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From Myofascial Stiffness to Psychophysiological Dysregulation: Ultrasound Phenotyping of the Suboccipital–Pterygoid–Postural Axis

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Introduction: Persistent stress and central sensitization may be accompanied by sustained protective muscle activation, altered head–neck posture and reduced movement variability. The suboccipital muscles, through their anatomical connections with the cervical dura, may represent an important mechanical interface between peripheral musculoskeletal dysfunction and central sensory/autonomic regulation. The pterygoid muscles provide an additional link with temporomandibular function and craniofacial posture. However, this potentially measurable structural phenotype has received little attention in psychophysiological disorders.
Objectives: Hypothesis:

We hypothesize that excessive stiffness of the suboccipital and pterygoid muscles represents a measurable component of a stress-related postural phenotype and may contribute to a self-reinforcing loop involving central sensitization, headache, temporomandibular dysfunction, sleep disturbance, autonomic symptoms and psychological distress.

Methods: We propose a prospective ultrasound-based phenotyping protocol combining shear-wave elastography (SWE), B-mode assessment, dynamic M-mode analysis of suboccipital muscle/myodural structures, and quantitative assessment of head–neck and shoulder posture. Pterygoid muscle stiffness and temporomandibular function will be assessed in parallel. Ultrasound-guided dry needling (DN-US) of objectively identified myofascial trigger points will provide a physiological perturbation test [Bubnov R. EPMA Journal 3, 13 (2012). https://doi.org/10.1186/1878-5085-3-13]. Pre/post assessment will include muscle stiffness, range of motion and posture, headache/central sensitization measures, sleep and psychological symptoms, with autonomic parameters such as heart rate and blood pressure recorded where appropriate.
Results: In our clinical observations, trigger-point stiffness substantially exceeds normal muscle values, with focal suboccipital measurements occasionally reaching approximately 100 kPa, compared with approximately 5 kPa in relaxed muscle and up to approximately 30 kPa in highly stiff trigger-point regions. Following targeted DN-US, reduction of muscular stiffness has been accompanied by restoration of movement and changes in dynamic myodural/spinal-root motion.
Conclusions: This approach may establish an objectively measurable **suboccipital–pterygoid–postural phenotype** linking musculoskeletal dysfunction with central and psychological manifestations. Reproducible pre/post changes would provide a clinically testable model of bidirectional interaction between posture, peripheral nociception, central sensitization and psychophysiological regulation, and could support personalized rehabilitation rather than symptom-based treatment alone.

Disclosure of Interest: None Declared