STRETCH REFLEX: IS THERE A GENDER DIFFERENCE?

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INTRODUCTION
One of the defining characteristics of spasticity associated with upper motor neuron lesions is hyperreflexia. During the course of a comparative study of the stretch reflex in spinal cord injured (SCI) patients and non-SCI normal subjects, we detected a significant gender difference in the vibro-reflex and reinforced Achilles tendon reflex (ATR) responses in the non-SCI subjects. The purpose of the present study was to report the gender differences in ATR responses and to further investigate the gender difference in the stretch reflex using both the ATR and the Quadriceps tendon reflex (QTR) tests. Our hypothesis was that the previously observed gender difference was dimorphic in nature and not associated with hormonal changes that occur during puberty.

MATERIALS AND METHODS

Achilles Tendon reflex test
Ten able-bodied female subjects and ten able-bodied male subjects, with no history of any neurological disorder, participated in a preliminary study. In the present study, six able-bodied female subjects (mean age = 26 years) were tested, two of whom were taking oral contraceptives. These subjects were tested in a sitting position; their feet were placed on a 4 inch thick foam pad to maintain the test position yet allow reflex planter flexion movement. Recording electrodes were taped to the skin of the calves at the mid-point between the popliteal fossae and the level of the medial malleolus (the approximate location of the mid-soleus muscle). A reference electrode was placed 8 cm. distal to the active electrode and a ground electrode was placed on the calf between the popliteal fossae and the active electrode. A solenoid-driven mechanical reflex hammer that produced a variable impact force on a scale of 1 to 10 (9N of force per scale number with total force ranging from 9 to 90N) was positioned 1 cm. behind the Achilles tendon. The highest impact force of 10 was used to evoke the reflex responses to five taps, with 5 second intervals between taps and the responses to each decreasing impact, which decreased incrementally from 10 to 1, were then recorded on computer and the amplitudes measured at each impact level. The six female subjects were tested daily, beginning at various times of the menstrual cycle. The reflex amplitudes for the legs (at impact level 10) were averaged each day and the days of the menstrual cycle were averaged for each of the four phases of the cycle. The effects of vibration and Jendrassik reinforcement on the ATR were tested in the adult male and female subjects (1). In the Jendrassik reinforcement test, these subjects were instructed to forcefully contract the finger flexors during the tendon tap. In the vibration test, a hand-held vibrator was applied to the shin for 20 seconds and the tendon tap was delivered during the last second of vibration. After one minute a post-vibration reflex was obtained. The right leg was always tested first and the responses of the two legs were averaged for each condition. The ATR at impact 10 was used as a control response in both vibration and Jendrassik reinforcement tests.

Quadriceps stretch reflex test
Ten pre-pubertal subjects, 5 males and 5 females (mean age = 10 years), with no history of any neurological disorder, were tested. These subjects were instructed to sit in a relaxed position on a stool. A Flexicomp electromyometer was used to measure the angular displacement of the right knee in response to the tap on the quadriceps tendon. Each subject's quadriceps tendon was tapped with a soft tap and a hard tap and the reflex movements of the leg were recorded with an Apple computer. The amplitude of their QTR was measured. To test the effect of exercise on the QTR, the subjects were then instructed to skip for 2 minutes and the amplitude of their QTR was remeasured.

Data Analysis
The data were analyzed using ANOVA with p=0.05 as the level of significance.

RESULTS

Achilles tendon reflex test
The ten female subjects had significantly greater amplitudes of graded ATR reflex responses compared to the ten male subjects at every impact force (p<0.01 (Figure 1)). However, we did not find any significant variation in the ATR reflex amplitude relative to the phase of the menstrual cycle (p=0.24).

The ten females showed a significantly greater increase (p<0.01) in the amplitude of the reflex (at impact 10) with the Jendrassik reinforcement maneuver than the ten males. However, reflex inhibition by vibration was similar for both males and females. Post-vibration, reflex amplitudes returned to control values which were significantly greater for the females than the males (impact 10).

Quadriceps stretch reflex test
All pre-pubertal subjects demonstrated a significantly greater amplitude of the QTR with the greater strength of stimulus (hard tap compared to the light tap) (p<0.001). When reflex amplitudes obtained with the soft and hard taps were combined for both boys and girls, the difference between the girls' and the boys' reflex amplitudes at rest was found to be significant by the ANOVA (p<0.05) (Figure 2). However, after exercise, the reflex amplitudes (combined values of soft and hard tap responses) of the two groups were not significantly different.

DISCUSSION
Sex differences have been shown to exist in sensory function, such as taste, olfaction, auditory acuity and somesthesia (2). However, the “sensitivity” of female subjects to these modalities has been shown to be affected by the menstrual cycle, suggesting that these are hormone dependent behaviors. In the present study, we demonstrated that the amplitude of the Achilles reflex was not affected by the menstrual cycle, indicating that the ATR is not sex-hormone dependent, and was evident prior to puberty, indicating a sexual dimorphism.

REFERENCES

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