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Increased muscle activity in acoustic startle response among children with recurrent pain in the head, neck and abdomen due to chronic stress.

Andersson E^{1,2}, Alfvén G³

¹Laboratory of Biomechanics and Motor Control, Swedish School of Sport and Health Sciences, Stockholm, Sweden

²Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden

³Clintec, Karolinska Institutet, Stockholm, Sweden

Email: eva.andersson@gih.se

Summary

With recorded EMG amplitude and time parameters, increased resting activity and potentiated acoustic startle responses were observed in the muscles involved in stress tender patterns among children with recurrent psychosomatic pain.

Introduction

Children with recurrent pain of negative chronic stress origin from different locations have a characteristic pattern of tender points in the temporal, trapezoid, great pectoral and abdominal muscles. The aim was to study if acoustic startle reactions are higher, measured with increased EMG-responses, in muscles sites related to tender point pattern and the recurrent pain among those children as compared to healthy controls.

Methods

Forty-two children of both sexes (10-17 years) participated, whereof 19 in a pain (PAIN) group and 23 in a control (CON) group (mean age 12,7 and 13,0 years, respectively). Acoustic Startle Responses (ASR) were elicited with a 50-ms-duration stimulus of unexpected short white noise (USWN) at 105 dB with an instantaneous rise time in both ears via headphones. The subject was laying supine on a bench in a calm milieu. The stimulus was controlled with a digital audio-stimulator. Eight ASR were given with varying time intervals, usually between 1.5 and 2.0 min, similarly for all subjects¹. Surface EMG was recorded and analyzed (via Mega Electronic Ltd-system, Finland) for the six muscles OR-orbicularis oculi, TE-temporalis, TR-trapezius, PE-pectoralis major, RA-rectus abdominis and ES-erector spinae (L3-L4 level, 2-3 cm lateral to the spinal processes). The recording sites were similar to general tender point positions. The PAIN group had pain of "non-organic origin" recurring at least once a week for more than 3 months and affecting activity of daily life. Eighteen had abdominal pain in a mean of 37,2 (8-140) months all fulfilling diagnosis criteria of functional abdominal pain. All reported frequent headache, five backache and three shoulder pain. All described stress and anxiety problems and fulfilled six of

seven criteria for the diagnosis of psychosomatic pain². Eighteen children had nine of nine stress tender points and one had seven³. One child had school-stress-induced depression. All the children met the same paediatrician specialist at several sessions until diagnosis. The matched controls were without recurrent pain problems and in general good health. Fifteen were enrolled from four school classes, and eight from personal contacts. Socio-economic status was comparable in the two groups.

Results

The PAIN group showed significantly higher resting activity and higher acoustic startle response values ($p < 0,05$), than the CON group, for all six muscles together regarding the mean amplitude in the initial 100 ms (Tab. 1), the initial 200 ms, and during the burst of activity (start $\geq 10 \mu V$, end $< 10 \mu V$), as well as longer burst duration and shorter burst latency (ms). These results are based on average for all eight startle sound events (ASR) together. For PAIN compared to CON, all separate muscles showed generally higher values of EMG amplitudes and burst durations as well as shorter latencies for the burst onset in all measures; with statistically significant differences or strong trends for several parameters and muscles.

Conclusions

The results show in children and adolescents how recurrent pain of negative stress, origin from the head, abdomen, back and chest, is associated with increased acoustic startle reaction and increased muscle tension in these regions, shown with EMG amplitude and EMG timing parameters for six muscles in the body. This study, showing increased muscle excitability in children with stress-induced pain in the head, neck and abdomen, may contribute to the understanding of the mechanisms underlying the broad problem of recurrent psychosomatic pain.

References

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Table 1. Mean EMG-amplitude (± 1 SD) in μV for the initial 100 ms period after the startle sound for all six muscles together and separately for each muscle in the two groups of children (PAIN and CON). Each value represents an average for all eight startle sound responses (ASR) together.

| Time interval from the startle sound | All 6 muscles | OR | TE | TR | PE | RA | ES |
|--------------------------------------|---------------|-------------|------------|-------------|-------------|-----------|---------------|
| 100 ms PAIN | 16 \pm 28 | 37 \pm 20 | 11 \pm 5 | 26 \pm 57 | 10 \pm 12 | 5 \pm 7 | 2,9 \pm 1,4 |
| 100 ms CON | 9 \pm 12 | 28 \pm 19 | 7 \pm 5 | 7 \pm 8 | 5 \pm 6 | 4 \pm 6 | 1,4 \pm 1,4 |