How does sitting-induced low back pain affect brainwaves of pain processing?

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Summary

Prolonged sitting can induce transient back pain; however, it is unknown where this pain signal originates. One potential contributing factor may be changes in brain wave oscillations. This study explored how electroencephalography (EEG) frequency band power changes after 1-hour of sitting and between groups of pain states (PD: Pain Developer; NPD: Non-Pain Developer). Theta, alpha, beta, gamma1, gamma2, and global frequency bands for the frontal, central, temporal, parietal, occipital, and global regions were determined. The gamma 1 and 2 band power of the central region increased after sitting. Beta band power was higher in PDs than in NPDs over the frontal region. Our findings indicate that sitting can affect neural oscillations which have the potential to affect cognitive functions such as attention and pain processing.

Introduction

Prolonged sitting has been shown to induce clinically relevant levels of transient back pain in some back-healthy individuals [1]. These pain groups have been classified as PDs and NPDs using thresholds of clinically meaningful changes in pain. However, where this signal comes from is unknown. One factor that has been associated with pain and is temporarily modifiable, thus playing a potential role in transient sitting-induced LBP, are brain waves. To better understand the mechanism of transient sitting-induced LBP, this study investigated EEG frequency band power in people with and without transient sitting induced pain.

Methods

50 (22 males) pain-free adults were recruited to complete a standardized typing task while seated on a backless office chair for 1-hour at an ergonomically adjusted workstation. Perceived pain ratings were taken at baseline, 30- and 60-minutes to classify tolerance group using a 100mm visual analogue scale (VAS, 0mm = no pain and 100mm = 'worst pain imaginable). PDs were identified when change in pain was ≥10mm and NPDs if change in pain was <10mm. EEG were recorded at baseline and 60-min (5-min with eyes closed, dark/silent room, with 32 electrodes at 500Hz (ActiChamp, Brain Products GmbH, Gilching, Germany)). EEG, band power were calculated for the theta (4-8Hz), alpha (8-13Hz), beta (13-30Hz), gamma1 (30-58Hz), and gamma2 (62-100Hz) bands for the frontal, central, temporal, parietal, occipital, and global regions. A two-way MANOVA was completed for each frequency band for each region respectively with a between-factor of tolerance group (PDs, NPDs) and within-factor of time (pre- and post-sitting). Significance was accepted at $p<0.05$.

Results and Discussion

29 participants were identified as PDs (VAS: 19.5±9.1mm) and 21 as NPDs (VAS: 5.1±3.3mm). No significant interaction between time and pain groups were found for any frequency band ($p>0.05$). A main effect of time was found for gamma 1 and 2 in the central brain regions (Fig 1): the power in both bands increased pre- to post-sitting. A main effect of pain group was found for the beta band in the frontal region (Fig 1): the power was higher in the PDs than NPDs.

The gamma band power, which increased after sitting, is involved in cognitive functions such as attention, memory or learning [2], thus, the observed increase could be related to typing related attention requirements. Increased gamma band power has also been associated with tonic pain [2]; however, the change was the same in PDs and NPDs. The beta band power which was higher in PDs than NPDs is also associated with cognitive function and plays a role in the top-down control of behavior [2]. Thus, it has the potential to modulate descending signals to inhibit or excite pain perception. This is a potential factor that may contribute to transient sitting-induced pain which is observed in 40-60% of people [1].

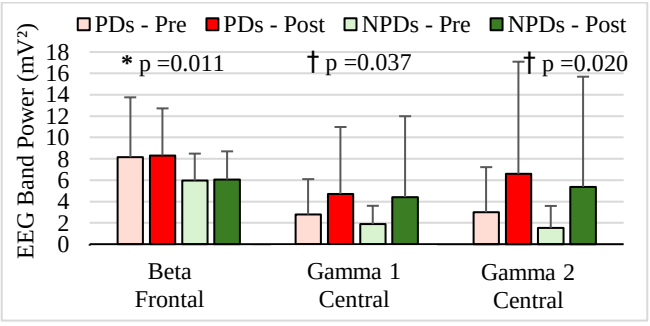

Figure 1: Frequency band power of all bands/regions for which a main effect of pain group (*) or time (†) were found.

Conclusions

One hour of sitting altered brain oscillations which have the potential to affect cognitive functions including attention and pain processing. Our findings suggest that neural oscillations may play a role in transient sitting-induced LBP development.

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References

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