A proposed new classification system for whiplash associated disorders—implications for assessment and management

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Abstract

The development of chronic symptoms following whiplash injury is common and contributes substantially to costs associated with this condition. The currently used Quebec Task Force classification system of whiplash associated disorders is primarily based on the severity of signs and symptoms following injury and its usefulness has been questioned. Recent evidence is emerging that demonstrates differences in physical and psychological impairments between individuals who recover from the injury and those who develop persistent pain and disability. Motor dysfunction, local cervical mechanical hyperalgesia and psychological distress are present soon after injury in all whiplash injured persons irrespective of recovery. In contrast those individuals who develop persistent moderate/severe pain and disability show a more complex picture, characterized by additional impairments of widespread sensory hypersensitivity indicative of underlying disturbances in central pain processing as well as acute posttraumatic stress reaction, with these changes present from soon after injury. Based on this heterogeneity a new classification system is proposed that takes into account measurable disturbances in motor, sensory and psychological dysfunction. The implications for the management of this condition are discussed.

1. Introduction

Whiplash injuries from motor vehicle crashes, although common, remain a poorly understood clinical entity. Most individuals recover within a few weeks of injury but a significant proportion (14–42%) will develop persistent ongoing pain with 10% reporting constant severe pain (Barnsley et al., 1994). It is these people with persistent symptoms who contribute substantially to the significant economic costs related to this condition.

The most optimal management of whiplash associated disorders (WAD) is unknown. Evidence provided from systematic reviews would suggest that active interventions that stimulate the patient to return to daily activities as soon as possible are preferable to rest and wearing of a collar (Magee et al., 2000; Scholten-Peeters et al., 2002). While trials of physical management have enhanced the rate of recovery of those who are likely to obtain a reasonable recovery after injury, no treatment has been shown to decrease the incidence of chronicity associated with this condition (Borchgrevink et al., 1998; Rosenfeld et al., 2000, 2003). One reason for this may be that such treatments do not specifically target the physical and psychological impairments shown to be associated with WAD. Furthermore attempts to develop a classification system of WAD based on signs and symptoms (Spitzer et al., 1995), suffer similar flaws and this could explain the dubious value of the Quebec Task Force (QTF) classification of WAD (Kivioja et al., 1999).

This paper will outline recent advances made in the understanding of the physical and psychological impairments associated with both the acute and chronic stages of this enigmatic condition. A new classification system that takes into account specific impairments will be proposed and the implications these findings provide for the future management of WAD will be discussed.

2. Quebec Task Force classification of WAD

Symptoms reported following whiplash injury, particularly those whose condition fails to resolve, can be
diverse and may include neck pain, headache, dizziness, tingling, numbness, arm, thoracic and lumbar spine pain. The varied nature of symptoms reported following whiplash injury lends itself to suggest that a classification system of the condition would be useful in order to guide both research investigation and treatment decision-making. In 1995, the QTF developed the Quebec classification of WAD (Spitzer et al., 1995). The authors proposed this classification system (Table 1) in order to facilitate the evaluation of research and to provide clinicians with useful guidelines for making decisions about therapeutic management. It classified patients with whiplash according to the type and severity of signs and symptoms observed shortly after the injury (Spitzer et al., 1995).

Since its release, the QTF classification has been criticized. Much of this criticism has identified that whilst the QTF review of WAD rejected many articles that did not meet rigorous scientific criteria, the guidelines themselves suffered from the same faults—they were adopted and promoted without scientific validation (Freeman et al., 1998; Teasell and Shapiro, 1998; Freeman et al., 1995).

The potential usefulness by which such a classification may be judged are as predictors of the long-term outcome following whiplash injury. Kivioja et al.’s (1999) longitudinal study of 100 patients with WAD suggested that the application of the Quebec classification was of limited prognostic value. However, more recently Hartling et al. (2001) showed that the classification was prognostic of outcome at 6, 12, 18 and 24 months postinjury but these authors recommended that a modification of Grade II classification be made to distinguish between those with normal or limited range of movement. The reason for this was that those with less range of movement had a poorer outcome. A major drawback of this study was that the classification of the WAD patients was made retrospectively using the patients’ clinical notes and therefore emphasizes the need for more prospective studies on outcome. Nevertheless, Hartling et al. (2001) may have a valid point when they suggest modification of the WAD II subgroup. WAD II, although exclusive of clinical findings of neurological deficit, still covers a very broad range of symptoms and as such, suggests variance in outcome will be a feature of such a broad classification. Furthermore, WAD II is the most common of the four QTF classifications of whiplash and it is important that it accurately represents the whiplash subgroup it is supposed to portray.

While the QTF also recognize the shortcomings of their classification system, it was probably the best that could be developed at the time as knowledge about WAD was virtually limited to patient reported signs and symptoms. This situation is being slowly reversed and in recent years wide ranging physical and psychological impairments and the involvement of complex physiological mechanisms have been demonstrated to occur in chronic WAD (Radanov and Sturzenegger, 1996; Dall’Alba et al., 2001; Peebles et al., 2001; Nederhand et al., 2002; Sterling et al., 2002). These findings lay the foundation for future development of an improved classification system.

3. Physical and psychological features of chronic WAD

Early investigation of whiplash injury sought to determine the pathoanatomical structures involved. In vivo identification of structural pathology has proved difficult due to the insensitivity of current radiological diagnostic imaging techniques including conventional radiology, magnetic resonance imaging (MRI) and computed tomography scanning (CT) (Davis et al., 1991; Pettersson et al., 1994; Uhrenholt et al., 2002), although recent studies begin to provide hope that this situation may change in the future for at least some structures (Krakenes et al., 2002, 2003). Nevertheless, in vitro evidence from cadaveric and animal studies indicates that lesions may occur to virtually any cervical structure including bony elements, intervertebral discs and zygapophyseal joints, ligaments, muscles and nerve tissues (Schonstrom et al., 1993; Jonsson et al., 1994; Taylor and Taylor, 1996). It has been argued that the identification of the pathoanatomical source of symptoms provides little basis for appropriate management of musculoskeletal pain and emphasis should

<table>
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<tr>
<th>QTF classification grade</th>
<th>Clinical presentation</th>
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<tr>
<td>0</td>
<td>No complaint about neck pain No physical signs</td>
</tr>
<tr>
<td>I</td>
<td>Neck complaint of pain, stiffness or tenderness only No physical signs</td>
</tr>
<tr>
<td>II</td>
<td>Neck complaint Musculoskeletal signs including: Decreased range of movement Point tenderness</td>
</tr>
<tr>
<td>III</td>
<td>Neck complaint Musculoskeletal signs Neurological signs including: Decreased or absent deep tendon reflexes Muscle weakness Sensory deficits</td>
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<tr>
<td>IV</td>
<td>Neck complaint and fracture or dislocation</td>
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be directed toward a treatment approach directed toward mechanisms and processes underlying the condition (Woolf and Decosterd, 1999; Jensen and Baron, 2003).

In keeping with this argument, chronic WAD have been shown to be characterized by disturbances in the motor and sensory systems as well as psychological distress. Motor system changes observed include reduced active cervical spine movements and altered patterns of muscle recruitment within the cervical spine and upper quadrant (Bono et al., 2000; Jull, 2000; Nederhand et al., 2000; Dall’Alba et al., 2001; Elert et al., 2001; Nederhand et al., 2002). Disturbances in postural control mechanisms such as deficits in kinaesthetic awareness, balance and eye movement control have also been identified (Alund et al., 1993; Tjell and Rosenhall 1998; Treleaven et al., 2003).

Other studies have demonstrated findings that suggest chronic whiplash subjects show alterations in the neurobiological processing of pain mechanisms most likely occurring within the central nervous system. Generalized hypersensitive responses both local (in the cervical spine) and remote to the site of injury have been demonstrated to a variety of stimuli including induced experimental pain (Koelbaek-Johansen et al., 1999), electro-cutaneous stimulation (Sheather-Reid and Cohen, 1998; Curatolo et al., 2001) and mechanical stimulation (Moog et al., 2002; Sterling et al., 2002). Perhaps not surprisingly, those with chronic WAD also show evidence of psychological distress, which has been proposed to occur as a consequence of persisting symptoms (Radanov et al., 1996; Peeters et al., 2001).

4. The development of physical and psychological impairments following whiplash injury

This improved understanding of chronic WAD began to demonstrate further inadequacies of the QTF classification system. That is, the QTF classification system takes no account of the presence of both physical and psychological impairments as outlined above. However improvement of the classification system can really only be made when there is greater understanding of these impairments in the acute stage of whiplash injury and their role in the transition to either recovery or symptom persistence. This will allow the classification system to be used for treatment decision making and prognostic indication.

In contrast to the explosion of knowledge of mechanisms involved in chronic WAD, features detected and documented in acute WAD were limited to the presence of decreased active range of neck movement and local mechanical hyperalgesia within the cervical spine (Gargan et al., 1997; Kasch et al., 2001a, b). Psychological responses appeared to be within normal ranges soon after the accident with the psychological distress seen later proposed to be as a consequence of ongoing pain and disability (Radanov et al., 1996; Gargan et al., 1997). In order to better understand the whiplash condition from the time of injury until the patient either recovered or developed persistent symptoms, a prospective longitudinal study was conducted in The Whiplash and Cervical Spine Research Unit, The University of Queensland. This study followed 76 whiplash patients from a few weeks after injury until six months post injury. It measured a wide range of physical and psychological factors (Sterling et al., 2003a–c, 2004).

The assessment of physical factors in this study included measures of motor function (range of neck movement, neck kinaesthetic awareness (joint position error—JPE) and cervical flexor muscle recruitment patterns during the cranio-cervical flexion test); sensory function (pressure, heat and cold pain thresholds) as well as sympathetic nervous system activity via the sympathetic vasoconstrictor response (SVR) (Schumann et al., 1999). The study also utilized questionnaires measuring psychological distress (GHQ-28, mental health components of the SF-36), the patient’s fear of movement due to the injury (Tampa scale of kinesophobia—TSK (Kori et al., 1990)) and acute posttraumatic stress as a consequence of the accident (Impact of Events Scale—IES (Horowitz et al., 1979)).

In order to investigate the differences in processes involved between those who recovered and those who reported persistent symptoms based on their status at 6 months post injury, the subjects were classified at this latter time point into one of three groups using the Neck Disability Index (NDI) (Vernon, 1996). The three groups were: those patients who fully recovered (38%), those with residual milder symptoms (39%) and those with persistent moderate/severe symptoms (23%) (Table 2). The groups were compared for differences on the physical and psychological measures.

The majority of the 76 participants (93.4%) who completed the study could be classified as WAD II, 2.4% were WAD I and 4.2% were WAD III as per the QTF classification (Spitzer et al., 1995). All of the WAD I participants were part of the group who recovered by 6 months and all WAD III participants were part of the group who continued to report moderate/severe symptoms (Table 2). All three groups contained participants who could be defined as WAD II.

It was not the aim of the study to investigate the effect of treatment. Subjects were free to pursue any form of treatment. The types and numbers of treatments received (including medication) were not different between the three whiplash groups.
5. Changes in motor function

Decreased cervical range of movement was present in all three whiplash groups within a month of injury. Range of movement improved within 2–3 months in those who recovered and those who continued to report milder symptoms at 6 months. In contrast loss of cervical range of movement persisted in those participants with persistent moderate/severe symptoms at 6 months post injury (Sterling et al., 2003b). (Fig. 1 depicts range of cervical extension throughout the study period. Other movement directions showed a similar picture). Whilst decreased cervical range of movement had been demonstrated previously in acute WAD (Kasch et al., 2001a), these authors reported that restoration of movement loss had occurred by three months post injury. However the recovered participants were not differentiated from those with persistent symptoms. It would appear that such differentiation is important.

Altered patterns of cervical muscle recruitment were also apparent in all whiplash groups within a month of injury. This was exemplified in this study by increased activity in the superficial neck flexor muscles at the lower stages of the cranio-cervical flexion test (Fig. 2) (Sterling et al., 2003b). Interestingly, the altered muscle recruitment patterns persisted to 6 months in all the whiplash patients, even in those patients who reported full recovery. Research into low back pain has also shown that some muscle changes persisted despite the patient reporting recovery and may be one factor involved in the high rate of symptom recurrence associated with this condition (Hides et al., 2001). Whether the whiplash patients who recovered in this study continue to demonstrate increased muscle activity past the 6-month period and whether this persistence of muscle dysfunction has any relationship to recurrence of pain at some later date requires further investigation and will be assessed at a 2 year follow-up.

In addition to altered patterns of cervical muscle recruitment, changes have also been demonstrated in the shoulder girdle muscles. Nederhand et al. (2003) showed reorganization of muscle activation patterns of the upper trapezius during functional tasks that occurred soon after injury and persisted to 24 weeks postinjury.

Kinaesthetic disturbances, in this case greater joint repositioning errors, also occurred soon after injury. Whilst differences were statistically significant only in those with moderate/severe symptoms, participants with less severe symptoms and those who recovered also tended toward higher joint repositioning errors when
compared to asymptomatic subjects (Sterling et al., 2003b). These kinaesthetic disturbances were present within a month of injury, showed no change over time and persisted until 6 months postinjury. These results support previous research where chronic WAD participants with a higher neck disability index (in this case the Northwick Park questionnaire) demonstrated greater JPE (Treleaven et al., 2003). Impaired postural control as manifested by greater errors in joint positioning may be one reason for the frequently reported symptoms of dizziness and unsteadiness reported by some with chronic WAD (Heikkila and Astrom, 1996; Treleaven et al., 2003). In keeping with this proposal, it is of interest to note that a much higher proportion (42%) of those with persistent moderate/severe symptoms reported dizziness or unsteadiness when compared to recovered participants (7%) and those with residual mild pain and disability (7%).

In summary, longitudinal data has demonstrated that whiplash injury induces disturbances in motor function that are present soon after the accident. While these motor disturbances are greater in those reporting greater levels of pain and disability, they are also apparent in those with lesser symptoms and even in those who recover from the injury. It has been suggested that beliefs about the fear of movement and/or reinjury play a role in the motor system changes seen in WAD (Nederhand et al., 2002). The motor changes seen in our study were shown to occur independently of such psychological factors and as such may represent alterations in underlying physiological processes as a consequence of pain and injury (Sterling et al., 2003b).

6. Development of sensory changes

In the acute stage of whiplash injury, local mechanical hyperalgesia (decreased pressure pain thresholds) has been shown to be present within the cervical spine irrespective of symptom intensity (Kasch et al., 2001b; Sterner et al., 2001; Sterling et al., 2003a). Local mechanical hyperalgesia tended to resolve over time (2–3 months) in those who recover or report continuing milder symptoms but persisted unchanged in whiplash patients reporting persistent symptoms of a moderate/severe nature (Sterling et al., 2003a).

More widespread sensory hypersensitivity is recognized as a feature of chronic WAD (Koelbaek-Johansen et al., 1999; Curatolo et al., 2001; Sterling et al., 2002). The existence of this phenomenon in the earlier stages of the condition has been disputed (Kasch et al., 2001b). It is now clear that this hypersensitivity, including widespread mechanical and thermal hyperalgesia as well as heightened responses to the Brachial Plexus Provocation Test (BPPT), is present soon after injury in whiplash patients who develop persistent moderate/severe symptoms (Fig. 3) (Sterling et al., 2003a). Furthermore such sensory changes persist unchanged into the chronic phase of the condition. Sensory hypersensitivity does not appear to be a feature of those with persistent milder symptoms or those who recover from the injury, at any stage of the condition (Sterling et al., 2003a).

The sub-group of whiplash patients who develop persistent moderate/severe symptoms showed additional changes in sensory function including cold hyperalgesia and, in some cases, altered peripheral vasoconstrictor responses indicative of sympathetic nervous system function. These findings suggest that a neuropathic component to these patients’ pain syndrome cannot be ruled out and this adds to the complexity of their condition (Sterling et al., 2003a).

It is recognized that measures of pain threshold responses may be influenced by the patients’ levels of psychological distress (Rhudy and Meagher, 2000). We were able to show that the sensory changes demonstrated in this study occurred independently of psychological distress and for this reason the presence of generalized sensory hypersensitivity may be explained

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Fig. 3. Cold and heat pain thresholds of the cervical spine, PPT of remote site (Tibialis Anterior) and elbow extension with BPPT in whiplash groups (recovered, mild pain and disability, moderate/severe pain and disability) at <1 month, 2, 3 and 6 months postinjury.
by the involvement of changes within central pain processing mechanisms (Sterling et al., 2003a).

7. Development of psychological changes

Psychological stress, affective disturbances, anxiety, depression and behavioural abnormalities have been found in patients with chronic WAD (Peebles et al., 2001; Wenzel et al., 2002). It is generally thought that the psychological distress seen in the chronic stage of the condition is most likely as a result of ongoing pain and disability (Radanov et al., 1995; Gargan et al., 1997). Whilst psychological factors are believed to play a role in the transition from acute to chronic spinal pain (Linton, 2000), this has not been well investigated in WAD.

Our recent longitudinal investigation of whiplash injury demonstrated that all whiplash groups displayed initial (within a month of injury) psychological distress to some extent. All whiplash patients, regardless of their recovery rate, showed lower scores on the mental health components of SF-36 when compared to Australian population norms and above or close to threshold scores on the GHQ-28 questionnaire (Sterling et al., 2003c). In addition the whiplash groups who reported persistent symptoms at 6 months (either milder or moderate/severe symptoms) also showed higher scores on the TSK indicating elevated fears of movement and reinjury. The psychological distress of those who eventually recovered by six months postinjury and those with lesser symptoms at this time point decreased to normal levels and appeared to parallel decreasing levels of pain and disability.

Psychological distress and elevated levels of fear of movement/reinjury continued in those with persistent moderate/severe symptoms but this group of patients also showed a unique psychological reaction. They could be distinguished from the other groups by the early presence of moderate levels of acute posttraumatic stress that did not resolve over the study period. This acute stress response was not a feature of whiplash participants with a better outcome or full recovery at 6 months.

8. A proposed new classification system for acute WAD

The findings of this prospective longitudinal study, that the continuum of WAD involves a complex array of physiological and psychological mechanisms, has revealed the limitation of the QTF’s symptom-based classification of the condition. The QTF’s WAD II classification essentially covers all patients who report neck pain following a motor vehicle crash and who show some physical impairment such as cervical movement loss and/or the presence of tender points (Spitzer et al., 1995). The results of this prospective longitudinal study demonstrated the heterogeneity of those individuals classifiable as WAD II (the majority of participants in this study) in terms of the varying extents of physical impairments. Furthermore, the QTF’s classification takes no account of psychological disturbances. It is apparent that psychological distress, especially acute posttraumatic stress reactions are important factors, particularly in those with persistent moderate/severe symptoms.

The outcome of the participants in this study who were classifiable as WAD II varied enormously, ranging from full recovery at 6 months post injury to reporting continued moderate/severe symptoms. This high variability in outcome within the same classification group would be an explanation for the poor predictive capacity of the QTF’s classification system (Kivioja et al., 1999; Hartling et al., 2001). Reclassification of WAD, particularly WAD II is urgent. This category should be reclassified based on measurable disturbances in motor, sensory and psychological function. A preliminary proposal for an alternative classification system built onto the QTF classification is outlined in Table 3.

9. Implications for the assessment of the whiplash injured patient

The presence of physical impairments and psychological disturbances was not uniform in all the whiplash participants and demonstrates the heterogeneity of WAD at both the acute and chronic stages of the condition. It is evident from the data that more in depth evaluation of both physical and psychological factors and potential underlying processes is required with examination of each individual whiplash injured patient’s condition.

Conventional clinical tests of the cervical spine such as manual palpation and visual inspection of range of movement lack reliability or validity (Fjellner et al., 1999; Smedmark et al., 2000). The clinical evaluation of pain syndromes (including neck pain and whiplash) currently involves the identification or diagnosis of the primary patho-anatomical structure that is considered responsible for producing the pain. Sensory examination such as that required to detect the sensory disturbances seen in this study is rarely performed and if it is performed is usually limited to rudimentary assessment of muscle power, deep tendon reflexes and light touch sensation. Similarly, examination of motor function is usually limited to a visual estimate of cervical range of movement. In the context of whiplash where patients often perceive scepticism directed toward their reported symptoms, identification of the anatomical structure involved might reassure both the clinician and the patient. However it does little to provide understanding
of the underlying processes involved in the perpetuation of symptoms that may be amenable to treatment.

Recent calls have been made to direct clinical examination toward the recognition and identification of mechanisms involved in the patient’s pain syndrome (Woolf and Decosterd, 1999; Max, 2000; Treede et al., 2002). It is apparent that the assessment of motor dysfunction in the whiplash injured patient will need to be extended to include assessment of cervical muscle recruitment patterns and kinaesthetic deficits. Clinically this can be achieved with specific muscle tests such as the cranio-cervical flexion test (Jull et al., 2003) (Fig. 4) and simple measures of joint repositioning error. Disturbances in activity of the upper trapezius muscle during functional tasks have also been demonstrated in acute WAD (Nederhand et al., 2003). This suggests that assessment of scapulo-cervical muscle function may also be useful. It is likely that other motor dysfunction will also be present following acute whiplash injury, such as: poor muscle control in posture, loss of muscle strength and endurance, balance disturbances and impaired eye movement control. Such motor and postural control impairments have been demonstrated in chronic WAD (Falla et al., 2004; Treleaven et al., 2004) and need to be investigated in the assessment of the acute whiplash patient.

More detailed assessment of sensory changes will also be necessary. The first stage of this assessment would be thorough recording of the patient’s symptoms including

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<th>Proposed classification grade</th>
<th>Proposed new classification system for acute whiplash associated disorders (WAD)</th>
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<tr>
<td>WAD 0</td>
<td>No complaint about neck pain</td>
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<td></td>
<td>No physical signs</td>
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<tr>
<td>WAD I</td>
<td>Neck complaint of pain, stiffness or tenderness only</td>
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<tr>
<td></td>
<td>No physical signs</td>
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<tr>
<td>WAD IIA</td>
<td>Neck pain</td>
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<tr>
<td>Motor Impairment</td>
<td>Decreased ROM</td>
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<td></td>
<td>Altered muscle recruitment patterns (CCFT)</td>
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<tr>
<td>Sensory Impairment</td>
<td>Local cervical mechanical hyperalgesia</td>
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<td>WAD IIB</td>
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<tr>
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<td>Altered muscle recruitment patterns (CCFT)</td>
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<td>Sensory Impairment</td>
<td>Local cervical mechanical hyperalgesia</td>
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<tr>
<td>Psychological Impairment</td>
<td>Elevated psychological distress (GHQ-28, TAMPA)</td>
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<tr>
<td>WAD II C</td>
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<tr>
<td>Motor Impairment</td>
<td>Decreased ROM</td>
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<td>Altered muscle recruitment patterns (CCFT)</td>
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<tr>
<td>Sensory Impairment</td>
<td>Local cervical mechanical hyperalgesia</td>
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<td></td>
<td>Generalised sensory hypersensitivity (mechanical, thermal, BPPT)</td>
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<td></td>
<td>Some may show SNS disturbances</td>
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<tr>
<td>Psychological Impairment</td>
<td>Psychological distress (GHQ-28, TAMPA)</td>
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<td></td>
<td>Elevated levels of acute posttraumatic stress (IES)</td>
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<td>WAD III</td>
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<td>Motor Impairment</td>
<td>Decreased ROM</td>
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<td>Altered muscle recruitment patterns (CCFT)</td>
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<tr>
<td>Sensory Impairment</td>
<td>Local cervical mechanical hyperalgesia</td>
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<td>Elevated levels of acute posttraumatic stress (IES)</td>
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<td>Neurological signs of conduction loss including:</td>
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<td>Muscle weakness</td>
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<td>Sensory deficits</td>
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<td>WAD IV</td>
<td>Fracture or dislocation</td>
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the nature of the pain. Although the usefulness of symptom classification as a way of clarifying pain mechanisms is debatable, it is a necessary part of the patient’s assessment (Jensen and Baron, 2003). Quantitative sensory testing can also be utilized. This could include the measurement of mechanical pain thresholds with pressure algometry (Fig. 5), determination of the presence of allodynia with light tactile stimulation. Thermal sensitivity can also be examined with thermorollers set at predetermined temperatures (Jensen and Baron, 2003). However, it should be noted that whilst such sensory assessments can provide useful information, at present there is no consensus about the most appropriate method to use and what to compare findings with (Jensen and Baron, 2003). The development of the most appropriate sensory examination of whiplash injured patients is at an early stage and moves toward further development into clinically valid and useful measures is of vital importance.

While the assessment of physical impairments has been emphasized, recognition of psychological impairments must not be overlooked. This would be best achieved using validated questionnaires that encompass a broad overview of psychological distress. The results of the longitudinal study demonstrated that the presence of an acute posttraumatic stress reaction plays an important role in the development of persistent symptoms following whiplash injury (Sterling et al., 2003c). Physiotherapists should be alert to the presence of psychological distress, particularly acute posttraumatic stress reaction and institute early psychological referral.

10. Implications for the early management of WAD

The results of this study have demonstrated that changes in motor function, sensory disturbance and psychological distress occur very soon after the occurrence of injury. In those patients who report moderate/severe pain and disability that fails to resolve, these early disturbances remain unchanged through transition to symptom persistence. This finding is particularly important for those whose symptoms fail to resolve as it suggests that the window of opportunity to provide specific impairment based treatments should occur early post injury. Although speculative at present, it has been suggested that expeditious treatment may help to prevent transition from acute pain into persistent pain (Cousins, 2002). The proposal of the prevention of chronic pain has thus far been mainly confined to behavioural approaches to management (Cousins, 2002; Ferrari, 2002). It is apparent from the findings of this study that its application should extend to include treatment directed toward disturbances of both motor and sensory impairments. Certainly, this approach is likely to be more beneficial than the current situation where ad hoc treatments are usually prescribed for WAD.

The knowledge of underlying processes in the acute stage of injury will not only benefit those whose moderate/severe symptoms are unlikely to resolve. Whiplash patients who continue to report residual mild symptoms show resolution of local sensory disturbances, cervical movement loss and psychological distress. However, some motor dysfunction remains in the form of altered patterns of movement with the cranio-cervical flexion test. It is likely that addressing these residual motor changes by a specific tailored exercise programme may facilitate these patients to full recovery. Although yet to investigated in WAD, the efficacy of such a programme has been demonstrated in idiopathic neck pain (Jull et al., 2002). In addition, the participants in our study who recovered fully also showed residual motor dysfunction. Whilst the significance of these persistent motor deficits in whiplash injured patients is unknown at this stage, findings from research of low back pain (Hides et al., 1996) would suggest that a recurrence of symptoms in these patients at some later date is possible. This suggests that the institution of early specific motor retraining may be optimal for these patients.
In contrast those persons with persistent moderate/severe symptoms showed a much more complex picture. Whilst these patients did indeed show similar persistent motor dysfunction, their clinical picture was complicated by the presence of widespread sensory hypersensitivity and acute posttraumatic stress reaction. These patients may be benefited more from an early multiprofessional approach to their management. Based on the findings of this study, such a treatment approach may need to involve physical rehabilitation, psychological support and pharmaceutical management. In view of the sensory disturbances seen in this whiplash group, it is apparent that any physical treatment performed be non pain provocative in nature. It is usually the norm that multiprofessional management of whiplash is not commenced until it is clear symptoms are not resolving, often up to months following injury. The physical and psychological changes that occurred following whiplash injury were apparent within a few weeks of injury. This would suggest that multiprofessional management must be commenced early (within weeks of injury) in those at risk of developing persistent pain and disability. In comparison, those who report residual mild symptoms did not demonstrate such extensive impairments. In this group, both local mechanical hyperalgasia and psychological distress resolved by 2–3 months postinjury. The only physical impairment seen to persist in this group was that of altered muscle recruitment patterns with the cranio-cervical flexion test. This implies that minimalist intervention comprising active exercise and specific rehabilitation of cervico-brachial control may be indicated for these patients.

11. Conclusion

Whiplash is a complex multifaceted disorder involving varying degrees of both physical and psychological disturbance. A new classification system has been proposed which reflects the complexity of the condition and is inclusive of identified specific impairments. As a consequence of differences in processes between recovered patients and those who develop chronic pain, treatments will vary according to the presence or not of specific physical and psychological impairments. Physiotherapists play a pivotal role in the comprehensive assessment of whiplash injured patients, providing appropriate interventions and in the liaison with other health professionals.

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