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Profiles of painful neuropathy in the trigeminal region

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Background and aims

Trigeminal nerve injury is one of the most distressing complication that may occur after surgery and trauma, resulting in sensory disturbances often accompanied by pain and decreased quality of life. Hence, neurophysiological changes should be recognized as early as possible to start an appropriate therapy. Therefore, we established the Quantitative Sensory Testing (QST) implemented by the German Research Network on Neuropathic Pain (DFNS)[1] at chin, lip, gingiva and tongue and completed these neurophysiological investigations by questionnaires for pain estimation and psychic comorbidity.

Methods

QST is a non-invasive, psychophysiological approach to detect thermal and mechanical perception and pain thresholds in neuropathic pain[2]. Thereby the function of large and small afferent nerve fibres will be considered, revealing hypaesthesia, dysaesthesia and hyperaesthesia. QST data were evaluated for healty subjects (n=20) and patients suffering from painful trigeminal neuropathy (n=5) at chin and lip. In case of painful sensations, thermal and mechanical hyperalgesia, allodynia and the history of pain, as well as anxiety and depression (HADS-D) were monitored and evaluated.

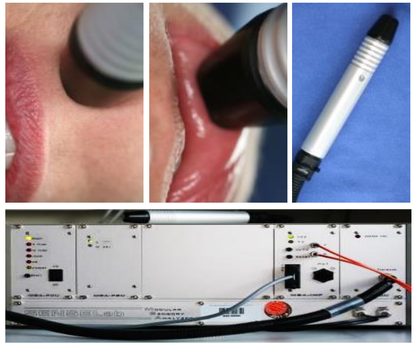

Figure 1: Quantitative Sensory Testing Thermal perception and pain thresholds

Thermal stimuli were applied at chin or lip by a computer controlled thermode with stimulation area of 9*9 mm². (Somedic, Hörby, Sweden), We recorded cold and warm perception thresholds (CDT, WDT) and thresholds for thermal difference (TSL), revealing paradoxical heat sensations. Further on we determined cold and heat pain thresholds (CPT, HPT).

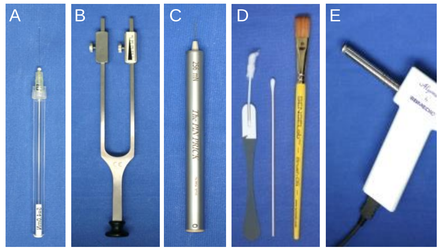

Figure 2: Quantitative Sensory Testing - Mechanical detection and pain thresholds

Mechanical perception and pain thresholds were estimated at chin and lip as presented for thermal thresholds in Figure 1. Mechanical perception thresholds were revealed using von Frey Filaments (0.125/0.25/0.5/1/2/4/8/16/32/64/128/256 mN, OptiHair, Marstock, Schriesheim, Germany) to sensitize light touch (MDT^{A}) and a conventional tunning fork (64 Hz, 8/8 scale) for vibrational experiences (VDT^{B}). Mechanical pain (MPT^{C}) and pain sensitivity (MPS^{C}) were assessed by PinPrick stimulators (8(16/32/64/128/256 mN, MRC systems, Heidelberg, Germany). Dynamic mechanical pain sensitivity (DMA^{D}) was measured within MPS using a brush (200-400mN), a cotton whisp (100mN) or a wool tip (3mN). Pain to pressure (PPT^{E}) was calculated by an algometer (rubber tip 1cm², increasing ramp of 50kPa/s, Somedic, Hörby, Sweden).

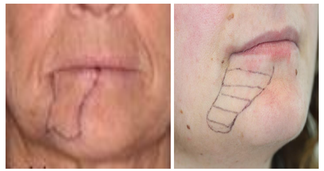

Figure 3: Mapping
Area of sensory deficit after injury of the inferior alveolar nerve

Results

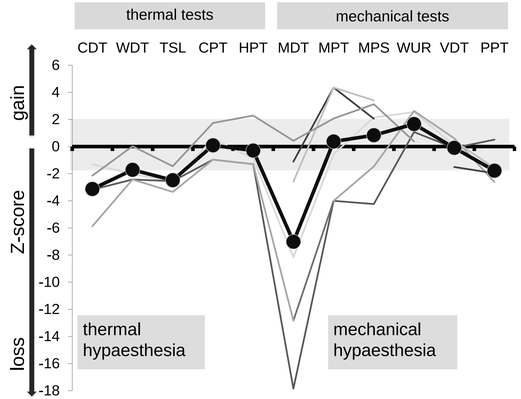

Figure 4: Sensory profiles of patients with trigeminal neuropathy

Hypaesthesia to thermal stimuli (CDT, WDT), as sign for small fibre loss and a loss in tactile perception (MDT) as a sign for large fibre disturbances was found for all patients at the chin. Patients differ in their severity of pain experience. We found thermal hyperalgesia (CPT, HPT), as well as mechanical hyperalgesia (MPT, MPS, WUR). The patients seem to be less sensible to pressure (PPT).

To compare patient's QST profiles, the QST data were normalized with healthy individuals by z-transformation *(z-value = [value patient – mean reference]/ standard deviation reference).* In three of the five patients nerve impairment occurred due to implant surgery. The other two patients underwent surgery for dental cyst removal and tumour resection. In all patients we found numbness at chin (Fig.4) and lip (similar data, not shown), coexisting with reduced temperature perception. This is typically for deafferentation of small (Aδ- and C-) and large (Aβ-) nerve fibres. Furthermore pain sensitization with varying severity, reaching from increased mechanical pain sensitivity to obvious mechanical and/or thermal hyperalgesia could be observed. Beside this, allodynia, meaning abnormal pain experience for normally not painful stimuli and enhancement of temporal pain summation were detectable. This indicates involvement of the central nerve system. In addition, the patients showed higher anxiety and depression scores.

Conclusion

Additionally to thorough dental and oral examination, QST is a helpful tool to reveal orofacial neuropathic pain. Typically for trigeminal neuropathy is the loss of both, small and large fibre function. But patients differ obviously in their expression of painful sensations. It depends on their individual risk for central sensitization, triggered by their pain history and psychological comorbidity. Thus it is important to assess individual sensory phenotypes as exactly as possible, including self report tools[3]. Based on the patient's profiles, an individual mechanism based therapy could be started and controlled for efficiency.

Literatur

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2) Backonij MM et al. Value of quantitative sensory testing in neurological and pain disorders: NeuPSIG consensus. Pain. 2013;154(9):1807-19
3) Gilron, et al. Neuropathic Pain: Principles of Diagnosis and treatment. Mayo Clin Proc. 2015;90(4):532-45.

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