Effect of Salat (Prayer) Movements versus Specific Stretching Exercises on Electromyographic Activity of Erector Spinae Muscle

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Abstract

Background: Salat is the prayer practiced by most of Muslims for five times a day and night. It involves several physical motions, namely standing, bowing and prostration. Benefits of salat from the spiritual point of view have been discussed at length by religious scholars. However, there is still little discussion on the salat’s benefit from science perspective even though it can be seen that performing salat is like performing slow and moderate exercise.

Objectives: This study was conducted to investigate the effect of salat movements versus specific stretching exercises on electromyographic activity of erector spinae muscle.

Methods: Thirty subjects of both gender (17 males and 13 females) with age ranging from 19 to 25 years voluntarily participated in this study. They were assigned in one group, each subject was randomly allocated for one of five different positions, 1) 45 degrees bowing, 2) bowing, 3) prostration, 4) long sitting bent-over back stretch position and 5) double knee to chest stretch position. The electromyographic activity of right and left erector spinae muscle was recorded and analyzed for each position as a ratio of maximum contraction recorded for each muscle.

Results: The univariate tests of repeated measure MANOVA revealed that there were significant differences in the mean values of EMG activity of right and left erector spinae muscle among different positions (F=77.322, p=0.000*) and (F=77.170, p=0.0001*) respectively.

Conclusion: Salat movements (bowing and prostration) are more advantageous than specific stretching exercises on decreasing erector spinae muscle myoelectrical activities. This indicates that subjects performing everyday prayer has the benefit of stretching effect on their erector spinae muscle. It can improve musculoskeletal system in both normal and subjects with low back pain receives stretching exercises as part of their rehabilitation program.

Key Words: Salat – Stretching exercises – EMG activities.

Introduction

SALAT is a ritual Islamic prayer that’s given by all those practicing the Muslim religion five times a day. The salat shows an individual’s dedication to God and is considered the most important act of worship. Salat has precise steps that all Muslim all over the world must do it. The various motions of the salat include standing, bowing, prostration, and sitting. The joints that are involved in the movements are the shoulders, wrists, elbows, metacarpophalangeals (MP), proximal interphalangeals, distal interphalangeals, temporomandibular, vertebral column, hip, knee, ankle, subtalar, metatarsophalangeal, and antanto-axial [1].

It can be seen that from this consecutive movement, salat can also be considered as a slow moderate exercise. Benefits of salat from the spiritual point of view have been discussed at length by religious scholars. However, there is still little discussion on the salat’s benefit from science perspective even though it can be seen that performing salat is like performing slow and moderate exercise [2].

Therapeutic stretching is a vital component of chronic musculoskeletal pain rehabilitation for increasing range of motion and counteracting the effects of physical deconditioning, to prepare the muscle for strength training, to help to prevent reinjure, to minimize the chance of pain flare ups, and to reduce pain. Patients with chronic low back pain (LBP) benefit from stretching the soft tissues in the back and around the spine which result in meaningful and sustained relief of LBP with increase in the range of motion [3].

Stretching exercise and the salat maneuver have some similarities. For example, like salat, stretching exercise must be performed in a relaxed manner and must be done correctly and regularly. Stretching exercise is performed to help body movements become easier. It is performed by loosening up tight muscles or muscle groups and
The electrical activity in the human muscles can be measured using Electromyography (EMG). This allows for the measurement of the change in the membrane potential as the action potentials are transmitted along the fiber. The study of the muscles from this perspective can be valuable in providing information concerning the control of voluntary and reflexive movement. The study of muscle activity during a particular task can yield insight into which muscles are active and when the muscles initiate and cease their activities.

So, the purpose of this study is to investigate the effect of salat movements versus specific stretching exercises on electrical activity of erector spinae muscle, suggesting that apart from spiritual act, salat can be an alternative exercise as well.

Material and Methods

This study was conducted in Faculty of Physical Therapy, Cairo University from July 2016 to September 2016, to investigate the effect of prayer movements versus specific stretching exercises on electromyographic activities of right and left erector spinae muscle. Thirty students from Faculty of Physical Therapy participated in the study. Thirty subjects (17 males and 13 females) with age ranging from 19 to 25 years, with Body Mass Index (BMI) was (18.5-24.9kg/m²). The subjects were excluded if suffers from back pain or any musculoskeletal disorders affecting the spine or lower limbs, postural deformity, leg length discrepancy, hamstring tightness or overweight (BMI >25kg/m²).

Instruments used for assessment:

Standard goniometer and tape measurement.

Instruments used for measurement:

Neurosoft EMG Micro 2-channel digital miniature system (Version 3).

Methods:

The study procedure was explained to each patient and they were asked to sign a consent form before participating in the study, which was approved by the Ethical Committee of the Faculty of Physical Therapy, Cairo University.

The participants were randomly selected from Faculty of Physical Therapy, each subject was checked to satisfy the inclusion criteria by by the Schober method using a plastic tape measure to determine the amount of distraction (in centimeters) between two points on the lumbar spine during trunk flexion. The patient had to stand straight, a sign was made over the spine at the height of the posterior superior iliac spines, a second sign 10cm above the first. Then the patient had to bend forward with locked knees as far as possible, and the distance between the two marks is measured. Included subjects showed an increase of this distance of at least 5cm, for hamstring muscle flexibility 90/90 active test was used by placing each subject supine with the hip and knee at 90° of flexion. The hip was then stabilized in this position by having the subject place both hands around the distal thigh just proximal to the knee joint with the fingers interlocked. To determine hamstring flexibility, the knee was actively extended while the hip is maintained at 90° of flexion by the subject. Measurements was recorded as number of degrees from complete (0°) knee extension using the goniometer with the stationary arm placed parallel to the midline of the femur and the movable arm placed parallel to the midline of the fibula.

EMG data were collected using disposable Ag/AgCl surface electrodes placed according to the SENIAM recommendation along either sides of erector spinae muscle 3cm lateral to L3 spinous process. Reference electrode was clipped to the subject’s right hand around his wrist joint.

Each position was tested three times. Each of salat movements was assumed for 5 seconds (45 degrees bowing, bowing and prostration) and the two stretching exercises for the lower back were assumed for 10 seconds (long sitting forward lean stretch and double knee to chest stretch).

EMG activity of erector spinae muscle was recorded immediately after assuming these positions with one-minute rest in-between each repetition and five minutes' rest between each position and another to avoid fatigue.

In order to compare value of EMG activity across subjects it was necessary to normalize the
EMG data. Normalization was made by recording of the Maximum Voluntary Contraction (MVC) of erector spinea muscle by positioning the subject prone on the mat with arms extended at his sides, hips maintained in a neutral position and knees extended, the subject was than instructed to actively extend his trunk against maximal manual resistance applied for 5 seconds to his upper thoracic back with his head facing forward until his full range of trunk extension was reached [7].

The values of all muscle activity amplitudes for each position were averaged and then normalized as ratios of MVC and can be presented as percentage by multiplying the ratio by 100.

Statistical analysis was conducted using SPSS for windows, Version 18 (SPSS, Inc., Chicago, IL).

**Results**

Thirty participants (17 males and 13 females) participated in the study. Their mean ± standard deviation for age, body mass, and height were 23.23 ± 1.97 years, 68.46 ± 9.02kg, and 167.83 ± 7.64 cm respectively. Repeated measure MANOVA was used to compare the tested variables of interest at different tested positions. Within subject MANOVA was performed on the examined sample with the alpha level 0.05.

Table (1) shows the mean ± SD values of EMG activity of right erector spinea muscle. The univariate tests of repeated measure MANOVA revealed that there were significant differences in the mean values of EMG activity of right erector spinea muscle among different positions (F=77.322, \( p = 0.000^* \)). So, multiple pairwise comparison tests (post hoc tests) revealed that there were significant differences between (45 degrees bowing vs. long sitting stretch), (bowing vs. long sitting stretch), and (prostration vs. double knee to chest) with (\( p = 0.000^* \), 0.004*, and 0.006*) respectively.

Table (2) shows the mean ± SD values of EMG activity of left erector spinea muscle. The univariate tests of repeated measure MANOVA revealed that there were significant differences in the mean values of EMG activity of left erector spinea muscle among different positions (F=77.170, \( p = 0.000^* \)). So, multiple pairwise comparison tests (post hoc tests) revealed that there were significant differences among (45 degrees bowing vs. long sitting stretch), (bowing vs. long sitting stretch), and (prostration vs. double knee to chest) with (\( p = 0.0001^* \), 0.002*, and 0.001*) respectively.

**Discussion**

The Results of the current study revealed significant differences in the mean values of EMG activity of both right and left erector spinea muscle among different positions. The mean of the electromyographic activities when measured as % of MVC were lesser in prostration (8%, 10%) for right and left erector spinae muscles respectively, than other positions followed by bowing position (10%, 12%), then double knee to chest (11%, 13%), long sitting (12%, 14%) and finally bowing at 45 degrees (20%, 21%) of MVC of right and left erector spinae muscles.

This decrease in the muscular activity when the subjects assume full flexion position is explained by flexion relaxation phenomenon that during progressive trunk flexion, tension in the posterior ligaments and zygapophysial joints increases to a level where the active extension moment generated by the posterior muscles of the spine is no longer needed. The FRP is defined by reduced or silent myoelectric activity of the lumbar
Erector Spinae (ES) muscle during full trunk flexion and is observed in healthy individuals [8]. It is believed to reflect the load-sharing interaction of the active and passive components of lumbopelvic stability [9].

Olson et al., reported that the FRP during trunk flexion from a standing position was not present during trunk flexion from a supine position and concluded that the gravitational load applied to the lumbar spine seems to be an important modulator of the flexion-relaxation response [10]. This finding supports our results in decreasing the activities of the erector spinae in bowing position more than that in the long sitting stretching position.

While Raschke and Chaffin [11] investigated the association between erector spinae length and tension (torque production) using modelling techniques. They found that the length-tension relationship of the erector spinae increases linearly up to 45 degrees of trunk flexion suggesting that optimal torque production could occur in spinal postures approaching 80% of maximum flexion, independent of passive tissue recruitment. This finding agrees with our study as ours results revealed a significant increase in EMG activity of erector spinae muscle as the subject assume 45 degrees bowing position.

There were different studies that compared salat movements with stretching exercises for different group of muscles other than erector spinae muscle [12,13]. However these studies revealed that there was no significant difference between salat movements and stretching exercise in contrast to the results of our study. These differences may be due to many factors during testing e.g. the small number of participants in some of these studies, besides that, the muscles presented in these studies were different from ours, that they act on muscles other than the erector spinae, while the only study took erector in consideration was concerned with its strength not stretching [14].

**Conclusion:**

Salat movements (Bowing and Prostration) are more advantageous than specific stretching exercises on decreasing erector spinae muscle myoelectrical activities. This indicates that subjects performing everyday prayer has the benefit of stretching effect on their erector spinae muscle. It can improve musculoskeletal system in both normal and low back pain subjects receiving stretching exercises as part of their rehabilitation program.

**References**

تأثر حركات الصلاة مقابل تمارين إستطالة محددة على النشاط الكهربائي لعضلة الناطبة للعمود الفقري

الخلفية: الصلاة هي عبادة تمارس من قبل أغلب المسلمين خمس مرات في اليوم والليلة، وتشتمل على عدة أوضاع جسدية وهي الركوع والصبيحة والقيام. وقد نوقشت فوائد صلاة من المنظور الريفي من قبل علماء الدين كثيراً. وبالرغم من ذلك، لا توجد أبحاث كافية تتحدث عن فوائد الصلاة من المنظور الجسدي على الرغم من أنه يمكن أن يكون أداء الصلاة هو مثل أداء التمارين البدنية المعتدلة.

الهدف: هدف هذه الدراسة: أجريت هذه الدراسة لمعرفة تأثير حركات الصلاة مقابل تمارين إستطالة محددة على النشاط الكهربائي لعضلة العمود الفقري.

الطريقة: شارك في هذه الدراسة كجمعية واحدة ثلاثون شخصاً من الجنسين (17 ذكرًا و13 أنثى) تتراوح أعمارهم ما بين 25-49 سنة. تم تسجيل وتحليل النشاط الكهربائي لعضلة العمود الفقري خلال القيام بخمس أوضاع مختلفة وهم (الركوع بدرجة 45 إلى الامام-الركوع بدرجة 90 إلى الامام-الركوع بدرجة 90 إلى الامام-السجود-تمرين ضم الريبوت إلى الصدر-تمرين وضعية الإحماء إلى الامام بساق مدودة أثناء الجلوس).

النتائج: كانت هناك فروقات ذات دلالة إحصائية في متوسط قيم النشاط الكهربائي لعضلة العمود الفقري بين الخمس أوضاع المختلفة. تشير إلى أفضلية أوضاع الصلاة على تمارين الإستطالة للحصول على نشاط أقل للعضلة مما يدل على أن الشخص الذي ي يؤدي الصلاة بصورة بيومية لديه القدرة على تحسين كفاءة الجهاز العضلي الحركي سواء للأشخاص الأصحاء أو الذين يعانون من الأمراض المزمنة.