The jaw muscles and central sensitization in migraine

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ABSTRACT
Sensitization of the trigeminal subnucleus caudalis (Vc) is an important process in the generation of migraine pain. The role in migraine of afferent input from the jaw muscles in the sensitization of the Vc is discussed.

INTRODUCTION
This article investigates the evidence for jaw muscle involvement in central sensitization. The importance of central sensitization in migraine has been well-documented.\(^1,2\) Although it is widely believed that sensitization of meningeal nociceptors is fundamental to the generation of migraine headache,\(^3,4\) this does not exclude the possibility that migraine pain may originate from other anatomical structures as well. Sensory signals that originate from many structures in the head are processed by Vc neurones. These structures include not only the meninges, but also jaw muscles, facial skin, cornea, hair follicles, and intra- and extra-cranial blood vessels.\(^4\) It follows therefore that input from any of these structures may enhance the sensitivity of the Vc. There is extensive convergence of afferent nerves, including from the jaw muscles, on Vc neurones.\(^5\) A considerable proportion of the wide dynamic range (WDR) and the nociceptive specific (NS) neurones in the Vc have afferent inputs from the jaw muscles,\(^6\) and can be excited by jaw muscle afferent stimuli.\(^7\) The Vc is especially important in pain perception of the jaws and face,\(^6\) including from convergent cutaneous and jaw muscle afferents.\(^8\) It is a critical element in the activation of masticatory muscles.\(^9,10\) Sessle et al demonstrated that stimulation of jaw muscle afferents excites neurones in the Vc,\(^10\) and that nociceptor afferent impulses from muscles produce a long lasting central sensitization.\(^12\)

DISCUSSION
The first suggestion that sensitization of the Vc may be important in the pathophysiology of migraine was made by Strassman et al in 1996.\(^1,1\) Subsequent research has validated this hypothesis.\(^14-18\) Sensitization of the Vc now widely accepted as important in the generation of migraine pain, particularly in the later stages of the acute attack and in the development of chronic migraine.\(^19\)

Sensitization of the Vc is important not only in the maintenance and exacerbation of acute migraine attacks,\(^14,20-22\) but it is also thought to contribute to migraine becoming chronic.\(^23\)

Sensitization of muscle nociceptors leads to a lowering of the mechanical threshold into the innocuous range, and hyperexcitability of dorsal horn neurones, resulting in prolonged neuronal discharges, increased responses to noxious stimuli, and expansion of the receptive field.\(^24,25\)

Myofascial trigger points are hyper-irritable spots in skeletal muscle, that are painful on compression.\(^24\) They are a common finding in migraineurs, and in most cases, compression of the trigger points elicits pain which exhibits typical migraine features.\(^25\) Trigger point palpation provoked a full blown migraine attack in 29.6% of migraineurs and the number of individual migraine trigger points was found to be directly related to both the frequency of migraine attacks and the duration of the disease.\(^25\)

Nociceptive inputs from trigger points produce continuous afferent bombardment of the Vc and activation of the trigeminovascular system, contributing to the initiation and perpetuation of migraine pain.\(^26,27\) It has been shown that during a migraine attack, 100% of patients have sensitivity to palpation of the pericranial muscles, which include the jaw muscles.\(^28\)

The Vc plays a crucial role in craniofacial nociceptive transmission, including receiving stimuli from convergent cutaneous and jaw muscle afferents,\(^8\) and from muscle nociceptor afferents which produce a longer-lasting central sensitization than do those that innervate skin\(^12\) or dura.\(^29\) Sensitization of muscle nociceptors leads to a lowering of the mechanical threshold into the innocuous range, and hyperexcitability of dorsal horn neurones, resulting in prolonged neuronal discharges, increased responses to noxious stimuli, and expansion of the receptive field.\(^30-32\)

Treatment of migraine with intra-oral appliances designed to reduce muscle tension in the craniomandibular muscles has been shown to be effective in reducing the severity and frequency of migraine attacks, often eliminating them altogether.\(^33-36\)

CONCLUSION
The evidence suggests that jaw muscle afferent input contributes to central sensitization of the Vc in migraine.

ACRONYMS
NS: Nociceptive Specific
Vc: Trigeminal Subnucleus Caudalis
WDR: Wide Dynamic Range

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