Neural Signature of Pain Processing in Musicians

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Musicians performing repetitive movements are at increased risk of developing musculoskeletal pain syndromes, often attributed to overuse. But, long-term musical training also induces substantial plastic changes in sensory and motor cortical regions. Certainly, even brief training involving simple, repetitive movements can trigger adaptive neuroplasticity, which may influence how sensory inputs are processed. However, the neural mechanisms by which extensive musical training modulate and interact with pain processing remain poorly understood. This project investigated how musicians' brains respond to prolonged muscle pain and how its neurophysiological adaptations manifest.

Twenty healthy musicians and 20 non-musicians participated in three lab sessions (Day1, Day3, Day8). Pain was induced via intramuscular injection of nerve growth factor into the right first dorsal interosseous muscle on Day1. In each lab session, subjective pain ratings, quantitative sensory tests (pressure pain thresholds, PPT, electrical detection thresholds, EDT) were collected. Neurophysiological measurements consisted of corticomotor excitability and event-related responses as well as all cortical dynamics registered using transcranial magnetic stimulation (TMS) and electroencephalography (EEG).

Compared to non-musicians, pain-free musicians showed greater sensitivity (lower EDT) and increased event related responses to sharp electrical pain but displayed a resilience response to prolonged muscle pain—manifested as lower pain ratings, stable corticomotor excitability and EEG dynamics patterns together with an increment of left frontal alpha asymmetry, a marker of approach-related coping.

These findings suggest that musicians exhibit a resilient neurophysiological profile in response to prolonged muscle pain, likely due to use-dependent plasticity and effective coping strategies. Clinically and occupationally, this presents a double-edged sword: while musicians' motivation and goal-directed behavior towards musical training may enhance pain resilience and inform non-pharmacological pain management, it may also mask the severity of musculoskeletal conditions. This could lead musicians to delay care and continue performing despite injury, increasing the risk of chronic overload and serious tissue damage.