2	164.76 $\pm$ 6.45
MTP	15	24.5 $\pm$ 2.7	57.5 $\pm$ 5.47	163.35 $\pm$ 5.4

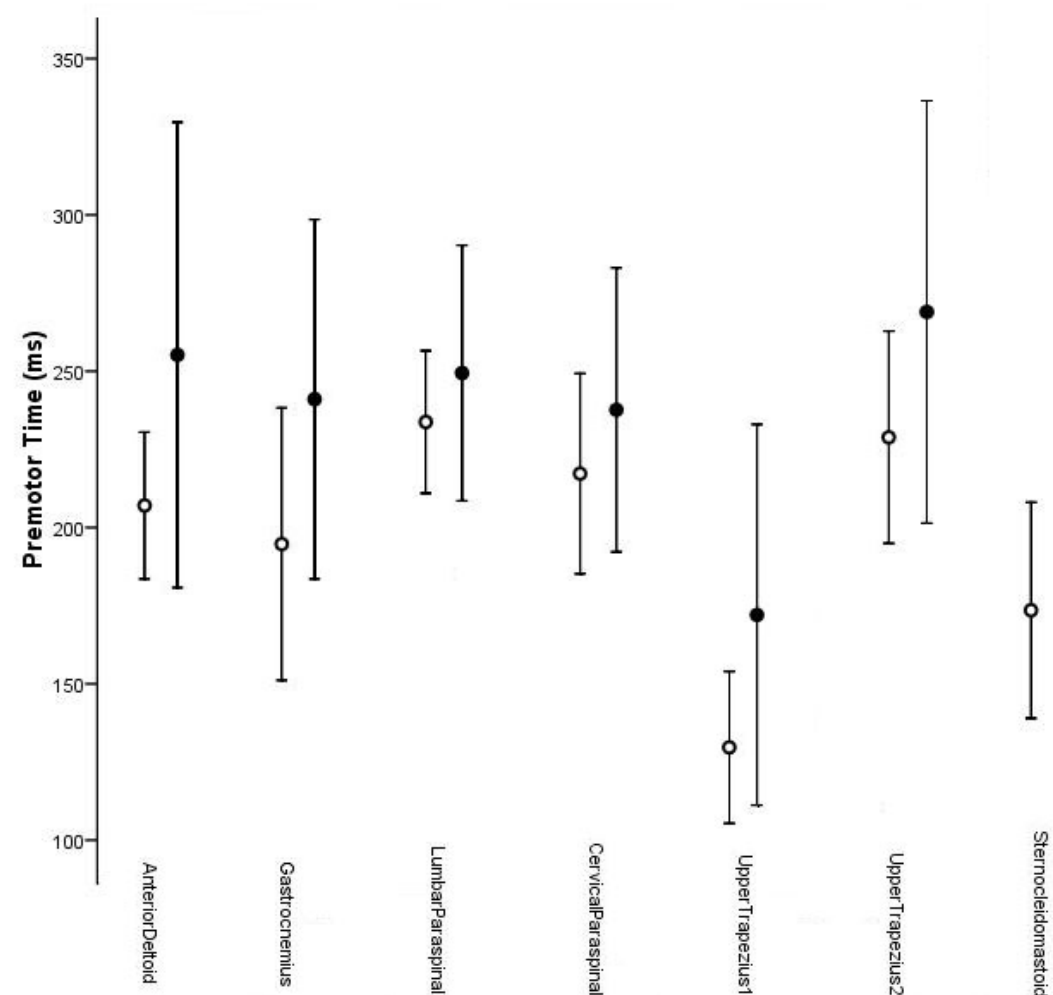


Fig. 2. Means and standard deviations of SEMG premotor time for the control group(°) and patient group(·).



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- Upper trapezius1 was considered as the upper trapezius with MTP in patient group and as a dominant upper trapezius in control group.
- Upper trapezius2 was considered as the upper trapezius without MTP in patient group and as a non-dominant upper trapezius in control group.

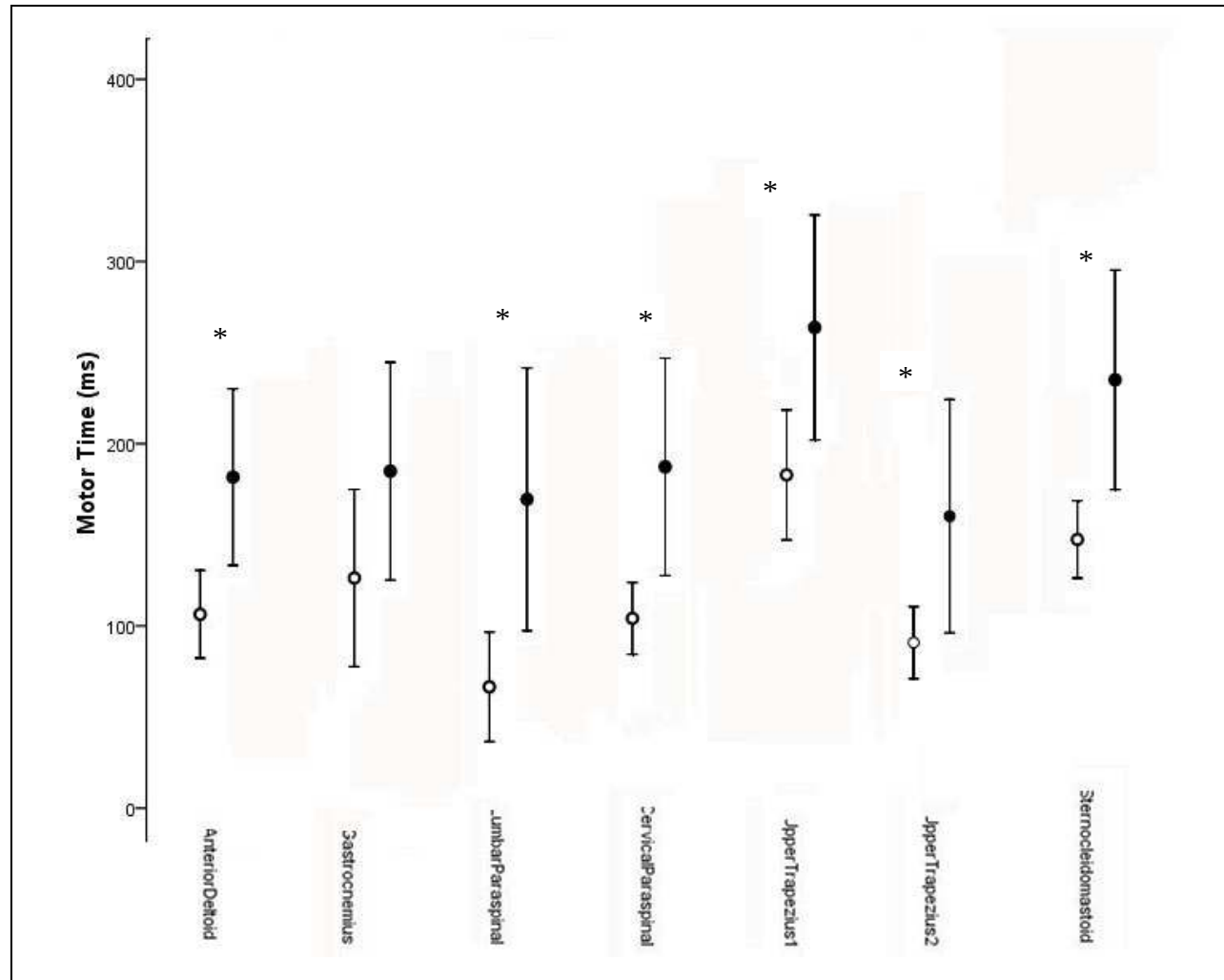


Fig. 3. Means and standard deviations of SEMG motor time for the control group(°) and patient group(°). Asterisk indicates significant difference (P < 0.05) for all of muscles except Gastrocnemius.

- Upper trapezius1 was considered as the upper trapezius with MTP in patient group and as a dominant upper trapezius in control group.
- Upper trapezius2 was considered as the upper trapezius without MTP in patient group and as a non-dominant upper trapezius in control group.

Discussion

Results of premotor muscle time as one of the variables indicated no significant difference between MTP and healthy control groups. However, premotor times defined as incorporating perception, decision making, information processing and transfer[17], was increased in MTP group. Absence of meaningful difference in this parameter between two groups may be due to lack of information receiving and processing[17, 18, 31].

Movement time as a variable relating to muscle force production rate is also considered as an indirect measure of muscle–tendon unit stiffness[19].

In this study, time of movement showed an increasing trend in patients' group, which is in agreement with variations in arousal level of CNS, growth in CNS parameters and response stimulus[32]. It can be claimed that patients with high irritability may have encountered higher inputs causing an increase in motor response and movement time[2, 32]. The first reasoning for abnormal response to peripheral stimulation can be attributed to disturbance in information processing. It is verified that the patients with trigger points have disorders in motor control at level of limbic system, especially at planning level[33]. Muscle reaction time showed an increasing trend in patients' group. This increase can be attributed to neuromuscular control reduction in this group.



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The probable reason for such a reduction may be cervical muscle tone increase due to trigger point[2, 4, 32]. Moreover, the reported increase of sympathetic response in patients with trigger point[32, 34, 35] can be due to cutaneous afferent input increase which finally affects gamma fusimotor in muscle spindle and cervical proprioception [1, 32, 36].

On one hand, most studies have examined the low back pain effect on reaction time and on the other hand, there is no published paper in our study subject. Therefore, we had to use low back studies for comparison. Jacobs et al. investigated the low back pain (LBP) associated with altered postural stabilization and concomitant changes in the cerebrocortical motor physiology. They showed that Cerebrocortical activity altered prior to arm movements, requires anticipatory postural adjustment for individuals with chronic LBP. The results demonstrated that the participants with LBP exhibited a significant difference in their onset latencies of their contralateral erector spinae muscle, which was not evident from the participants without LBP. In our study, increasing reaction time due to pain is in agreement with Jacobs et al. findings[37, 38].

Tsoa considered reorganization of the motor cortex that associated with postural control deficits in recurrent LBP. They observed, when LBP individuals moved their arm rapidly into flexion, activation of transverses abdominal SEMG was significantly delayed compared to the healthy individuals[39]. Despite differences in nature and causes of back and neck pain, it can be claimed that pain can change the muscle reaction time.

In general, in MTP patients after each stimulus, more time is needed for CNS to accept the new stimulus. The process of hyperactivity in control centres leads to lack of self- regulation which finally results in the application of an unusual muscular pattern or different co-activation[32, 40]. This behavior can undoubtedly affect the parameters of reaction and movement control[37, 41]. This can be regarded as one of the most important results in this study. In other words, following each particular stimulus, individuals can be expected to respond correctly. However, it takes a long time for CNS to react; consequently the extent of coincidence declines. This occurrence is because of reducing the habituation of the control system after applying a specific motor command[37, 41]. Patients involve more sources of attention leading to abundant degree of freedom[8, 42, 43]. So increase of degree of freedom can cause variation of muscular behavior and reaction time[42].

Study Limitations

This study was only carried out on female participants and sample size is small, therefore, the results from this study could not be extrapolated to males.

Conclusion

Firstly patients had less compatibility with environmental stimulations, and secondly, they responded to a specific stimulation with many degrees of freedom and variability in SEMG. According to the results of this study, it can be concluded that use of motor control techniques in this type of patients might be useful.

Suggestion for future studies

Performing new research in both sexes and considering another muscles is proposed. Also, investigating parts of brain with electroencephalography(EEG) or Contingent Negative Variation(CNV) synchronized with SEMG in MTP groups is proposed .

Conflicts of Interest

The authors have no conflict of interest to disclose.

Acknowledgment



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