

## Stress and pain - subgroups, mechanisms and treatment outcomes

Chronic pain affects 100 million US adults and with costs exceeding \$500 billion per year. Fibromyalgia (FM) is a prevalent chronic pain disorder characterized by widespread pain, fatigue, anxiety and depression, and problems with memory and concentration. Although many treatments have been evaluated, there are currently none that alleviate symptoms in most patients. Our study evaluated the overall effects of two behavioral treatments that target the perception of pain and its impact - one based on reinforcement principles –operant behavior therapy (OBT) where response to adaptive behaviors such as activity pacing are encouraged and attention is withheld from maladaptive behaviors such as complaining and sedentary response and the other, cognitive-behavior therapy (CBT) focuses on targeting the effects of thinking (e.g., beliefs, expectancies, problem solving, coping strategies) regarding stress and pain situations emphasizing problem-solving and adaptive coping. Although the outcomes of both treatments may be comparable on some outcomes (e.g., pain reduction, functional improvement) the physiological mediating mechanism may vary with CBT focusing in general on arousal in response to stress (e.g., muscle tension, skin conductance); OBT more specifically targeting heart rate dysfunction associated with inappropriate response to stress.

We compared CBT and OBT with whole-body infrared heat (IH) to control attention and placebo effects. In addition to subjective ratings of pain intensity following treatment, we examined specific physiological variables – muscle tension assessed by surface electromyographic (EMG) activity, blood pressure (BP), heart rate (HR), and arousal measured by skin conductance levels (SCL) during various laboratory-induced stress phases: social conflict (stress), mental arithmetic (stress), and relaxation (stress reduction) tasks prior to and following treatment. The IH group did not show any significant changes in pain reduction or physiological parameters.

We subdivided the groups, based on a pre-determined levels of pain reduction ( $\geq 50\%$ ), into responders (OBT (53.5%) and CBT (45.2%) and non-responders post-treatment and at 12-month follow-up. Interestingly in comparison to the non-responders, at baseline the OBT responders were characterized by low BP variability, whereas the CBT responders had elevated skin conductance levels; although perceived pain levels were similar. Both OBT and CBT responders reduced clinically significant levels of pain intensity immediately post-treatment and at 12-month follow-up. They also showed physiological response patterns comparable to pain-free controls following treatment, but, as hypothesized, they achieved this through different stress reducing physiological mechanisms. OBT demonstrated significantly higher and healthier diastolic BP, whereas CBT responders demonstrated reduced general arousal (i.e., SCL) comparable to healthy controls.

The different mechanism shown by responders to the different treatments are expected as OBT targets extinction of activity avoidance, thereby increasing adaptive activities, which in turn increases the BP and related HR variability observed during stress<sup>1</sup>. CBT, on the other hand,

teaches patients to reduce stress by reinterpreting stress situations thereby reducing general arousal

The study indicates that monitoring physiological variables such as HR, BP, SCL and EMG may contribute to better understanding of FM and its treatment through the identification of subgroups that have different underlying mechanisms in spite of having the same diagnosis. Moreover, FM patients have different physiological patterns in response to stress and thus might benefit from treatments such as CBT and OBT that target these different patterns. Perhaps most importantly, our study shows physiological changes that reflect the chronic pain experienced by patients are reversible and can be effectively treated.

See our paper “Differential psychophysiological effects of operant and cognitive behavioural treatments in women with fibromyalgia” that describes a mechanism whereby persistent stress causes the baroreceptors and the NTS (nucleus tractus solitaries) reflex arcs to be depreciated in chronic pain patients, reducing BP variability and pain analgesia.

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## **Publication**

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