Assessment of Somatosensory Function using Quantitative Sensory Testing

For most musculoskeletal (MSK) pain disorders, nociception arises in the peripheral nervous system, is transmitted through the peripheral nervous system to the dorsal horn and further transmitted upwards to higher brain centers, where the pain experience is produced. Additionally, the descending pain pathways (neurons projecting from the brain down to the dorsal horn) can be activated and inhibit or facilitate incoming nociceptive signals. Quantitative sensory testing (QST) is a neurological examination of somatosensory function, that provides information about the transmission and modulation of nociception in 1) the peripheral nervous system, 2) the dorsal horn and 3) via the descending pain pathways.

Although many QST modalities exist, people with MSK pain are often most sensitive to pressure stimuli, as these target muscles and joints and MSK pain conditions are often mechanically mediated (such as osteoarthritis). Commonly, pressure pain thresholds (PPTs) are utilized as a proxy assessment of localized pressure hyperalgesia, which is a sign of peripheral pain sensitivity, temporal summation of pain (TSP) is often utilized as a proxy assessment of the excitability of dorsal horn neurons and conditioned pain modulation (CPM) is utilized as a proxy assessment for descending pain inhibitory control.

Quantitative Sensory Testing findings in people with MSK pain

Substantial evidence suggests that, on average, people with chronic MSK pain have lower PPTs, higher TSP and impaired CPM when compared to healthy pain-free people, which could indicate that the nervous system is sensitized to nociceptive input. Some studies indicate that the extent of pain duration might be associated with a higher degree of pain sensitivity. It is important to understand that there is substantial variation in QST findings among people with chronic MSK pain and therefore it would be incorrect to state that all people with chronic MSK pain are pain sensitive. Instead, it is likely that subsets of more or less pain sensitive people with chronic MSK pain exist, particularly given that the pain experience is influenced by numerous factors.

Potential as predictors of MSK treatment outcomes

Studies have investigated whether the extent of pain sensitivity could be linked to treatment outcomes for common MSK treatments. In general, a higher degree of pre-treatment pain sensitivity has been linked to 1) chronic postoperative pain after total joint replacement surgery, 2) lower analgesic effect to non-steroidal anti-inflammatory drugs (NSAIDs) and paracetamol, and 3) poor
pain relief to exercise-based therapies\textsuperscript{5,6}. Although these associations significantly predict treatment outcomes, it is important to highlight that the predictive value of QST is low-to-moderate\textsuperscript{4}, suggesting that QST cannot be a stand-alone prognostic tool in the clinic. Chronic MSK pain is complex with multifactorial contributors, involving several pain mechanisms, lifestyle factors, and psychosocial influences, among others. As such, it is likely that a broader multimodal approach towards prediction models is needed.

**Factor likely to influence QST findings in people with MSK pain**

A subset of people with MSK pain are obese, inactive and report poor quality of sleep, and these lifestyle factors are likely to influence pain sensitivity in MSK pain. Obesity is not directly associated with pain sensitivity, but obesity is associated with a higher degree of pro-inflammatory cytokines, and animal studies suggest that these cytokines can sensitize both peripheral and central nociceptive neurons, leading to increased pain sensitivity\textsuperscript{8}. Similarly, preclinical studies have demonstrated that inactivity is linked to a higher level of inflammation\textsuperscript{4}, which can potentially sensitize the nociceptive system, and human studies suggest that improving physical activity might be linked to less pain sensitivity\textsuperscript{5}. Finally, poor sleep quality is linked to increased clinical pain in people with chronic MSK pain and data suggest that sleep quality may moderate the extent of pain sensitivity\textsuperscript{3,9}. Psychological factors (e.g. depression, anxiety) may influence QST findings in MSK pain, but recent data questions this association\textsuperscript{7} and therefore this should be further studied in the future.

**Conclusion**

Substantial evidence suggests that people with chronic MSK pain frequently have more pain sensitivity than healthy pain-free people, and there are subgroups of people with chronic MSK pain who are more pain sensitive than others. Higher degrees of pain sensitivity have been linked to poor response to standard pain treatments such as joint replacement surgery, NSAIDs and paracetamol, and exercise-based therapy. Lifestyle factors such as obesity, inactivity and poor quality of sleep might be indirectly associated with the degree of pain sensitivity in people with chronic MSK pain.

**References**
