

# Influence of Wearing a Brassiere on Pain and EMG Activity of the Upper Trapezius in Women with Upper Trapezius Region Pain

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**Abstract.** [Purpose] This study examined the effect of wearing a brassiere on upper trapezius (UT) region pain and EMG activity during arm elevation by women. [Subjects and Methods] Fourteen healthy women were recruited. Surface EMG data were collected from the UT muscles during arm elevation. Pressure pain in the UT region was measured using a baseline dolorimeter. [Results] The EMG activity of the UT increased significantly when a brassiere was worn compared to without. UT region pain showed no significant difference between with and without wearing a brassiere. [Conclusion] This suggests that wearing a brassiere increases the muscle activation of the UT in women.

**Key words:** Brassiere, EMG, Upper trapezius

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## INTRODUCTION

Pain in the upper trapezius (UT) region may be caused by the performance of repetitive tasks or continuous weight on the shoulder<sup>1,2)</sup>. UT region pain is more common among women than among men<sup>3)</sup>. Brassieres may be a factor contributing to UT pain in women because the weight of the breast causes the brassiere strap to press on the UT muscle<sup>4,5)</sup>. From their teenage years on, women continuously wear brassieres on a daily basis<sup>6,7)</sup>. In most cases, the brassiere has parallel straps that go over the shoulders from front to back<sup>8)</sup>. The weight of the breasts causes the parallel straps to cut into the outer shoulder and lengthen the UT muscle, causing pain<sup>5)</sup>. Gerwin reported UT tenderness related to brassiere straps<sup>5)</sup>. Excessive UT muscle activation resulting from continuous weight on the UT region generates myofascial trigger points that cause pressure pain<sup>9)</sup>. Generally, clinicians concerned about upper trapezius region pain have overlooked whether or not wearing a brassiere leads to upper trapezius region pain. In addition, previous studies have suggested that wearing a brassiere may be a factor contributing to UT region pain due to the weight of the breasts<sup>4,5,9)</sup>. However, the influence of wearing a brassiere on the muscle activity of UT has not been scientifically proven. Therefore, the purpose of the present study was to examine the effect of wearing a brassiere on

UT region pain and muscle activity during arm elevation by women.

## SUBJECTS AND METHODS

Fourteen female with UT region pain aged 25 to 47 years volunteered for this study. Inclusion criteria were history of UT region pain for at least 6 weeks and a visual analog scale (VAS) score > 5 (severe pain) at rest. Exclusion criteria included past or present neurological pain, cervical spine fractures, radiating pain to an upper limb, and a history of unresolved cancer. The subject's mean age was 34.12 ± 11.62 years, and their mean height and weight were 158.73 ± 4.49 cm and 54.65 ± 6.23 kg, respectively. All subjects read and signed an informed consent form approved by the Inje University Ethics Committee for Human Investigations prior to their participation in this study.

Surface electromyography (EMG) data were recorded using a Delsys Trigno Wireless EMG system (Delsys, Inc., Boston, MA, USA). Surface EMG electrodes were used for the Trigno EMG sensor. EMG data were collected from the right side UT muscle (approximately half the distance between the seventh cervical spinal process and the acromion). Sampling was performed at 1,000 Hz, with a bandwidth of 20–450 Hz, and the root mean square was calculated using EMG Works 4.0 analysis software (Delsys, Boston, MA, USA). The subjects performed maximal isometric contraction of the UT muscles against manual resistance<sup>10)</sup>. Each maximum isometric contraction maneuver was performed twice for 5 s, and the average muscle activity of the middle 3 s of the two trials was used to normalize the data. Pressure pain in the UT region was measured using a baseline dolorimeter (Pain Diagnosis and Treatment, Inc., Great

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Neck, NY, USA). The instrument consists of a gauge attached to a hard rubber tip 1 cm in diameter. The dial gauge can be calibrated in kilograms (kg) or pounds (lb), with a range of 1–30 kg or 1–60 lb. at intervals of 0.25 kg or 0.5 lb. The force recorded is the amount of pressure that causes pain. Inter-examiner reliability for the baseline dolorimeter is good to excellent (interclass correlation coefficient=0.75–0.89)<sup>11</sup>).

Prior to testing, the subjects were instructed to indicate when the pressure point was painful. To measure the pressure pain in the UT, the subjects were instructed to sit upright on a chair with their feet on the floor looking straight ahead. The examiner stood and measured pressure pain in the middle of the muscle belly between C7 and the acromion. The right and left sides were each measured three times, and the average was calculated. Activation of the UT muscles was measured in the upright sitting position. The subjects were instructed to perform shoulder flexion with scaption. During upper limb elevation, the scaption plane was controlled using a vertical bar. Subjects were asked to hold the right side shoulder at an angle of 120 degrees for 5 s. The middle 3 s of muscle activity averaged over three trials was used in the analysis.

The pressure pain and EMG activity were measured with and without wearing of a brassiere in a randomized order. A 1-min rest was allowed between measurements. UT muscle activity and pressure pain between with and without wearing brassiere were compared using the paired t-test. Statistical analyses were performed using SPSS (ver. 17.0; SPSS, Chicago, IL, USA). P values < 0.05 were considered to indicate statistical significance.

## RESULTS

The EMG signal amplitude (%MVIC) of UT increased significantly (mean  $\pm$  SD, 50.87  $\pm$  8.92 compared to 39.79  $\pm$  7.08) when wearing a brassiere compared to the no brassiere condition in the females with UT region pain ( $p < 0.05$ ). The UT pressure pain did not differ between two conditions ( $p > 0.05$ ).

## DISCUSSION

Previous studies have suggested that wearing a brassiere may be a factor contributing to UT region pain in women<sup>9, 10</sup>. However, no studies have reported the influence of wearing a brassiere on the EMG activity of UT. To the best of our knowledge, this is the first study to demonstrate that a brassiere can increase UT muscle activity during shoulder scaption in women with upper trapezius region pain.

Our results shows there was a significant 21.7% increase in UT muscle activity when wearing a brassiere. The main function of the UT is scapular elevation. A brassiere transfers the weight of the breast from the pectoral fascia to the UT region, generating a downward force on the shoulder<sup>12</sup>. To counterbalance the downward force, greater UT contraction is required to elevate the shoulder, resulting in increased UT muscle activity. Moreover, shoulder scaption resulted in greater contraction of the UT muscle due to the

increased leverage of the arm in this study. Sustained and repeated UT muscle contraction would quickly generate UT muscle fatigue, resulting in UT tenderness<sup>10</sup>. Therefore, when wearing a brassiere, the UT sustains the small weight of the breast with ischemia induced by the brassiere, which would lower the pressure pain threshold of UT.

A previous study suggested that brassiere removal during a day (24 hours) was effective at reducing UT and pectoral girdle muscle pain<sup>12</sup>). However, in this study, the pressure pain threshold showed no significant difference between the brassiere and no brassiere conditions, because subjects were asked to remove the brassiere for just one minute for no brassiere condition. Further study is needed to investigate the effects of brassiere removal during the day on the UT muscle activity and pressure pain threshold of the UT region in women with upper trapezius region pain. The investigation and comparison of various designs of brassiere on the UT muscle activity and pain threshold is also required.

A limitation of this study was that we did not measure the breast weight or size of the subjects; different sizes of breast may affect the pain intensity of UT. Also, we did not control for the fit of the brassiere that each participant wore. In conclusion, wearing a brassiere can increase UT muscle activity, so clinicians should consider recommending brassiere removal for as long as possible, or suggest wearing a well-fitting and supportive brassiere when managing women with upper trapezius region pain.

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