Journal of
Novel Physiotherapies
ISSN: 2165-7025

Short Communication Open Access

Physical Treatment of Headache and Neck Pain from a Neuroscience Perspective

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Introduction

Headache causes significant discomfort and incapacity in people's everyday lives, resulting in a huge burden and cost to society of 173 billion Euros per year in Europe alone [1]. Tension-type headache (TTH) and migraine are the most common main headaches globally. These headaches are commonly accompanied with neck discomfort. In a recent open population research, those with primary headache had a 1-year prevalence of neck pain of 68.4% or higher compared to people without primary headache. After adjusting for age, gender, education and poor self-rated health, the prevalence of neck pain (56.7%) In comparison to persons without headaches, was remained considerably greater in people with only migraine (76.2%), migraine plus TTH (89.3%), and simply TTH (88.4%). In their quest for diagnosis and therapy, people with headaches and neck pain regularly consult health care providers such as medical physicians (general practitioners, neurologists) and physical therapists [2]. Reassurance, self-management tactics, pharmacological, and non-pharmacological therapies are among the therapy options available. The evidence regarding physical therapy's usefulness in the treatment of headaches is minimal. Despite the absence of good scientific evidence, physical therapy is a widely used alternative or supplementary treatment that is recommended in numerous clinical recommendations (the European Federation of Neurological Societies (EFNS) guideline, the Italian guideline for primary headaches) [3]. In everyday practice, a mix of pharmacological (acute and prophylactic medicines) and non-pharmacological (education, physical therapy, exercises, biofeedback) treatments is regarded to be an effective strategy in the treatment of headache problems. Additional study on non-pharmacological preventative headache therapy techniques is, however, critically required. Understanding the neuro-physiological underpinning of headache and neck pain is critical for clinical reasoning in fields that target the cervical spine in attempt to reduce headache. Experimental research in both animals and people has recently revealed fresh insights into the relationship between extra cranial input from the (upper) cervical spine and headache. This new knowledge might be extremely useful in understanding and (re)designing physical techniques for many forms of headaches that are accompanied by neck discomfort The neuro-anatomical and neuro-physiological findings from experimental research on the trigemino-cervical complex are first described in this paper (TCC). Finally, we discuss physical therapy as a treatment option for headaches and neck discomfort.

Trigemino-cervical complex, the anatomical basis

Further neurophysiological insights into the relationship between headache and neck discomfort have come from experimental studies. The importance of understanding the TCC's neuro-anatomical structures and neural activity appears to be important. The widespread incidence of headache and neck discomfort is linked to shared nociceptive innervation of the head and neck in the trigemino-cervical complex's dorsal horn C1-2. The TCC extends from the medulla (pars oralis and pars interpolaris) to the first and second cervical segments, according to animal and human anatomical investigations (pars caudalis) [4]. The pars caudalis of the TCC receives first order nociceptive A- and C afferent neurons from the ophthalmic nerve, as well as first order A- and C nociceptive afferent neurons from the dorsal root C2. These afferent neurons are coupled to second-order neurons directly or indirectly via large dynamic range neurons. The ophthalmic nerve sends nociceptive input to nociceptive second-order neurons in the superficial and deep layers of the medullary dorsal horn C1 and 2 in the TCC through small diameter A- and C afferent nerve fibres. The A- and C nociceptive afferent information of arteries and dura mater of the posterior fossa, as well as myofascial structures of the upper cervical segments, is represented by the upper cervical root C2. This nociceptive input from the upper cervical nerve root C2 is well-documented, and nociceptive nerve terminals from the ophthalmic nerve root at the first and second cervical dorsal horns in the TCC have a structural overlap. A study indicate an extracranial origin for meningeal nociception by showing in vitro that collaterals of trigeminal afferents generate functional connections between intracranial and extracranial tissues in rats and humans. As a result, information from pericranial muscles can reach the dura mater via ortho- and antidromic conduction via axon collaterals, potentially influencing meningeal functions and the cause of headaches in people [5].

Evidence from animal studies

Experimental neurophysiological investigations in animals that recorded nociceptive afferent fiber input at the C1-2 dorsal horn helped to a better understanding of referred pain in both directions, i.e., from the neck to the head and from the head to the neck.

The activation of the trigeminovascular pathways by increased visceral nociceptive A- and C fibres input of the dura and intracranial arteries on the TCC appears to be the primary cause of headache during a migraine episode. This input is usually limited to the ophthalmic nerve's area, but it can also cause discomfort in the occipital region of the head, which is innervated by the greater occipital nerve C2. These findings suggest that headache and neck discomfort might be regarded as referred pain.

Evidence from human studies

Human investigations have found clinical evidence of referred pain based on the convergence of cervical and ocular nociceptive A-

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Received: 05-Jan-2022, Manuscript No. jnp-22-52237; **Editor assigned:** 07-Jan-2022, PreQC No. jnp-22-52237(PQ); **Reviewed:** 21-Jan-2022, QC No. jnp-22-52237; **Revised:** 26-Jan-2022, Manuscript No. jnp-22-52237(R); **Published:** 02-Feb-2022, DOI: 10.4172/ 2165-7025.1000503

Citation: Castien R (2022) Physical Treatment of Headache and Neck Pain from a Neuroscience Perspective. J Nov Physiother 12: 503.

and C afferent input coming from separate tissues. Clinical studies have revealed that intracranial nociceptive input from arteries, as well as extracranial nociceptive input from the vertebral artery, can cause unpleasant feelings in the forehead. Several investigations have shown that administering experimental nociceptive stimulation to upper cervical regions can cause headache. Saline injections in the neck and sub occipital area, sterile water and low-frequency nerve stimulation across the upper cervical dorsal roots have all been proven to cause headache.

Physical treatment of headache and neck pain

The neuro-anatomical and physiological relationship between the brainstem nuclei, the (upper) neck, and the trigeminal nerve must be taken into account while developing physical treatments for headaches in the cervical spine, particularly the upper cervical area. According to the 'gate-control' concept, the relatively large volume of proprioceptive afferent muscle input to the central nervous system of higher cervical segments may change nociceptive A- and C fibre afferent input [6]. The activation of the supraspinal DNIC system by stimulation of myofascial A- and C fibres by manual pressure techniques at the upper cervical spine can be of added value. Stimulation of proprioceptive input by active exercises for neck muscles may decrease the excitability of second order neurons at the TCC and activation of the supraspinal DNIC system by stimulation of myofascial A- and C fibres by manual pressure techniques at the upper cervical spine can be of added value.

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