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# Interictal migraine reveals posterior insular and anterior cingulate cortex activation in response to high-frequency visual stimuli

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## Introduction

Migraine, a common neurological disorder with recurrent headache episodes, is actively researched for its relationship with visual sensory processing (O'Hare & Hibbard, 2016). The neural basis of migraine has not yet been fully elucidated (Goadsby et al., 2017).

This study aims to investigate the neural foundations of sensory processing in migraine patients using functional magnetic resonance imaging (fMRI) during a visual task.

## Materials and Methods

Twenty-four volunteer participants (10 healthy controls (31.1 ± 6.62), 14 interictal migraine patients (26.9 ± 6.79)) who passed preliminary evaluations by clinicians were included. During the fMRI scan, participants were given a visual task consisting of two sessions. The task primarily required participants to respond based on the position of a target stimulus (a triangle). The task included three different conditions.

The fMRI data were analyzed using SPM12. The main effects were analyzed using the Full Factorial ANOVA incorporating a two-level group factor (control and migraine patients during interictal periods) and a three-level condition factor (stripped, scanning, and control).

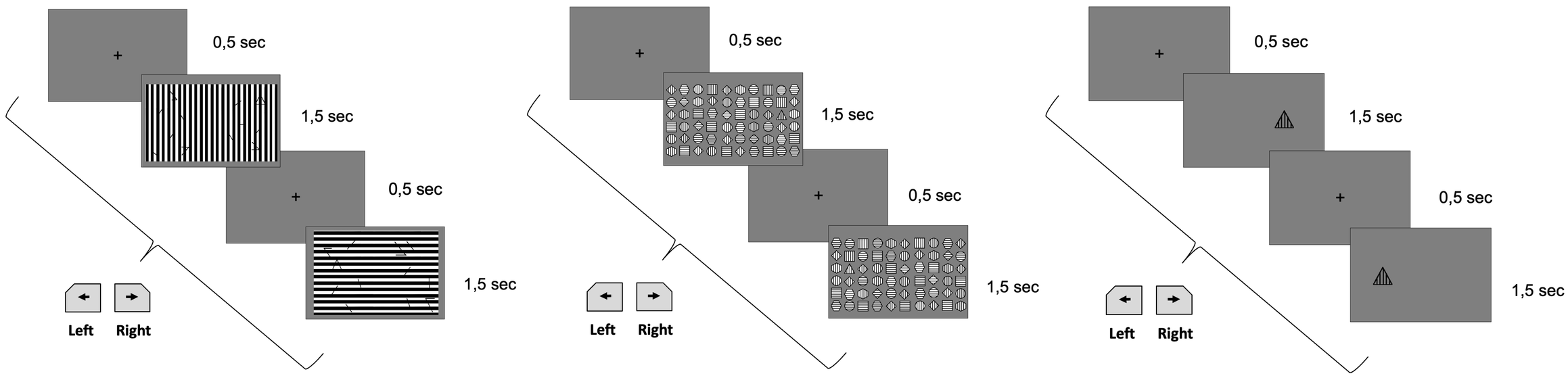


**Figure 1.** Experimental design

## Results

In the patient group, intense and widespread cortical activations were primarily observed in the extrastriate cortex. In the main effect of the task, activations in the anterior cingulate and anterior insula were observed, while in the main effect of the group, posterior insula activation was highlighted.

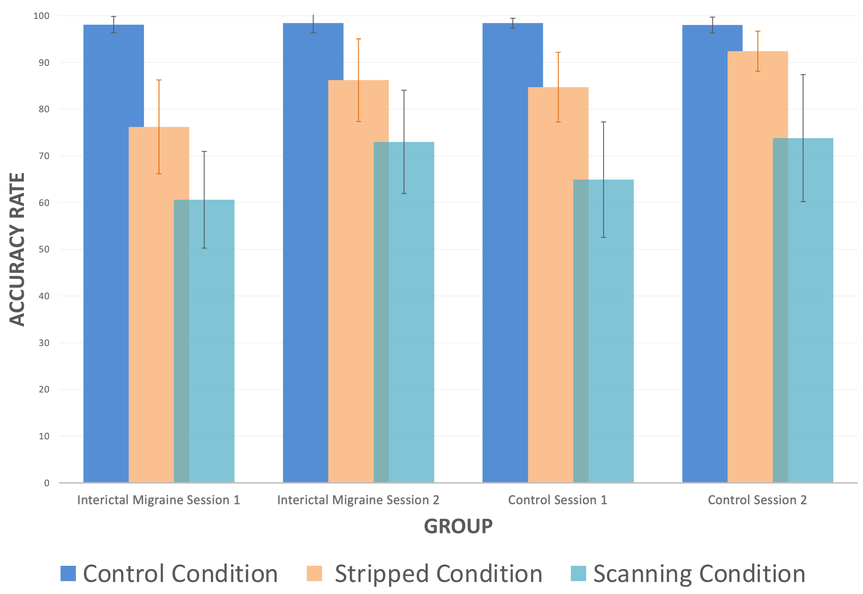


**Figure 2.** Accuracy rate on tasks

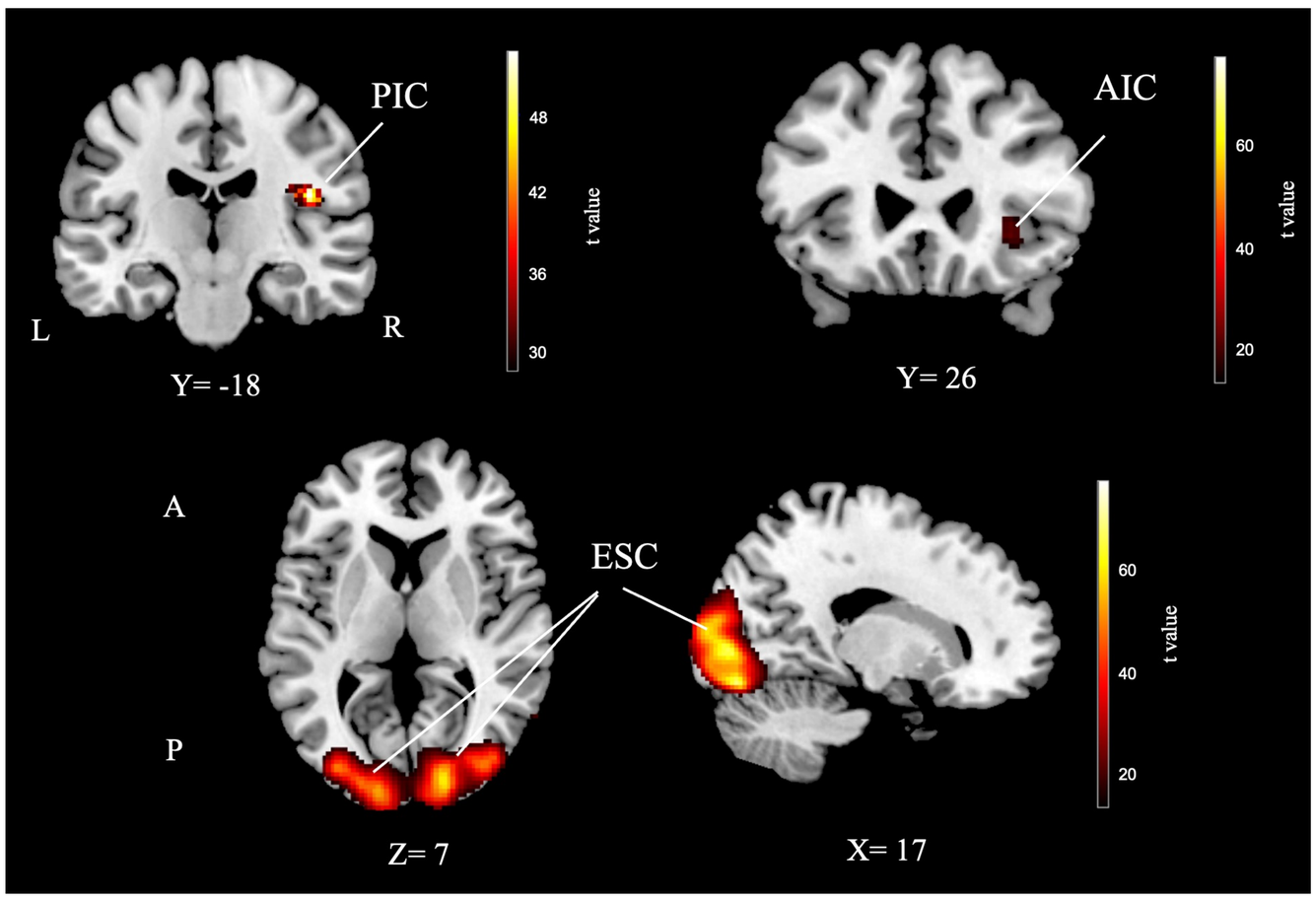


**Figure 3.** Activation in the posterior insular cortex (PIC) was observed as a main effect of the group, whereas activations in the anterior insular cortex (AIC) and extrastriate cortex (ESC) were observed as main effects of the task.

## Discussion

The widespread activations observed in the patient group compared to the control group might be related to increased cortical sensitivity to visual stimuli and sensitivity to specific patterns, such as high-contrast striped patterns, in migraine patients.

The anterior insula and anterior cingulate cortex, which emerged as the main effect of the task, may play a significant role in pain anticipation and the stress response that pain anticipation can generate (Paulus & Stein, 2006; Allman et al., 2001). The posterior insula, seen in the main effect of the group, is discussed to be critically important in pain modulation in migraine patients (Ostrowsky et al., 2002).

## References

O'Hare, L., & Hibbard, P. B. (2016). Visual processing in migraine. *Cephalalgia : an international journal of headache*, 36(11), 1057–1076.

Goadsby, P. J., Holland, P. R., Martins-Oliveira, M., Hoffmann, J., Schankin, C., & Akerman, S. (2017). Pathophysiology of Migraine: A Disorder of Sensory Processing. *Physiological reviews*, 97(2), 553–622.

Ostrowsky, K., Magnin, M., Ryvlin, P., Isnard, J., Guenot, M., & Mauguière, F. (2002). Representation of pain and somatic sensation in the human insula: a study of responses to direct electrical cortical stimulation. *Cerebral cortex (New York, N.Y. : 1991)*, 12(4), 376–385.

Paulus, M. P., & Stein, M. B. (2006). An insular view of anxiety. *Biological psychiatry*, 60(4), 383–387.

Allman, J. M., Hakeem, A., Erwin, J. M., Nimchinsky, E., & Hof, P. (2001). The anterior cingulate cortex. The evolution of an interface between emotion and cognition. *Annals of the New York Academy of Sciences*, 935, 107–117.

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