The Role of Physiotherapy in the Management of Whiplash Injury: A Narrative Review

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ABSTRACT

Many people in the developed countries have experienced a whiplash injury, in which their cervical spine followed a rapid force of acceleration-deceleration in their neck, in a small or a greater scale, mostly as a result of a vehicle injury. Whiplash associated disorders (WAD) is the term that is used to describe injuries which sustained as a result of these sudden acceleration-deceleration movements. This term also refers to the presence of a total of symptoms that a patient can experience after a whiplash injury such as pain, headache, stiffness and dizziness. As a result, these injuries have many effects and costs in a patient's daily and work life, work ability and psychology, making it necessary to find treatments that can relieve them. The published reviews have shown the importance of including the therapeutic exercises in a rehabilitation programme aiming to the reduction of those symptoms. Many reviews and researches have been published referring to different therapeutic methods in a whiplash injury, so it is important to discover the appropriate physiotherapy methods for the management of the whiplash injury's symptomatology. This review is about investigate the role of physiotherapy methods to treat the short-term and long-term symptoms of the whiplash injury.

Key words: whiplash, whiplash injury, whiplash-associated disorders (WAD), physiotherapy, management.

Introduction

A very common traumatic injury that is estimated to affect between 70 and 420 people in every 100.000 and is produced most likely by a road traffic crash is a whiplash injury [1] . It is caused by a sudden passive extension of the neck, followed by a sudden flexion, in a whip-like fashion [2-3].

Campbell et al indicate that one in two individuals who experience a whiplash injury will never fully recover and up to 30% will remain moderately to severely disabled by this condition [4].

After the whiplash injury, characteristic morphological changes occurred. Some of these changes are fatty infiltration in the multifidus muscle and ligaments injury, sprain in the nuchal ligament and in the anterior longitudinal ligament, who naturally offer

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stability in the cervical spine and also altered superfacial and deep cervical muscle behaviour is observed. Deconditioned neck muscles may affect the physical support of the cervical spine [5]. Pain, stiffness, neck and/or shoulder pain with or without radicular symptoms, kinesiophobia, headache, loss of cervical mobility, reduced range of motion in the cervical spine and neurological deficits, not only in the early stages of the accident, but also years later, are the most commonly symptoms that a patient has. Patients with neurological signs report arm pain, paraesthesia or hyperalgesia without other known causes that occurred in the same dermatome/myotome.

The anatomy of the upper cervical region in combination to the direct connection and access to the vestibular nuclear complex are very important for the postural control, and for this reason, if a disorder occurs, it directly affects the vestibular system and the neck movement which might be a possible cause of symptoms such as dizziness among patients with whiplash-associated disorders (WAD)[6-7].

After a whiplash injury, there are a lot of people with neurological symptoms that don't recover fully and these signs may be caused by brachial plexus traction and/or disc protrusions, which rather seem to progress over time in WAD [8].This study supports that the somatosensory system of the patients is also affected and Castaldo et al [9] reinforced this view by adding that the patients exhibit changes in their central sensitisation. For instance, myofascial trigger points are affected and lead to the presence of persistent pain and sensitization in chronic pain patients.

The presence of these total symptoms impose a significant effect in a patient's life and it is a characteristic of a term called whiplash associated disorders (WAD) which is used to describe injuries sustained as a result of sudden acceleration-deceleration movements, affecting a high percentage of the individuals involved in road traffic incidents [9] .

Physiotherapy interventions have shown amazing results in the management of WAD. The majority of the published studies and reviews have demonstrated the effects of therapeutic exercise, before and after the injury and have emphasized the importance of the therapeutic methods in the reduction of those symptoms. It is therefore, necessary to investigate and to treat the short-term and long-term symptoms of the whiplash injury. The current narrative review is about understanding the role of physiotherapy interventions in the management of the whiplash injury. Finding the appropriate and the most effective therapeutic method, among many different ones, is an increasingly important issue.

This review aims to evaluate and appraise the current evidence of the effects of physiotherapy interventions on the management of the whiplash injury. For this cause, a literature review was conducted based on the PubMed internet database. Inclusion criteria comprised randomized controlled trials and randomized comparative clinical studies, where the participants could be of any gender and age. Studies describing any physiotherapy intervention that had to do with pain, dizziness, stiffness, stress and low quality of life, were also included. Studies comparing no intervention to standard care group or contrasting the differences between two or three therapeutic methods were included. Furthermore, keywords that were used in the PubMed database, were "whiplash", "whiplash injury", "cervical acceleration-deceleration", "whiplash injury syndrome", "whiplash neck injury '. The studies that were selected were published in the last decade, from 01/01/2012 to 02/2022. Furthermore, the narrative review does not include those studies that were referring to interventions such as drugs and / or surgeries, those studies that were reviews, and those studies that dealt with the cost of the treatment for whiplash injury.

Discussion

The study selection had initially found 143 citations in the international databases (n=143), of which 59 were rejected, because they were reviews. Following the removal of duplicates and verification of titles, 106 remained, of which 47 studies were remained after checking on the abstract. Finally, after screening abstracts and manuscripts, 29 studies finally included (Figure 1).

Dealing with a whiplash injury

***Basic Body Awareness Therapy (BAT)*:** Basic body awareness therapy (BAT) is a method used by physiotherapists, for the treatment of chronic musculoskeletal pain disorders, that includes the postural assessment, patient's awareness of its body and its posture. It is a method that has shown great improvements in cognitive function, cervical range of motion and quality of life. The researchers Seferiadis et al [10] demonstrate that patients who followed the basic body awareness therapy, have shown greater improvements compared with the patients in the exercise therapy group, such as the increase of their physical functioning, a greater body pain reduction and a better social. Basic body awareness therapy (BAT), not only produced a greater impact in patients with WAD, but it had been suggested by the researchers to be a part of the rehabilitation programme [10].

Acupuncture versus Relaxation therapy: A high percentage of therapists uses acupuncture as a main treatment for managing chronic pain by activating analgesia and reducing patient's pain and disability level. Other therapists suggest another effective method that is relaxation therapy in patients with chronic WAD. On the other hand, Tobbackx, et al. [11] discovered that acupuncture is a more effective method in decreasing local and referred pain but also in offering stronger improvements in local pressure pain sensitivity painful region, than relaxation therapy.

Dry-needling: Sterling M et al [12] suggested that dry-needling may have effects on central nociceptive processes in individuals with WAD. They examine the effectiveness and cost effectiveness of dry needling and exercise in patients with chronic WAD grade II. The dry-needling had greater results compared to sham-needling, concerning the pain-related disability, pain catastrophizing, cold hyperalgesia and post-traumatic stress symptoms [12].

Vestibular Rehabilitation: The anatomy of the upper cervical spine is very special and has an important role in the vestibular functions. When a pathology of the cervical spine has been occurred, the postural control will be affected and therefore the vestibular system will react with a total of symptoms, such as dizziness.

The majority of patients with WAD have shown dizziness, as the second most common symptom after neck pain. Likewise, Hansson et al [6] had examined the neck pain intensity, the cervical range of motion (CROM) and the balance in their patients, using a vestibular rehabilitation programme. In the vestibular rehabilitation group, participants have shown a significant greater improvement in their balance and in their self-perceived dizziness handicap, and they reported lower pain intensity. In the same study [6] it was suggested that even though the vestibular rehabilitation is an important tool in the physiotherapist's hand, as long as it can improve the patient's body posture and the mobility in flexion and in the orientation of the patient, further investigation is needed.

Psychological Factors & Stress: Psychological (i.e stress, depression, fear of re-injury) and psychosocial factors have an important role in the prediction of whiplash injury, as well as high pain intensity and pain related disability and they can make the transition from the sub-acute to chronic phase. The psychological condition of the patient, can reduce or otherwise increase the pain intensity and dysfunction in a daily routine and the most critical phase is two or three months after the injury. Patients who believed that they can make a full recovery, had lower disability six months after the incident, compared to those who did not. With this in mind, researchers Åsenlöf et al [13] found that individuals with mild symptomatology, did not have a good physical activity previously to the accident, although they had a better health condition. On the other hand, patients with severer clinical signs, who had already experienced a road traffic accident before, it was found that they have higher levels of pain intensity, fear of movement and re-injury, post-traumatic stress symptoms and lower level of functional self-efficacy. For this reason, Campbell et al [4] combined evidenced-based physiotherapy sessions with trauma-focused cognitive behavioural approach and their main goal was to decrease the levels of pain and disability in individuals with chronic whiplash and post-traumatic stress disorder. On the other hand, another multiply approach [7], including specific individualized physiotherapy, psychology for post-stress syndrome and pharmaceutical care in patients with a acute whiplash injury, failed to achieve the reduction of the rate of chronicity by 50% , the reduction of the proportion of the patients with persistent pain by 30% and the raise by 70% of those who recovered.

In patients with acute WAD grade II or III and are at risk of poor recovery, another study[14] have demonstrated a combined intervention, consisted of physiotherapy exercise with a physiotherapist-deliv-

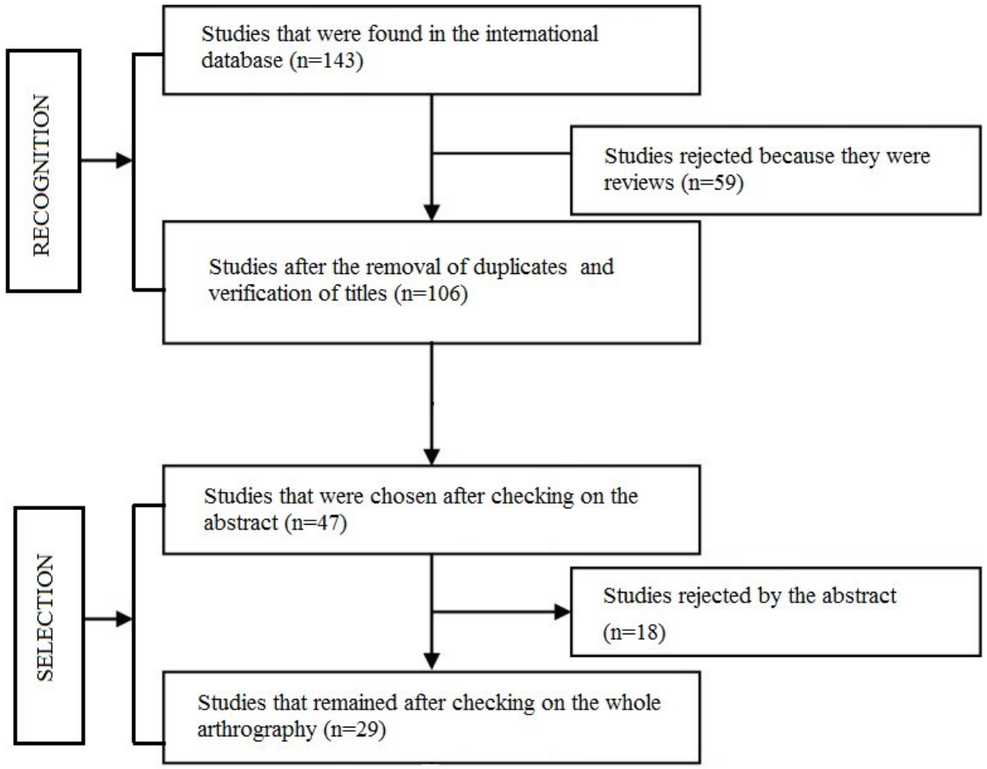

Figure 1: *The flowchart of trial identification and selection for inclusion in the narrative review*

ered stress inoculation training (Stress Model) compared with guideline-based exercise alone. This combined intervention has better primary and secondary outcomes regarding pain and general health and physiotherapists with the appropriate training can provide early psychological care and can effectively deliver a psychological type of intervention, helping with the management of the stress - related symptoms and providing greater effect on later disability, pain and mental health outcomes. Having said that, Ludvigsson et al [15] proved that the psychological condition of a patient did not change the initial outcome following intervention in chronic WAD.

Percutaneous Needle Electrolysis (PNE: The whiplash-associated disorders (WAD) occurred, more often, in a low energy traffic accidents but can also happen in sport activities, causing symptoms from mild to strong severity, such as brachialgia or vertiginous syndrome. Garcia Naranjo et al [2] found that PNE intervention is a therapeutic method that is cheaper than the basic physiotherapy protocol and can be considered to be a very effective option for the treatment of acute whiplash injury, alone or additionally to the standardized physiotherapy programmes. The participants receiving this therapy report decrease of their pain and pressure-pain threshold

Spinal Manual Therapy: Spinal manual therapy is commonly used for the treatment of neck-associated disorders. It is an important tool in the hands of physiotherapists and can also be used with combination with exercises. Castaldo et al [9] demonstrate that following a multimodal physical therapy intervention, patients with mechanical neck pain and WAD exhibit similar clinical and neurophysiological responses despite having higher neck-related disability and widespread pressure pain sensitivity.

Active Behavioural Physiotherapy Intervention (ABPI): The Active Behavioural Physiotherapy Intervention (ABPI) combines the active physiotherapy approach such as education, manual therapy, exercise therapy and home exercises, and the behavioural approach of a patient aiming to prevent the transition of acute WAD to chronicity. Researchers Wiangkham et al [16] have conclusively shown that ABPI is an important tool for the rehabilitation, causing a reduction in the neck disability and pain intensity.

Training the Emergency staff

The researchers Lamb et al [17] suggested that one year of training the staff in the emergency department to provide active consultation in the initial meeting with patients with acute whiplash injury of grade I-III, is more effective than usual consultation. This approach is more effective, if a physiotherapy package is following the initial approach, to strengthen the advice they took from the emergency department. This physiotherapy package has a meaningful role in the reduction of the work day loss caused by the whiplash injury by 40% and also can improve the self-rated efficacy of each individual. Additionally, Lo et al [18] referred to the important effects in the patient's work life, caused by this injury.

Neck Specific Exercises with or without a Behavioural approach and Prescription of Physical Activity (PPA): Neck specific exercises (NSE) aim to deep cervical muscles with a focus of maintaining a good body posture, while the patients are supervised by a physical therapist, while doing those exercises and they follow a similar exercise programme at home. The most recent studies [3-19] suggested another intervention combining NSE, with behavioural approaches, called neck-specific exercise with a behavioural approach (NSEB). Patients are learning the way for managing their pain through activities, such as breathing and relaxation exercises. Hence, a prescription of physical activity (PPA) was used, including activities that can be performed outside of the health care system [5-20].

Health in general is multidimensional, and socioeconomic factors, age and low social status can have an impact in health-related quality of life (HRQoL). HRQoL in patients with WAD is lower than in another neck-pain related disorders and is related with non-pain factors, such as pain catastrophizing and depression. Moreover, the HRQoL, may be affected positively by NSE and NSEB, more than PPA. Ludvigsson et al [19] found that there were no differences between the NSE/NSEB groups, which they examined, in any of the HRQoL outcomes at any time point and they may improve the HRQoL, more than PPA in chronic WAD grade II or III, claiming that the reduction of the depression had a positive impact in the HRQoL while the improvement of work ability can reduce the pain. The researchers [19], had also found that NSE and NSEB can cause a rapid reduction of preliminary headache symptoms and maximum headache by 50%, in contrast with PPA intervention. Similarly, adding a behavioural component to neck specific exercises(NSE), which are better than general physical activity, had limited advantages over NSE alone,even though NSEB moderates the psychological and the pain factors that impact the health related quality of life in patients with acute and subacute WAD [5,15,20].

Taking into account that balance, dizziness, proprioception and unsteadiness occur early after the initial injury and are connected to poorer outcome following a whiplash trauma, Treleaven et al [21] claimed that an intervention concluded a behavioural approach (NSEB) can be beneficial for the recovery of a patient with WAD, who has low self-efficacy, psychological distress, fear of re-injury and dizziness during activity. In addition, Peterson et al [22] found that both the NSE and NSEB groups improved in dorsal neck muscle endurance (NME) and they had presented greater reduction of pain compared with the PPA group. However, an added behavioral approach cannot improve the results of an exercise intervention.

Up to 90% of people who suffer from a chronic whiplash injury, they often complain about having radiating signs and symptoms in the arm that are relevant to neurological deficits after one year. Not all people with cervical radiculopathy present muscle weakness, pain nor decreased tendon reflexes but on their study, Ludvigsson et al [23] including participants with cervical radiculopathy from C4 to C7, stated that neck-specific exercise may alleviate neurological signs and symptoms as well as radiating arm discomfort. However,

adding a behavioural approach to those exercises does not appear to be of further benefit, and thus the prescription of PPA is not supported. Similarly, Peterson et al [24] indicated that if exercise interventions (NSE, NSEB) are used with a focus on the neck muscles, persistent disability following whiplash injury can be reduced and reduced active cervical range of motion and grip strength may improve. Peterson et al [25] found that individuals in the NSE approach had greater improvements in pain intensity and muscle interactions than those in the waiting list and that ultrasound is a useful diagnostic tool for muscle impairment and can also evaluate exercises for the neck, thus being a holistic management for chronic WAD.

Comprehensive Physiotherapy Exercise Programme: Considering a comprehensive exercise programme delivered by physiotherapists in patients with chronic whiplash-associated disorder grade I or II, Michaleff et al [26] argued that it is not more effective for pain reduction than simple advice alone (one session and telephone support). Other studies support the importance of exercises in a whiplash injury rehabilitation programme [27-28].

Therapeutic Ultrasound: The therapeutic ultrasound is a useful tool in the hands of physiotherapists as long as it can affect the pain not directly but secondarily in the treatment process, taking into account its pro-inflammatory effect [29]. Active ultrasound can reduce the pain and accelerate the healing process 20 days after completing the implementation of ultrasound, more than placebo, but it cannot increase the joint mobility, in acute traumatic cervical sprain grades I and II.

Conclusion

Whiplash injury is a common health problem associated with a mechanism of injury in the cervical spine. The whiplash-associated disorders occurred, more often, in low energy traffic accidents but also may occur in sport activities and can cause symptoms from mild to strong severity. The range of symptoms concerns not only the musculoskeletal system of the patient, but has also an important role to the patient's psychological condition, as long as they affect their daily and work life. Health-care professionals' assessment is crucial for the prognosis of the rehabilitation, likewise many physiotherapy methods have been used in the deal with chronic pathologies. The role of the physiotherapy science in the management of whiplash injury and whiplash-associated disorders (WAD) is necessary and there are many physiotherapy methods to use, individually or in combination. Taking into account that the ligaments in the cervical region are only responsible for the 25% of the stability in this area, the superficial and especially the deep cervical muscles is the crucial key point for the rehabilitation. Focusing on strengthening these muscles and improving body posture, can reduce symptoms' intensity. Good posture can reduce forces exerted on the cervical spine, and together with the right ergonomic, can provide a better daily life. Physiotherapist should provide a multidimensional approach to the patient, emphasizing also on patient's psychological condition, as it may affect treatment's results and retard rehabilitation.

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