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GUEST EDITORIAL

Referred pain

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One of the first symptoms of a heart attack can be pain in the teeth and/or jaws. In the case of a heart attack, the presence of pain in the teeth or jaws doesn't mean that there is any dental condition that needs to be treated, in the absence of any pre-existing dental condition. The experience of dentally related pain during a heart attack is a classical example of referred pain which is pain felt at a site distant from the site of origin. But referred pain can also occur under less dramatic circumstances unrelated to any cardiac pathology. Thus pain referral is frequently found in patients with chronic musculoskeletal pain (for example, temporomandibular disorder (TMD), fibromyalgia, and chronic low back pain). In patients with TMD, for example, muscle and/or jaw joint pain could refer to the teeth and other parts of the orofacial area. Patients and clinicians alike can become convinced that the pain is actually due to some form of dental pathology and there are clinical cases where tooth extractions have been carried out in the mistaken belief that there is a dental cause to the pain. In these circumstances, tooth extractions have no effect whatsoever on the cardiac pain.

How does pain referral arise? Is the patient imagining the pain? Or is there a neural basis for pain referral? Are there any diagnostic tests that can be done to help distinguish pain referral to a tooth as distinct from pain arising in that tooth?

Pain referral is, indeed thought to have a neural basis. Specific pathways and neural connections in the brain are thought to lead to the possibility of pain referral. Convergence is one of the important neural phenomena that plays a critical role in pain referral. To understand convergence it is necessary to revise our understanding of how sensory information enters into and is processed in the brain. Information about touch and tissue damage is conveyed as action potentials along specific sensory nerve fibres that have their sensory receptors in the periphery (e.g. muscle, skin, joint, tooth pulp). One group of nerve fibres conveys information about touch and another group conveys information about tissue damage or noxious stimulation. The sensory nerve fibres conveying information about noxious stimuli are called nociceptive nerve fibres. Both the nociceptive and the touch nerve fibres convey action potentials into the brainstem to terminate on second order neurones in the trigeminal brainstem sensory nuclear complex. Once in the brainstem, 2 important things can happen. First, many nociceptive sensory fibres from different parts of the orofacial area can terminate on the same set of second order neurones, for example, nociceptive nerve fibres from jaw muscles, tooth pulps, and skin can all converge onto the same second order neurone. Second, both nociceptive and non-nociceptive (e.g. touch, pressure) sensory nerves can converge onto the same second order neurone.

The biological reason for this convergence is not totally clear but it appears to be at least part of the reason for referred pain. The second order neurones are part of the pathway that sends sensory information to higher centres for perception. However, since there is so much convergence of sensory information from different body parts onto the same second order neurones, these second order neurones may provide ambiguous information as to the exact location of the noxious stimulus. This neural mechanism is thought to be one way whereby the higher centres of the brain can become "confused" as to the exact location of the noxious stimulus.

Another intriguing phenomenon that may help explain pain referral is the unmasking of otherwise silent or latent synaptic connections that may occur with the activation of nociceptive sensory nerve fibres. Upon entering the brainstem, nociceptive afferent nerve fibres branch extensively to terminate on many different second order neurones that are responsible for conveying information from extensive parts of the orofacial area. Some of these synaptic connections are ineffective or latent and action potentials arriving at these synaptic connections under normal circumstances do not result in activation of the next (second-order) neurone in the afferent nerve pathway. It appears that when there is prolonged and/or intense noxious stimulation (for example, muscle trauma or repeated heavy parafunctional clenching), some of these ineffective synapses may become effective connections. Under these circumstances action potentials may be transmitted along pathways that convey information from parts of the orofacial region unrelated to the source of the noxious peripheral stimulus. The brain therefore can become confused as to the correct location of the initiating noxious stimulus.

There is a simple diagnostic test that can be done to help distinguish pain referral to a tooth as distinct from pain arising in that tooth. Clinicians can administer a diagnostic local anaesthetic to produce a neural inactivation at the site where the patient complains of the pain, e.g. a tooth. If the pain being felt in the tooth is referred pain, then the pain should persist despite the local anaesthetic. Such a clinical finding should alert clinicians to the possibility that the pain arises from other sites. Included in the differential diagnosis should be evaluation of muscles and joints for a possible diagnosis of TMD. Treatment of TMDs involves reversible strategies including home-care remedies such as application of moist heat and pharmacotherapy.

The reader is referred to some recent excellent reviews that explain in more detail aspects of the above[1-3].

References

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