No threat: Emotion regulation neurofeedback for police special forces recruits

The work of police officers is highly demanding in terms of stress, high-tension and threatening situations. This is even more the case for officers of the special forces. Their tasks are specifically high-risk operations, such as arrests of armed suspects and anti-terror interventions. Improving emotion regulation skills of police officers might be vital investment and it has been advised to support officers with psychological trainings (Berking et al., 2010; Kale & Gedik, 2020). In the current study, Dutch special forces recruits followed a 3T functional Magnetic Resonance Imaging (fMRI)-based emotion regulation (ER) neurofeedback (NF) training. The aim is to evaluate whether recruits can successfully learn to downregulate the activity of ER related areas.

Participants (mean age 34, mean time served in military 10 years, all male) were randomly assigned to control group (n=15) or experimental group (n=13). The experimental group received 6 weekly sessions of NF training, while the control group received treatment as usual. Both groups completed behavioural pre-post-tests. Firstly, participants rated valence and arousal of negative and neutral images coming from a threat-based image battery which was also used for neurofeedback (Kveraga et al., 2015), and of a selection of the Military Affective Picture System (MAPS; Goodman et al., 2016). Secondly, the Dutch version of the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004; Neumann et al., 2010) was administered. The six NF scanning sessions were spaced one-week apart. A passive-viewing localizer task, consisting of negative and neutral image blocks, was conducted each session to select the individual’s NF target region. During the two following NF runs the participant had the task to reduce the image size of a threatening image. NF was provided in real-time by means of image size and updated every TR (TR = 1s; voxel size = 2mm³). Seven images were presented for 30s each, with 30s rest between NF blocks. During session one and six mirror runs were collected as well, where the feedback of the previous NF run was shown. Only one NF-mirror pair was collected in session one.

A RM ANOVA comparing average NF image size of session one and six shows a significant decrease in image size over sessions (F(12) = 2.83, p = .015). When comparing the average NF and mirror session target region activity between session one and six a RM ANOVA shows a trending interaction term between condition and time (F(1) = 4.467, p = .061). For NF we find a trend towards reduced activity over time (t(10) = 1.82, p = .099). When calculating a random effects analysis (n=11) between the very first and very last NF runs, constructing a contrast cleaning both NF runs for the corresponding mirror run activity, and inspecting the resulting voxel activation map at an FDR corrected threshold, we see no significantly active voxels. Comparing control and experimental group on the overall DERS score with a RM ANOVA shows no significant group differences. Comparing the image ratings separately for valence and arousal does also not show significant group differences, however, a trend on the interaction term for arousal is present (F(1,25) = 3.2, p = .08).

Overall, we may conclude that recruits in the experimental condition can successfully learn ER downregulation over six NF sessions. However, the sample size may be too small to identify involved brain areas in a random effects analysis. Furthermore, no group differences can be found between experimental and control group on the behavioural pre-post measures.