Temporomandibular Disorders, Headaches, and Neck Pain Following Motor Vehicle Accidents and the Effect of Litigation: Review of the Literature

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A literature review concerning the relationships between motor vehicle accidents and temporomandibular disorders, whiplash, headache, neck pain, and litigation was undertaken. The review shows that many patients recover or resume work prior to settlement, but most unsuccessfully treated patients do not generally recover following the settlement of legal claims; the postinjury problems are not strictly psychologic. Litigating patients and nonlitigating patients are often not dramatically different in most important regards (including pain and return to work), with litigating patients deserving the same treatment as other patients with chronic pain. It was found that postinjury neck symptoms and headaches can be persistent. Employment appears to be a better predictor of long-term outcome than compensation and litigation. In addition, limited consensus is available concerning prognostic factors. Patients with postinjury temporomandibular disorders tend to respond less well to treatment than do noninjury patients with temporomandibular disorders, as do litigating compared to nonlitigating temporomandibular disorders patients, but a cause and effect relationship is not known. The incidence of temporomandibular disorders following motor vehicle accidents may not be as high as has been claimed in whiplash cases. More research is required in the area of temporomandibular disorders, motor vehicle accidents, and litigation.

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Motor vehicle accidents (MVAs) are a common cause of head and neck injuries that potentially result in a multitude of symptoms that practitioners examining patients with orofacial pain problems need to recognize. These symptoms include temporomandibular disorders (TMD), headaches and neck pain, and possible psychologic and behavioral changes.[1] Many of these patients become involved in litigation following their injury. The issue of litigation and settlement, despite considerable research, remains controversial and unsettled with respect to the course and prognosis of symptoms following injury. The purpose of this study is to review the relevant literature to address the following questions: *(1)* What is the impact of litigation on the outcome of injury-related symptoms? *(2)* Are postinjury problems more likely to be primarily organic or psychologic in origin? *(3)* Are there differences

between postinjury patients who pursue litigation and those who do not? *(4)* What is the long-term course of postinjury symptoms? and *(5)* Are there known prognostic factors that can aid in predicting the course and outcome of postinjury symptoms?

Although the original intent of the present article was to review only the literature dealing specifically with TMD related to MVAs and litigation, it became clear that few studies have been published in the TMD literature dealing with these issues. Therefore, neck pain, whiplash, and headache, which also are frequently seen in patients with TMD following MVAs, have been included. In the present review, considerable research has been reported related to cervical pain, whiplash, and headache because these conditions have potential implications for the effect of litigation on TMD. It was also decided to include studies that date back many years for historic purposes and because some of these ideas are still used in legal arguments, whether or not they continue to be appropriate given the body of knowledge that has developed since those times. It was decided to use the terminology for the various conditions discussed in the individual studies as originally written in case of misinterpretations in converting to more modern terms. This review article has been organized to consider the aforementioned questions related to injury and litigation matters. Within each section, studies have been grouped together according to the type of article: ie, prospective, retrospective, literature review, and opinion/editorial. Comments made by the authors of the present study about the individual articles reviewed are identified as such; otherwise, the comments included are from the articles cited.

Attempts were made to include all pertinent articles (English language only, excluding abstracts and textbook chapters) that are related to TMD, whiplash injury, MVAs, and litigation found by Medline search (National Library of Medicine, Bethesda, MD) and by review of the references in these articles for consideration in this review.

Clinical Overview

Before reviewing the literature related to the aforementioned questions, a brief overview of TMD and whiplash is presented for background purposes.

A significant problem inherent in assessing the postMVA TMD literature is that over time, the definitions and classifications of head pain and TMD have changed. Recent efforts have resulted in standardized criteria for diagnosing and classifying TMD,[2] although much research is still needed before this or any other system is ready for general clinical use. The term *temporomandibular disorders* has been defined by Dworkin and Massoth[3] as a heterogeneous set of clinical conditions characterized by pain in the masticatory and related muscles of the head and neck, pain in the temporomandibular joint (TMJ) and associated hard and soft tissues, limitations in jaw function, and/or clicking and popping sounds in the TMJ. These authors considered TMD to be chronic pain conditions that share the major characteristics (including psychologic and behavioral parameters) of other common chronic pain conditions, notably headache and back pain.[3]

Burgess[4] has reported that the clinical presentation of patients with posttraumatic TMD can include complaints of pain in the TMJ, face, and ear regions, with radiation of the pain to the temple and neck areas. The onset of head and face pain was reported to occur for most patients within the first 48 hours of the accident. Diminished jaw opening and TMJ clicking could also be present, with the onset being mostly in the first month postMVA. Results of this study suggested that depression, anxiety, or somatization may be a presenting problem in some patients with posttraumatic TMD.[4]

Whiplash has also recently been reviewed and reassessed. Spitzer and coworkers[5] published the "Quebec Task Force on Whiplash-Associated Disorders." This work represents an extensive and critical literature review of whiplash-related topics, initially including 10,382 titles and abstracts, of which 1,204 studies met the authors' criteria for the preliminary screening, with 62 studies eventually being accepted as both relevant and scientifically meritorious. Whiplash was defined as an acceleration-deceleration mechanism of energy transfer to the neck that may result from rear-end or side-impact motor vehicle collisions but that can also occur during diving or other mishaps. Collision impact was thought to result in bony or soft tissue injuries (whiplash injury), which in turn may lead to a variety of clinical manifestations (whiplash-associated disorders [WAD]). The authors proposed a classification of WAD using a clinical-anatomic axis, as well as a time axis. In the clinical-anatomic axis, grade 0 was characterized by the absence of complaints about the neck and the absence of signs, either immediately or within a short time of the injury (ie, no disorder manifested). Grade I was used when there were general, nonspecific complaints or symptoms (eg, pain,

stiffness, or tenderness) about the neck without objective signs. Grade II was used when there were neck complaints plus signs limited to musculoskeletal structures (including decreased range of motion and point tenderness). Grade III was used when there were reports of neck complaints coupled with neurologic signs (including decreased or absent deep tendon reflexes, weakness, and sensory deficits). (Grades I to III were associated with soft tissue injury.) Grade IV was used when there were neck complaints plus spinal cord injury and bony tissue injury, such as fracture or dislocation. Symptoms and disorders that could manifest in all grades included deafness, dizziness, tinnitus, headache, memory loss, dysphagia, and TMJ pain/disorders. For the time axis, patients were classified within each grade as those lasting less than 4 days from the time of the injury, those lasting from 4 to 21 days from the date of injury, those lasting from 22 to 45 days, those lasting from 46 to 180 days, and those with durations of more than 6 months (ie, chronic).[5]

Spitzer et al[5] also reported that the annual population-based incidence of compensated whiplash injury in Quebec, Canada, in 1987 was 70 per 100,000 inhabitants, with the incidence rate being generally higher among females and people aged 20 to 24 years. They estimated that the overall incidence rate in Saskatchewan, Canada, may be as high as 700 per 100,000.[5] Barnsley et al,[6] in their extensive review, estimated the incidence of whiplash injury in western societies to be approximately 1 per 1,000. Their literature review[6] suggested that the average age at injury is in the fourth decade, with an even distribution between males and females. One other study[7] suggested that females experience whiplash injuries more often than males.

Teasell,[7] in another overview, used the term *whiplash* to refer to a sudden, forced hyperextension-flexion injury of the cervical spine that results in cervical soft tissue injuries referred to as *cervical sprain*, *soft tissue injury*, *flexion-extension injury*, and *acceleration-deceleration injury*. Barnsley and coworkers[6] defined *whiplash injury* as an injury to one or more elements of the cervical spine that arises from inertial forces being applied to the head in the course of an MVA resulting in the perception of neck pain. Teasell[7] stated that typically, the injured person is the occupant of a stationary vehicle that is struck from behind, although he proposed that injury can occur following side and head-on collisions. He speculated that injury results because the neck is unable to compensate adequately for the rapid head and torso movement resulting from the acceleration forces generated at the time of impact, and that when the physiologic limits of cervical structures are exceeded, anatomic disruption of the soft tissues of the neck (including muscles, ligaments, and joint capsules) occurs, producing a number of potential pathologic lesions.[7]

The clinical picture of cervical whiplash is generally dominated by head, neck, and upper thoracic pain and is often associated with a variety of poorly explained symptoms, such as dizziness, vertigo, tinnitus, or blurred vision. The symptom complex is remarkably consistent from patient to patient and is frequently complicated by anger, frustration, anxiety, depression, and pending litigation.[7] Other symptoms that have been associated with this type of whiplash include arm pain, paresthesias, weakness, dysphagia, lower back pain, TMD, concentration and memory disturbances, psychologic symptoms, and drug dependency.[6,7] As a result, marital and family disruption and loss of job and income may occur. Onset of symptoms several hours after impact was reported as characteristic of whiplash injuries. Many patients reportedly feel little or no pain for the first few minutes after the injury, with symptoms gradually intensifying over subsequent days. During the first few postinjury hours, findings on examination of "whiplash only" patients are generally minimal. It has been hypothesized that the delay in onset of symptoms may be a result of the time required for traumatic edema and hemorrhage to occur in injured soft tissues. After several hours, however, limitation of neck motion, tightness, muscle spasm and/or swelling, and tenderness of both anterior and posterior cervical structures may become apparent. As pain becomes chronic, subjective reports of symptoms may appear to be disproportionate to physical findings. Local tenderness and pain referred to sites distant from the original injury have been reported as two hallmark features of the whiplash syndrome. Two possible reported explanations for pain referral include myofascial pain and sclerotomal pain.[7]

Assessment of the Impact of Litigation: Complete Recovery After Litigation

There is controversy in the literature related to the effect of litigation on the outcome of treatment for accident- or injury-related problems. The concept of patients with pending litigation not getting better until the case is settled, and then recovering completely thereafter, is discussed in the following studies.

Prospective Studies

No prospective studies that were found discussed the concept of patients with pending litigation who did not get better until the case was settled, and then recovered completely.

Retrospective Studies

Miller[8] published two lectures in 1961 about *accident neurosis*. He described 200 consecutive head injury cases and also included a follow-up study of 50 patients (18 who had been involved in a traffic accident) in whom "gross neurotic symptoms after an accident had been found on examination."[8] The average age of these 50 patients was 42 years (ranging from 22 to 70), and 41 of them were males. In three cases, there was no physical injury whatsoever, while in 35, the injury was "trivial." Thirty-six of the 50 cases were said to exhibit the typical psychiatric picture of accident neurosis. Personal predisposition to neurosis was apparently evident in the previous histories of 15 of the 50 cases. Forty-two of the 50 had their cases settled by negotiation out of court, and in four, the claims were withdrawn or abandoned. The four remaining cases all went to trial, and in each instance, the claim for compensation was rejected. The average interval between settlement and reexamination was a little longer than 2 years. Only two of the patients had undergone psychiatric treatment for their "nervous symptoms." All but four of the 45 previously employed had returned to their own or similar work. Two of the 50 "unselected" patients with accident neurosis were still disabled by their psychiatric symptoms on reexamination 2 years after settlement; in three other cases, psychiatric symptoms persisted without occupational disablement (in each instance, similar symptoms had been present for many years before the accident). The author described *accident neurosis* as a syndrome with clinical features that include an inverse relation to the severity of the provoking injury; an unexpectedly inconstant correlation with neurotic predisposition; scanty objective signs of emotional disturbance; a differential social incidence; and an absolute failure to respond to therapy until the compensation issue was settled, after which nearly all the cases described recovered completely without treatment. He claimed that the evidence presented was based on personal experience of about 4,000 patients examined for medicolegal assessment after accidents during a dozen years of consultant practice (no formal statistical analyses were included).[8] This assessment of the effect of settlement has been questioned by several authors since publication of this study; nevertheless, this point of view is frequently raised during litigation.

Parker[9] reported on 100 cases of accident neurosis referred by solicitors; patients with the slightest suggestion of brain damage and those with whiplash injuries were excluded, as were all cases in which simulation (ie, malingering) was considered an important complicating factor. The control group comprised patients who had been involved in accidents and who had not been compensated. The author found a greater number of immigrants among the litigants, and preaccident obsessional traits were more commonly found than preaccident neurosis. Parker[9] believed that many patients with an accident neurosis seemed to need to keep on working after an accident, and if unable, they would "go to pieces." In addition, he wrote: "Time and again one sees the new Australian hobbling around on a walking stick long after his leg injury has completely healed; indeed he throws away his prop only after the litigation has been settled" (no formal statistical analyses were included).[9]

Berry[10] described a series of 50 consecutive patients with whiplash who were examined from a neurologic and a psychiatric point of view. Nine patients had suffered a head blow without concussion. Results of the neurologic examinations were negative in 34 of the patients, and results of cervical radiographs were negative in 31 of the 50 patients. Twenty-nine of the patients had some form of anxiety, and eight patients received a "negative" psychiatric diagnosis. The diagnosis of malingering was rarely made, although exaggeration and undue concern over trivial symptoms were believed to be significant in many patients. Berry[10] believed that the clinical picture of the chronic whiplash syndrome noted was essentially identical to that of chronic neurosis and that this condition usually subsided after medicolegal settlement. He stated that lasting cervical symptoms were unlikely after rear-end accidents without head or neck blows and without severe damage to the car, and that an early settlement of the accident claim should be urged, especially when the motivation for financial gain or invalidism is strong (no formal statistical analyses were included).[10]

Balla[11] described a *late whiplash syndrome*, which was defined as a collection of symptoms and disabilities presenting more than 6 months after a neck injury occurring in an MVA, usually a rear-end collision. He reported, with no corroborating evidence, that the physical symptoms and associated problems of most patients settle over a matter of weeks, but sometimes chronic symptoms

of other patients persist for 6 months and much longer. Since litigation was noted to be frequently involved, he suggested that exaggerated complaints of pain and injury may have occasionally been made to secure financial gain.[11] Balla also reported on 300 consecutive patients with late whiplash syndrome in Australia who were previously detailed[12] and compared them to "controls." In addition, 20 patients with acute whiplash injury in Singapore were reviewed more than 2 years after the diagnosis was made, and no cases of late onset of symptoms were observed. The author thought that the late whiplash syndrome is a culturally constructed illness behavior (some statistics were included, but many of the conclusions did not seem to be supported by the statistics shown).[11]

Mills and Horne[13] compared the incidence of whiplash injury between New Zealand and Victoria, Australia, two areas with distinctly different legal systems for injury compensation. A statistically significantly greater number of whiplash injuries in Victoria was found when comparing the number of people with whiplash injuries with the total number of injuries and with the total population. In addition, a statistically significantly greater number of rear-end collisions occurred in Victoria. The ratio of the number of rear-end collisions reported in Victoria compared to the number of whiplash injuries was 1:1.94, in contrast to lower values in New Zealand (1:0.78). It was concluded that the striking difference in the incidence of whiplash injury in the two study groups indicated that litigation and the expectation of financial compensation can have an influence on development of whiplash symptoms.[13]

Literature Review

No literature reviews that were found discussed the controversy related to the effect of litigation on the outcome of treatment for accident- or injury-related problems.

Opinion/Editorial

In 1946, Kennedy wrote a statement that has often been quoted in relation to litigation: "A compensation neurosis is a state of mind, born out of fear, kept alive by avarice, stimulated by lawyers, and cured by a verdict."[14]

Field[15] stated in a letter to the editor that "post-traumatic syndrome" (PTS) occurred in subjects who had never had a head injury, and that following settlement, the previously intractable complaints of patients with PTS apparently no longer required his therapeutic efforts, because the patients disappeared from his outpatient clinics. Field[16] also presumed, in another letter to the editor, that a reasonable explanation for persistent subjective complaints following a trivial injury was the concern and anxiety that may arise as a reflection of the subject's role as a litigant, including beliefs that the greater the suffering, the greater would be the damages.

Assessment of the Impact of Litigation: Litigating Patients Who Do Not Recover

The concept of litigating patients not getting better even after the case is settled is addressed in the following studies.

Prospective Studies

Norris and Watt[17] assessed 61 patients who presented in an orthopedic clinic after rear-end motor vehicle collisions. The patients were divided into three groups: one complaining of symptoms related to their injuries, but with no abnormality on physical examination (n = 27); a second group who, in addition to symptoms, had a reduced range of movement of the cervical spine but no abnormal neurologic signs (n = 24); and a third group with symptoms, a reduced range of cervical movement, and objective neurologic loss (n = 10). The patients who claimed compensation (group 1, n = 15; group 2, n = 16; group 3, n = 10) were followed-up to assess the influence of their claims on the prognosis. Analysis revealed no statistical difference between the three groups in improvement of symptoms after settlement, with one half to about two thirds of patients in all groups reporting no change after settlement, and one quarter in the third group considered worse after settlement. The authors suggested that litigation per se had little influence on symptoms.[17]

Fee and Rutherford[18] reviewed 44 consecutive patients with concussion for whom a medicolegal report had been written and who were reassessed 3 to 4 years after their accidents (22 were involved in traffic accidents, with three cases still pending at the end of the study). These patients were compared to 145 patients admitted with minor head injuries to the observation ward of the same hospital. Fifty-seven percent in the litigation series were reported to have complained of symptoms when the medicolegal reports were written (mean interval from accident 12.9 months), 39% had symptoms at the time of settlement (mean interval 22.1 months), and 34% had symptoms 1 year later.

Fifty-one percent of the general series had symptoms 6 weeks after the accident, and 14.5% had symptoms at 1 year. The authors suggested, based on statistical analyses, that litigation itself is a factor in the persistence of symptoms and that this effect continues after legal settlement has been reached.[18]

Retrospective Studies

Packard[19] interviewed 50 patients diagnosed as having permanent posttraumatic headache who had settled claims at least 1 year previously (average time from settlement to interview 23 months). Forty-six of the 50 had been in automobile accidents. All patients reported persistent headaches 1 year or more following legal settlement, and improvement in headaches was reported by only four patients (no formal statistical analyses were included).[19]

Parmar and Raymakers[20] studied 100 patients (of a potential 144 patients who could have received a letter of invitation to be reviewed) who sustained neck injury in rear-impact MVAs. They were seen for clinical and radiologic review a mean of 8 years after injury. Detailed medicolegal reports from the early years were available on all patients and used to supplement the information obtained at review. Fifty percent of the patients reported significant pain at 8 months, which decreased to 22% at 2 years and 18% at 3 years. At review, 14% continued to have significant pain. Ninety-one patients had successfully completed legal action at the time of review. Of these, 58 were free of pain when their case was settled. Of the remaining 33, there was some improvement in the severity of pain within a few weeks in four patients, and within 3 months in an additional seven. Overall, there was a mean interval of 72 weeks between settlement and improvement by even one pain grade (on a four-point scale) in the 33 patients. The authors suggested (with no formal statistical analyses included) that for some patients, the timing of compensation was not associated with improvement in symptoms.[20]

Maimaris and coworkers[21] reported the results of a retrospective study of 102 patients with whiplash injuries at approximately 2 years postinjury. Thirty-five patients in this sampled cohort continued to exhibit symptoms. Fifty-seven percent of symptomatic patients and 18% of asymptomatic patients had filed insurance claims. One half of the symptomatic patients who made insurance claims had their claims settled an average of nine months after the accident; the remainder had not settled their claims. The authors suggested (with no formal statistical analyses included) that "litigation" does not influence the natural progression of symptoms.[21]

Tarsh and Royston[22] conducted a follow-up study of 35 patients with "accident neurosis" (derived from a group of 50) who were seen for psychiatric assessment. All patients had severe somatic symptoms, without an adequate basis in physical pathology. However, return to work was found to be unusual, and complete recovery was rare. Most cases demonstrated continuing and often severe symptoms at follow-up, with reported improvement being unrelated to the time of compensation. The authors suggested that about one third of the group was expected to suffer continuing disability and that lack of improvement after compensation did not support the view that many of these people were malingering for financial gain (no formal statistical analyses were included).[22]

Merskey and Woodforde[23] reviewed 27 patients reporting minor head injury (unconscious less than 1 hour) for whom compensation was not relevant, either because the patients had not been in the position to make a claim (n = 10) or because a claim had been settled (n = 17), and who were seen primarily for psychiatric advice. In those with a previously settled claim, symptoms (eg, headache, dizziness, poor memory, depressed mood, phobias, and anxiety) persisted for a median period of 1 year, with many still receiving treatment. At follow-up, 10 showed little or no improvement, eight were moderately improved, and nine were much improved or recovered. The proportions improved were similar in the "compensation not sought" and "compensation paid" groups. The authors considered that in many instances the "postconcussional" syndrome may have an organic basis without neurologic signs or psychometric changes (no formal statistical analyses were included).[23]

Macnab[24] followed 145 of 266 "whiplash" patients for whom all legal action had been completed 2 or more years previously. Symptoms were found to continue in 45% (121 of 266) of the subjects, with the author noting that this group, consisting of patients referred for specialist opinion because of the severity or persistence of symptoms, had more severe disabilities (no formal statistical analyses were included).[24]

Balla and Moraitis[25] assessed 82 patients who suffered back or neck injuries in industrial or traffic (n = 23) accidents and whose legal problems had been settled at the time of the review. The time from accident to legal settlement was never less than 1 year, and the time from settlement to

review was greater than 2 years for more than half of the patients. In this study cohort, 40 patients reported they returned to work before settlement, 11 patients reported they returned after settlement, and 31 patients reported they never returned to work. In the latter patients, symptoms were noted to persist relatively unchanged for considerable periods of time. The authors reported the correlation between early settlement and return to work as "not high"; however, no formal statistical analyses were provided.[25]

Culpan and Taylor[26] evaluated people involved in road traffic (n = 41) and industrial (n = 30) injuries who were referred by solicitors for a medical evaluation of postinjury psychiatric symptoms (attempts were made to follow-up 82 subjects). Seventy-eight percent of the victims were reported to have developed psychiatric symptoms within 2.5 months of injury, none after a year. Most (47 of 63) of the subjects reported return to work during the first year after their injury, but the majority did not resume the same job and suffered a decline in income. At the end of the study, only four of the original working group had not resumed work. About half of the total sample showed a tendency towards progressive improvement with time, but 37 subjects for whom there appeared to be a significant compensation factor did not improve over a period of months or years, and their symptoms became more severe at the climax of the litigation. At follow-up, 6% of the original group was considered to be malingering or inflicting injuries on themselves to simulate illness. Twenty-three percent of the total group had recovered completely from psychiatric disability before their claims were settled, 14% recovered completely following settlement, 40% were improving when last seen by their lawyers (usually at the time settlement monies were paid), and 21% remained disabled. They did not find that virtually all sufferers from postaccident neurosis were motivated by financial factors or that the condition was virtually indistinguishable from malingering. The authors recommended that psychiatric referral be made early in cases in which it appears that a discrepancy exists between the severity of complaints and the physical findings, and that settlement should be made as quickly as possible once compensation neurosis is diagnosed as a factor in the subject's continuing ill health. Following this, a good prognosis may be anticipated (no formal statistical analyses were included).[26]

Gay and Abbott[27] followed 50 patients who suffered a whiplash injury of the neck during a 4-year period. Persons who received a direct blow on the head or neck were excluded. Many of these patients experienced pain radiating from the posterior neck to the mandible. The authors included the following statement (based on no formal statistical analyses): "In some patients, the aggravation of legal action was considered important, but, even after settlement, these patients were often partially disabled by recurrent nervous symptoms."[27]

Schutt and Dohan[28] studied neck injuries in females following automobile accidents. As part of their study, they followed 74 hourly employees from 6 to 26 months after their MVA-related neck injury. All patients had 7 or more days of postMVA disability. Seventy-four percent (32 of 43) of those with litigation pending continued to have symptoms, compared to 71% (five of seven) in the settled group and 82% (14 of 17) in the "no suit" group (eight of these 17 received some reimbursement from the company insuring the owner of the other car). The authors believed that their data did not show that the symptoms of whiplash injury were commonly the result of malingering or secondary gain related to financial settlement (no formal statistical analyses were included).[28]

Kelly and Smith[29] assessed outcome in PTS by attempting to trace 100 patients already seen and documented as having PTS. Fifty-one were located, and information was obtained from 43 patients. The authors reported that patients suffering from PTS recovered and returned to full-time work before litigation was settled (16 of 43; 37%). They concluded that failure to have returned to work by the time of settlement indicated a bad prognosis because such patients rarely returned to work later (22 of 26; 85%). In addition, they stated that the older the patient, the worse the prognosis (no formal statistical analyses were included).[29]

Literature Review

Mendelson[30] published a review on the effect of legal settlement on compensation claimants. He concluded that the literature did not support the idea that patients become symptom free and resume work within months of the finalization of their claims. He noted that up to 75% of those injured in compensable accidents failed to return to gainful employment 2 years after legal settlement.[30] In another monograph, Mendelson reviewed 18 follow-up studies of personal injury litigants with heterogeneous problems.[31] He reported that in three of the assessed studies, claimants improved "within a fairly short time" of the finalization of their claims. In the remaining 15 studies, patients did not invariably become symptom free and return

to work after finalization of their claim; nine of the studies indicated that in patients with head injury, between 50% and 85% failed to return to work after settlement. He reported that patients with neck injuries appeared to have persistent disability of a severe degree in 12% to 60% of the cases 5 years after injury.[31]

Shapiro and Roth[32] wrote an extensive review of the effect of litigation on the recovery from whiplash injury. They reported that the majority of evidence suggested that litigation does not hamper patient treatment response. They also concluded from their analysis of retrospective studies that there was little evidence to support the thesis that settlement of litigation leads to resolution of whiplash-related symptomatology[8] and speculated that studies suggesting such a relationship were methodologically flawed. Based on their review, Shapiro and Roth[32] concluded that a significant proportion of patients with whiplash recover before their litigation is settled, and that settlement of litigation may not be associated with resolution of disability for a large number of patients. They claimed to have located only three studies that they thought were prospective (one was actually retrospective according to its title) and that adequately assessed the influence of litigation on recovery from whiplash and, on the basis of their evaluation, stated that there was no relationship between legal settlement and resolution of symptoms.[32]

Barnsley and colleagues[6] reviewed more than one dozen articles in the section of their review article titled "Litigation neurosis" and concluded that there was no real evidence that malingering for financial gain contributes to the natural history of whiplash injury. They stated that the majority of whiplash injuries result in real, organic lesions in genuine patients.[6]

Weighill[33] reviewed the literature dealing with "compensation neurosis." He concluded that there was little evidence of a link between compensation neurosis and degree of injury, although the degree was often minor. He noted that "gross dramatization" of symptoms occurred in many cases, but objective signs of distress were usually absent. Evidence for the relevance of pre-existing neurotic difficulties was termed *conflicting*. He reported that return to work appeared to be delayed in compensation cases, with this not always a result of compensation factors. Time to settle the claim was reported to possibly be relevant, with lengthier absence being related to longer delays in settlement. It was concluded that there was little evidence to suggest that problems resolve on settlement of legal action. The usefulness of assessing recovery in terms of return to work, rather than in terms of absence of symptoms, was also questioned.[33]

Evans,[34] from his review of whiplash injuries, stated that the end of litigation does not signal the end of symptoms for many patients, and the patients who exaggerate or malinger are in a distinct minority. He indicated that the length of time from the injury until settlement of litigation can be important; patients who settle the litigation within 1 year of the injury may have less significant injuries and may recover sooner than those who settle later and have persistent complaints. The author also noted that a prolonged period of pending litigation may encourage exaggeration of symptoms and unnecessary treatment.[34]

Elkind[35] reviewed headache and facial pain associated with head injury. He noted that accident neurosis and labeling patients' status as suggesting that litigation effects the clinical presentation is not helpful in establishing a diagnosis. He reported that organic changes of a small degree may result in the symptoms of post-head-trauma syndrome, and may be enough to produce a disabling illness. In this review, the persistence of symptoms was not found to be related to legal outcomes with financial settlements. A small percentage of patients was reported to have persistent symptoms after injury.[35]

Spitzer and coworkers[5] concluded from their literature review that studies addressing the influence of financial compensation and legal action on the prognosis of WAD were flawed by substantial patient selection and information biases. The association between compensation and legal action with outcome in whiplash injury, in their opinion, remained to be demonstrated.[5]

Opinion/Editorial

Mendelson,[36] in the introduction to a prospective study, described two diametrically opposing views in the literature related to personal injury litigants. One was based on the report of Miller,[8] suggesting that litigants improve after finalizing their claims, no matter what the outcome, and return to their previous lifestyle and gainful employment. The other was based on multiple studies conducted during the 20 years preceding his study. It was concluded that between 35% and 75% of litigants following a compensable injury in these studies failed to improve and failed to return to work following settlement of their claim.[36] Mendelson[37] also published an editorial in which he stated that

there were no published reports to confirm Miller's findings,[8] but that the finding that patients continue to experience symptoms and require treatment following the finalization of litigation was supported by several studies.[37]

Merskey[38] published an editorial in which doubt was cast on Miller's hypothesis.[8] He cited studies published since 1968 that found that at least some patients continued to have problems after settlement. He concluded that the assertion that all patients recover when the legal proceedings are over is false.[38]

Hodge[39] published an opinion on "whiplash neurosis" in which he described a variety of psychologic problems, including anxiety and hostility, that developed following whiplash injuries. He believed that the whiplash injury may represent a psychophysiologic reaction to a specific stressful situation. According to Hodge, it had often been said that people are not "cured" of their whiplash injuries until financial remuneration is received, but he stated that this is a simple and often erroneous explanation because there are many other secondary gains to illness. He also emphasized that rapid financial settlement almost invariably helps to minimize the development and/or severity of the secondary gains.[39]

Cohen[40] suggested that although the precise effect of litigation on posttraumatic stress disorder remained unclear, there was little evidence that the majority of claimants are malingerers, or that recovery is inevitable once litigation is settled.

Organic Versus Nonorganic Basis

There is continuing controversy in the literature regarding the physical and psychologic nature of postinjury problems and complaints.

Prospective/Experimental Studies

Pettersson and colleagues[41] studied 39 consecutive patients with whiplash injury following car accidents. Those with a head injury, loss of consciousness, fracture or dislocation of the cervical spine, or a previous history of neck injury or neck pain were excluded. The patients were initially examined at the emergency department by an orthopedic surgeon, and "acute" radiographs were obtained. A neurologic examination was performed on the same day as magnetic resonance imaging (MRI) studies, without knowledge of the MRI findings. The MR imaging, performed a mean of 11 days (range 4 to 15 days) after the injury, was reviewed by two radiologists without any knowledge of the patients' symptoms or clinical findings. Twenty-six patients showed changes on MRI; 25 had disk lesions of the cervical spine and one had a cervical muscle lesion. Twenty-nine cases had neurologic deficits, mostly sensibility disturbances. Despite many pathologic findings on MRI, the authors reported the absence of a relationship between these lesions and the neurologic deficit in the acute phase, and they felt that their study did not demonstrate significant soft tissue lesions that explained the symptoms and physical findings (no formal statistical analyses were included).[41]

Ommaya and coworkers[42] produced experimental whiplash injuries in 41 rhesus monkeys. They demonstrated that cerebral concussion, as well as gross hemorrhages and contusions over the surface of the brain and upper cervical cord, could be produced by rotational displacement of the head on the neck alone, without significant direct head impact. They suggested that whiplash injury may be of importance in producing the effects of closed-head injuries under conditions when the head is free to move.[42]

Retrospective Studies/Case Histories

Balla and Moraitis[25] (see "Assessment of the Impact of Litigation: Litigating Patients Who Do Not Recover" above) believed that the group of symptoms seen in their patients with postaccident back or neck injury (ie, headaches, giddiness, irritability, insomnia, loss of libido) had a psychogenic basis and were related to anxiety and depression. However, they also felt that organic pain was present in some patients, and that early mobilization and specific measures to increase mobility could prevent many of the subsequent problems.[25]

Ommaya and Yarnell[43] published case histories of two patients with subdural hematomas apparently caused by whiplash injury alone. They also suggested that rotation of the head was the common denominator to the cerebral trauma of both head injury and whiplash injury.[43]

Literature Review

Barnsley et al[6] described various pathologic changes following whiplash injury, including injuries to the zygapophysial joints, the intervertebral disks, and the upper cervical ligaments. Injuries to the TMJ from whiplash were mentioned as being suspected and reported, but their opinion was that the evidence was divided and that a causative link to whiplash had yet to be demonstrated.[6]

Shapiro and Roth[32] cited studies that suggested the possibility of physical damage in whiplash patients. They stated that they could find no evidence to support a revision of the theory of compensation neurosis, which proposes that although symptoms do not necessarily resolve after litigation, their persistence reflects a psychogenic problem. Regarding psychogenic factors, they concluded that patients with chronic whiplash pain often suffer two injuries: physical trauma to the neck and psychologic trauma. They also concluded that it is erroneous to ascribe etiologic significance to neurotic symptoms. Furthermore, attributing nonresolution of symptoms to emotional distress confuses cause and effect and is equivalent to blaming the victim, which, they further proposed, may promote the development of posttraumatic stress disorder. A systems model viewing the impact of litigation on return to work as a function of patients' expectations of their ability to achieve preinjury work status despite residual pain was hypothesized. They postulated that this expectation is influenced by a host of variables, including the degree of pain and disability, psychosocial and ergonomic workplace factors, family and treatment variables, personality, socioeconomic conditions, and the stress associated with adversarial litigation; the authors suggested that the stress of prolonged litigation can affect underlying physiologic mechanisms of pain, thereby increasing nociception and/or increasing the affective dimension of pain perception. Based on this, they proposed that litigation may affect return to work in a subset of patients.[32]

Mendelson[30] (see "Assessment of the Impact of Litigation: Litigating Patients Who Do Not Recover" above) suggested that a proportion of patients with acceleration/deceleration injuries of the cervical spine have organic disorders.

Opinion/Editorial

Guthkelch[44] stated that most patients with PTS (perhaps better called *postconcussional* or *postcontusional symptoms* according to the author) have organic problems, but a small minority are malingerers.

Litigants Versus Nonlitigants

A number of studies have attempted to assess whether patients pursuing litigation are different in any way from those not filing claims following whiplash injury.

Prospective Studies

Pennie and Agambar[45] reviewed 144 patients with whiplash injuries followed-up at two emergency departments until discharge or traced at 5 months from presentation (seven others were not able to be followed for the entire study period). They reported that 15.5% (18 of 116) of those claiming and 7.1% (two of 28) of those not claiming failed to recover by the end of the 5-month study period. No statistically significant difference in recovery between claimants and nonclaimants was demonstrated and claimants did not take longer to recover.[45]

Lee et al[46] studied psychologic state, response to pain, and style of interpreting everyday experiences in 32 female patients who had suffered a whiplash injury 1 to 84 months (mean period 18.5 months) prior to assessment. Subjects were compared with 15 age- and sex-matched patients without a history of chronic pain seen in a general practice. Twenty-three of the 32 patients were involved in litigation and suffered from pain for longer than the nonlitigants, were more depressed, and rated their whiplash injury pain more highly on the sensory and affective dimensions of the McGill Pain Questionnaire. Anxiety, cognitive errors, and the response to cold pressor pain were not found to be related to litigation. The authors suggested, based on statistical analyses, that whiplash injury sufferers were more anxious and depressed than control subjects, and that their psychologic distress may have been aggravated by litigation.[46]

Olsnes[47] examined 34 MVA-related whiplash patients with "chronic symptoms" 6 to 18 months after injury and compared them to 21 nonhospitalized patients with chronic neck and arm pain that kept them out of work for "some months," but who had no history of trauma. All of the whiplash subjects were evaluated with neuropsychologic examinations because of long-lasting symptoms. At the time of the examination, all patients were claiming financial compensation. The whiplash group had statistically significantly worse results compared to the control subjects on only four of 48 neuropsychologic test variables. Thirty-two of 34 whiplash patients mentioned somatic symptoms, such as neck pain and/or headache, as their main problem. Collectively, the results were interpreted as suggesting that whiplash patients with persistent symptoms were not significantly impaired on neuropsychologic testing as compared with control patients with chronic pain that was not the result of injury. The author suggested that the results did not constitute evidence for brain

damage as a cause of whiplash symptoms but also did not unequivocally exclude this possibility.[47]

Melzack et al[48] studied 145 patients suffering from chronic lower back pain (27 on compensation, 54 not) or musculoskeletal pain (15 on compensation, 49 not). Compared with noncompensation patients, compensation patients usually sought the opinion of fewer consultants and rated the overall intensity of their pain as less severe. The authors, based on statistical analyses, detailed several conclusions from their study: that patients on compensation did not exaggerate their pain compared to patients without compensation; that compensation was not a cause of pain, but was one of multiple factors that may affect pain; that the financial security provided by compensation may decrease anxiety; and that compensation patients did not appear to differ from people who did not receive compensation in regard to pain scores, pain descriptor patterns, or emotional disturbance.[48]

Tait and coworkers[49] examined the initial symptoms of patients with chronic pain who were (n = 70) or were not (n = 52) involved in some aspect of the compensation system (and they statistically analyzed the data). Compensation patients were found to be younger and less likely to be female, and tended to report fewer surgeries, shorter pain duration, and more vocational and sexual disability. In addition, they perceived their medical conditions to be more severe than had been diagnosed by physicians. The authors felt that the groups did not seem to differ in severity of pain or psychologic distress. They speculated that compensation patients were not "symptom magnifiers," although they noted that the data indicated that lifestyle changes reported by these patients may be greater than those reported by patients not involved in compensation.[49]

Carron and coworkers,[50] using self-report questionnaires prior to treatment and 1 year later, compared (using statistical analyses) chronic lower back pain patients seen in comparable clinics and undergoing comparable outpatient treatment programs in the United States (with an adversarial system) and New Zealand (with an entitlement system leaving no litigious aspect to recovery from pain or disability). A total of 198 US patients were initially compared to 115 New Zealand patients, with 117 US and 59 New Zealand patients compared at follow-up. They reported that patients demonstrated nearly similar reports of pain frequency and intensity, but the US patients, at both pretesting and posttesting, reported greater emotional and behavioral disruption as a correlate of their pain. The US patients consistently used more medication, experienced more dysphoric mood states, and were more hampered in daily functioning. Patients from both countries demonstrated a nearly equal degree of preimprovement to postimprovement (39% of the US and 45% of the New Zealand patients reported improving at least "somewhat"). The relative initial differences favoring the New Zealanders were observed to remain constant during the study. At the onset of treatment, 49% of the US sample and only 17% of the New Zealand patients were receiving pain-related financial compensation. At follow-up, patients from both countries receiving pretreatment compensation were less likely to report a return to full activity, although the relationship appeared more pronounced in US patients.[50]

Mendelson[36] compared (using statistical analyses) 47 patients with chronic lower back pain who were involved in personal injury litigation with 33 patients also complaining of lower back pain who were not seeking compensation. The author stated that personal injury litigants did not describe their pain as more severe than nonlitigants, and both groups showed similar levels of psychologic disturbance.[36]

Retrospective Studies

McKinlay and coworkers[51] compared two groups, each with 21 patients with severe, blunt head injury (from a possible total of 55 patients). In one group, patients were pursuing claims for financial compensation, and in the other group they were not (in the remaining 13 cases, there was doubt as to whether they had sufficient evidence to pursue a claim). Patients were assessed on cognitive tests, with both patients and family members interviewed at 3, 6, and 12 months after injury. Although claimants were significantly younger than nonclaimants, few differences were found initially between claimants and nonclaimants. Postconcussional symptoms were found to be common in both groups, cognitive performance was equal, and reports given by relatives of changes in the patients were very similar. No statistically significant association between claiming compensation and return to work was found. The authors claimed that the findings showed that claimants did not make efforts to present as more disabled than they were. However, reports given by patients differed over time, with claimants reporting slightly more symptoms than nonclaimants at 3- and 12-month follow-up ($P < .05$).[51]

Solomon and Tunks[52] collected data in a structured telephone interview for a litigant group of 80 patients and a nonlitigant group of 47 patients, all

of whom had primary complaints of musculoskeletal pain (from a possible 159 patients; 19 refused and 13 could not be interviewed). Litigants were found to have a shorter mean pain duration than nonlitigants. Litigation was found to be the primary predictor of Zung depression scores, but it was not found to be the primary predictor of downtime or medication use and was not the most important variable in distinguishing between those working and those not working, although it did appear to contribute to the equation in discriminant function analysis. The authors concluded that the suspicion and disbelief with which litigating patients are often treated is unfounded, and that the practice of refusing to treat patients with chronic pain until litigation is settled may not be wise, since the delay could worsen the patients' prognosis.[52]

Moldofsky and coworkers[53] studied 24 patients with chronic postaccident pain, and all except one was diagnosed with fibromyalgia. For eight patients, litigation was resolved; for 16 patients, medicolegal claims were unresolved. Patients from the resolved group were older, had a longer duration of symptoms, and had poorer occupational adjustment than those with outstanding litigation. Significant differences were not found in symptom report, clinical features, or physiologic measures (eg, sleep and arousal measures) of fibromyalgia.[53]

Guest and Drummond[54] assessed patients with lower back pain of at least 12 months' duration for emotional state, pain, and disability; 19 were receiving regular compensation payments and 18 others had settled their claim (34 other potential subjects chose not to attend for various reasons). Compensation recipients demonstrated statistically significantly more signs of emotional distress and greater difficulty coping with pain, and they reported that pain disrupted their life to a greater degree than for subjects who had settled their claim. However, the authors noted that even after settlement, there was clear evidence of emotional distress. Despite this, they stated that: "The promise of a financial windfall on settlement of a claim could discourage workers from resuming employment after injury. Unfortunately, this course of action increases the risk of pain becoming chronic and of unemployment and financial hardship continuing after settlement."[54] To prevent this, they argued that individuals should be encouraged to resume some type of employment as soon as possible after injury.[54]

Literature Review

Evans,[55] following an extensive review of the postconcussion syndrome, concluded that patients with compensation claims were similar to those without. Patients applying for compensation were reported to not have increased symptoms. The author speculated that the end of litigation did not indicate an end of symptoms or return to work for many claimants.[55]

Shapiro and Roth,[32] in their review, found no consistent differences between litigant or compensated patients and control subjects with no financial incentive from a number of different perspectives, including resolution of symptoms following settlement.

Opinion/Editorial

Beals[56] reviewed literature on workers' compensation and recovery from back injury and suggested that patients receiving compensation tend to receive more treatment, respond less well to treatment, and have greater residual disability than do noncompensated patients.

Residual Neck Symptoms

As has been previously mentioned, many patients continue to have symptoms following settlement of claims. The persistence of neck symptoms following injury is reported in a number of studies.

Prospective Studies

Radanov and coworkers[57] assessed 78 consecutive, randomly sampled whiplash subjects (26 others in the original sample did not meet the inclusion criteria or did not attend the 6-month examination). All patients suffered from MVA-related, noncontact whiplash and had full insurance coverage; none claimed compensation or were involved in litigation during follow-up. Baseline assessments were performed an average of 7.2 days after the injury. At the 6-month examination, 73% of the patients were fully recovered and 27% had persisting symptoms (statistical analyses were used for other between-group comparisons).[57]

Radanov et al[58] also followed 117 nonselected patients with MVA-related whiplash (excluding cervical spine fractures or dislocations, head injury, or alteration of consciousness). Forty-seven other patients of the original sample either did not meet the criteria or dropped out at follow-up examinations. All patients were fully insured and none were involved in litigation during follow-up. The initial examination occurred a mean of 7.2 days after trauma, and follow-ups were carried out

at 3, 6, and 12 months. Forty-four percent, 31%, and 24% of the patients were symptomatic at 3, 6, and 12 months, respectively; 5% were disabled at 1 year. Specifically, neck pain at baseline was a complaint of 92% of patients, and 79% had persistent neck pain at 1 year (statistical analyses were used for other comparisons in the study).[58]

Hildingsson and Toolanen[59] evaluated 93 consecutive patients treated in an orthopedic department because of noncontact injury to the cervical spine from an MVA (four others did not return for follow-up and were excluded). The follow-up examination occurred a mean of 25 months (range 6 to 43 months) after the accident. Thirty-nine of the patients who had no residual problems related to the injury were interviewed by telephone only. Eighty-eight percent of the patients reported neck pain initially, with 29% indicating pain at follow-up. Symptomatic recovery occurred in 42% of patients, and 14% reported minor discomfort, manifested by such symptoms as pain on doing unusual exercises. Forty-four percent of the patients reported major complaints, including discomfort sufficient to interfere with their capacity for work (statistical analyses were used in considering other aspects of this study).[59]

Miles et al[60] examined 73 patients who had sustained MVA-related trauma to the cervical spine without bony injury. Twenty-nine percent of the patients were reported to be symptomatic despite treatment at 2-year follow-up. The authors stated that the presence of degenerative changes in the neck at presentation was statistically significantly associated with a poor prognosis.[60]

Retrospective Studies

Hohl[61] reported a study of 146 patients with soft tissue injuries of the neck caused by automobile accidents. The subjects had no pre-existing cervical degenerative changes and were evaluated 5 years or more after the causative MVA (only 146 of 534 eligible patients were able to be personally examined 5 years or more after their initial injury). Symptomatic recovery occurred in only 57% of the 146 patients, and 43% had residual neck symptoms. Eighty-three percent of patients whose claims were settled in the first 6 months after injury were asymptomatic compared with 38% of those whose claims were settled after 18 months ($P < .05$).[61]

Gargan and Bannister[62] reviewed 43 patients (of 61 patients initially studied) who had sustained soft tissue injuries of the neck, mostly in rear-end collisions (these were the same patients from the Norris and Watt study,[17] reviewed now a mean of 10.3 years later). Of these, only 12% were noted to have recovered completely, with residual symptoms reported to be intrusive in 28% and severe in 12%. Compensation was claimed by 56% of the patients, with the average time to settlement 19 months. The amount of compensation and the time required to reach settlement were thought to correlate statistically with the severity of symptoms at long-term follow-up. Higher-valued claims were concluded after a longer period of time, and patients with the most severe problems had a longer interval before compensation.[62]

Watkinson and colleagues[63] completed clinical examinations and radiographic assessments of 35 of 43 available patients with soft tissue injuries of the cervical spine after an average of 10.8 years following an MVA (again, these were the same patients from the Norris and Watt study.[17]) Symptoms were found to persist in 86% and were reported as intrusive or worse in 23%. Degenerative or postural changes were noted radiographically in 20% of asymptomatic patients and 87% of symptomatic patients ($P < .02$) No patient with intrusive or severe symptoms had a normal cervical spine radiograph after 10 years. These results were interpreted as suggesting that the complaints of patients with whiplash injuries were organic and that the condition did not recover with time.[63]

Deans et al[64] contacted 137 patients with neck pain between 1 and 2 years after they attended a hospital following road traffic accidents (38 others were untraceable). Thirty-one percent of the patients reported neck pain when examined soon after the accident, with 62% stating that they had suffered neck pain at some time following their accident. Twenty-six percent were still experiencing neck pain 1 year after their accident (23% intermittently and 4% continuously). Statistical analyses were used to investigate other aspects of the study.[64] These results suggest that onset of neck pain may be delayed and is not necessarily identified immediately postinjury.

Spitzer et al,[5] as part of the "Quebec Task Force on Whiplash-Associated Disorders," assessed all whiplash patients who received some compensation from the single-payer motor vehicle insurance carrier in that province in 1987. A total of 4,766 subjects submitted claims for compensation after whiplash injury in an MVA, with nine not receiving any compensation or reimbursement. Multiple analyses were performed with varying numbers of subjects. Of the 4,757 claimants, 1,743 were excluded as a result of lack of police collision report data entered in the computerized data bases, leaving a total of 3,014 whiplash subjects in the source subco-

hort aimed at assessing the role of collision-related factors. An additional 204 subjects with a recurrence were excluded, leaving 2,810 members in the study cohort for analysis assessing duration of absence from usual activities. The study cohort for analysis of the rate of recurrence had 1,666 members because it excluded 1,348 subjects with multiple nonwhiplash injuries along with whiplash to ensure that the recurrence was related only to the whiplash injury. The study cohort for the analysis of costs comprised all 4,757 claimants. The authors reported that 21.6% of the whiplash subjects in their study did not appear to be injured at the scene of the collision. They stated that WAD were usually self-limited, with a median time to recovery (end of disability compensation) of 31 days in their study. A total of 22.1% of 2,810 subjects recovered within 1 week of the collision, 53% took more than 4 weeks to recover from their injuries, and 2.9% were still absent from usual activities or work 1 year after the event. Fifty-five percent of the cohort files claimed for whiplash only, with 1.9% of these still absent from usual activities or work more than 1 year after their injury. The 12.5% of patients still compensated 6 months after the collision accounted for 46% of the total costs paid by the insurance carrier (no further statistical analyses were included).[5] It should be noted that other authors have shown that symptoms persist despite settling claims (see "Assessment of the Impact of Litigation: Litigating Patients Who Do Not Recover" above).

Balla[12] completed a retrospective review of 300 consecutive whiplash injury patients seen in one practice. All suffered whiplash injuries in MVA but had no other significant associated injuries. Sixty-four percent of the patients were seen more than 2 years after the original injury, and 88.3% were seen more than 1 year after the injury. The complex of headache, neck ache, and neck stiffness was reported to be present in nearly all the patients, but no data were given as to the exact numbers involved.[12]

Gotten[65] studied 100 patients with previously diagnosed cervical neck strain following automobile accidents whose litigation or compensation claims had been settled (the student interviewer was unable to have personal interviews with and to complete the questionnaire on 119 others). After legal claims for damage were completed, 88 patients were considered to have recovered (54 with no residual and 34 with minor symptoms not requiring therapy), while 12 patients continued to have severe symptoms (no formal statistical analyses were included).[65]

Pearce[66] reviewed 100 consecutive medicolegal whiplash cases and found that the majority of subjects recovered quickly. However, 29% were not pain free at 12 weeks, 18% had discomfort or pain that required intermittent or regular analgesics at 6 months, and 15% were not pain free at 1 year (limited statistical analyses were included).[66]

Literature Review

Shapiro and Roth[32] reviewed prospective studies that involved patients seen in emergency departments after sustaining a whiplash injury. They reported that the incidence of residual symptoms 6 months to several years after injury ranged from 15% to 66% in these studies.[32]

Residual Headaches

The persistence of headaches following injuries is reported in a number of studies.

Prospective Studies

Radanov et al[67] completed a study of 117 MVA-related whiplash patients (the same patients as described in their 1994 study[58]; see "Residual Neck Symptoms" above). The patients were assessed by physical and neurologic evaluation, semistructured interviews, and self-ratings of well-being and personality traits. The prevalence of trauma-related headache was found to decrease from 57% to 27% during a 6-month follow-up period. Nineteen percent complained of headache at all three investigations (ie, baseline, 3-month, and 6-month follow-ups). Statistical analyses were used concerning prognostic aspects.[67] In a 1994 article by Radanov and coworkers,[58] 67 (57%) of 117 whiplash patients reported headache at baseline, while 25 of 28 (89%) of those who remained symptomatic had persistent headache complaints at 1 year.

Balla and Karnaghan[68] reported results of a study of 122 patients identified as having whiplash headache presenting within 4 weeks of an MVA. The headaches occurred in the occipital region in 46% of patients, were generalized in 34%, and involved other locations in 20%. At 12 weeks, headache persisted in 73% and in these patients was present more than half the time in 36% (no formal statistical analyses were included).[68]

Weiss et al[69] described posttraumatic migraine as a frequent cause of chronic headache in adults following minor trauma to the head or neck. They indicated that this may occur occasionally as an isolated symptom, in combination with nonmigrainous daily head or neck pain, or as part of the posttrau-

matic syndrome. They described 35 patients with recurrent episodic headaches seen during a 10-year period in a general neurology practice. Twenty-two cases were precipitated by an MVA, with seven patients reporting neck injury with no head trauma and no loss of consciousness. All patients were evaluated and treated by one or more physicians with no reported success prior to being placed on propranolol (or verapamil), amitriptyline (especially if the patient was found to have concomitant depression or insomnia), or a combination of propranolol and amitriptyline. With this pharmacologic regimen, 70% reported a dramatic reduction of frequency and severity of headaches, with the other 30% (n = 9) reporting partial or little headache palliation. Eighteen of the 23 patients (78%) who were actively involved in litigation reported a marked decrease in the frequency and severity of their headaches. The authors felt that their findings did not support the hypotheses that accident victims do not recover before settlement of litigation or that posttraumatic headaches are untreatable (no formal statistical analyses were included).[69]

Hildingsson and Toolanen[59] (see "Residual Neck Symptoms" above) reported that 50% of their subjects reported headache initially, and 14% continued to complain of headaches at follow-up (on average 2 years postMVA).

Retrospective Studies

Balla and Karnaghan[68] also reviewed 100 consecutive patients seen more than 6 months after a whiplash injury. Ninety percent of these subjects were seen within 3 years of the accident, and 80% continued to experience headaches.[68]

De Benedittis and De Santis[70] assessed chronic posttraumatic headache observed in 57 of 130 consecutive patients following closed head injuries. Eighty-four percent of the patients reported headache 1 year after the trauma (no formal statistical analyses were included).[70]

Packard,[19] as mentioned previously (see "Assessment of the Impact of Litigation: Litigating Patients Who Do Not Recover" above), reported that all 50 posttraumatic headache patients in his study continued to report persistent headache symptoms 1 year or more following legal settlement.

Literature Review

Kreeft[71] provided an overview of headaches following whiplash. Headache was reported to be a prominent symptom in whiplash injury, with 50% to 80% of patients experiencing headache within 2 months of injury (in addition to the more common symptoms of neck pain, neck stiffness, and shoulder pain). A range of 10% to 25% of whiplash subjects were reported to have headaches 2 years after the injury. Kreeft noted that the sequence of events linking whiplash injury and headache had been the subject of considerable speculation and suggested that initial events may include injury to the cervical spine, disturbance of cervical sympathetic nerves, cerebral perturbation by rotational forces, cerebral contusion, and trauma to the TMJ.[71]

Opinion/Editorial

Edmeads[72] wrote, "Cases of chronic headache due to neck injury clearly exist; what has not been established is that neck injury is a common cause of chronic headache."

Prognosis

A few studies have been written that deal predominantly with prognosis following whiplash injuries.

Prospective Studies

Norris and Watt[17] reported, based on their previously discussed study (see "Assessment of the Impact of Litigation: Litigating Patients Who Do Not Recover" above), that the factors that adversely affect the prognosis of neck injuries resulting from rear-end motor vehicle collisions included the presence of objective neurologic signs, stiffness of the neck, muscle spasm, and pre-existing degenerative spondylosis.

Radanov and coworkers[57] divided 78 whiplash subjects into two groups at the 6-month examination for an analysis of baseline findings, with 21 patients having persisting symptoms and 57 being fully recovered (see "Residual Neck Symptoms" above). In their stepwise regression analysis, psychosocial factors, negative affectivity, and personality traits did not significantly predict treatment outcome. However, initial neck pain intensity, injury-related cognitive impairment, and older age were significant factors predicting illness behavior. This study also considered several additional possible predictive factors, including psychosocial status, with the findings reportedly refuting results of previous studies indicating that psychosocial factors predict illness behavior in posttrauma patients.[57]

Radanov et al[58] evaluated the relationship between somatic and psychosocial factors and their influence on the course of recovery in whiplash

patients during a 1-year follow-up period (see "Residual Neck Symptoms" above for a description of the study population). Stepwise regression analysis revealed that poor improvement at all examinations was significantly correlated with factors associated with severity of injury, such as initial symptoms of radicular irritation and intensity of initial neck pain. These results suggested to the authors that poor recovery was related to severity of injury in addition to some pretraumatic factors (previous history of head trauma and headache) and initial injury-related reaction (ie, sleep disturbances, reduced speed of information processing, and nervousness). Assessed psychosocial factors were not found to predict recovery at any follow-up examination. It was the authors' opinion that variables indicative of more severe injury proved the most reliable predictors of recovery from whiplash, but not in a linear fashion. They believed that there was a complex interplay between severity of injury and initial injury-related reaction to trauma (eg, sleep disturbances).[58]

Radanov and colleagues[67] evaluated the importance of pretraumatic headache in patients who suffered from headache as a result of MVA-related injury, and assessed the relation between trauma-related headache and different somatic and psychologic variables (see "Residual Headaches" above for the patient make-up in this study). Investigations at baseline, 3 months, and 6 months included complete physical and neurologic evaluation, semistructured interviews, and self-ratings of well-being and personality traits (using the Well-being scale and the Freiburg personality inventory). In addition, conventional radiographs of the cervical spine were taken at baseline in all patients. All patients who developed headache during follow-up (at 3 and 6 months) already complained of neck pain at baseline and continued to suffer from it at follow-up examinations. In addition, patients who suffered from pretraumatic headache showed a tendency at baseline and a significantly higher probability at follow-up of presenting with trauma-related headache. However, many patients with a history of headache did not complain of it as a result of injury at any investigation. In addition, there was significant recovery from trauma-related headache in both those with and without previous history of headache. Based on these results, the authors believed there was not a direct relation between pretraumatic and trauma-related headache. Factors that were identified by logistic regression to be significantly related to trauma-related headache at the baseline investigation included initial neck pain intensity, baseline score on depression scale, baseline well-being score, and onset of initial neck pain; at the 3-month investigation, the factors were a history of pretraumatic headache and neck pain intensity at 3 months; and at the 6-month investigation, the factors were neck pain at 6 months, history of pretraumatic headache, and neck pain intensity at 6 months. Psychologic factors were not of primary significance in the development of trauma-related headache. A significant relation between psychologic variables (ie, score on the well-being and depression scales, a negative relation being found for depression) and trauma-related headache was found only at baseline. The authors thought that their results showed that pretraumatic headache was a considerable risk factor for injury-related headache in whiplash, but history of headache in the absence of a notable cervical lesion was not in itself a reliable predictor of the likelihood of trauma-related headache.[67]

Hildingsson and Toolanen[59] (see "Residual Neck Symptoms" above for more details of the study) studied 17 factors, including accident characteristics, subjective complaints, objective findings, and radiographic parameters, in patients with soft tissue injury of the neck as a result of MVAs. They reported no significant relationship between the studied factors and the development of persisting symptoms. Specifically, no prognostic significance (using a two-way analysis of variance and multiple regression) was given to rear-end impact, head rest use, gender, return to work, and reversal of cervical lordosis or presence of degenerative spondylosis seen radiographically.[59]

Retrospective Studies

Dworkin and coworkers[73] examined the relationships among compensation, litigation, employment, and short- and long-term treatment response in a series of 454 patients with chronic pain. Patients with headache, facial pain, and some other types of pain of less than 6 month's duration were generally not accepted by their service. Eighty-two of 100 randomly selected patients from a larger series were given a standard telephone interview an average of 18 months after the initiation of treatment ("missing data" were mentioned in some tables, but no details were included). The authors concluded that both compensation benefits and employment status predicted poorer short-term outcome in univariate analyses; however, when employment and compensation were jointly used to predict outcome in multiple regression analyses, only employment was significant. In additional analyses, employment was the only variable that significantly predicted long-term out-

come, whereas compensation and litigation did not.[73]

Parmar and Raymakers[20] (see "Assessment of the Impact of Litigation: Litigating Patients Who Do Not Recover" above) found in their patients with neck injuries (following statistical analysis) that front-seat position, pain within 12 hours of injury, past history of neck pain, and degenerative changes on radiographs were associated with a longer duration of significant pain.

Spitzer and coworkers[5] found that female gender, older age, married/cohabital status, and a greater number of dependents were the sociodemographic factors associated with a longer time of absence from usual activities following whiplash. Characteristics associated with a longer time of absence were being in a severe collision, in a vehicle other than a car or taxi, in a collision other than rear end, and not using a seatbelt. The presence of multiple injuries was shown to be an important prognostic factor. Rear-end collisions and having one or more dependents were associated with a higher rate of relapse or recurrence of symptoms of whiplash subjects.[5]

States and coworkers[74] reviewed 101 highway and racing accidents, 89 of which involved neck injuries. Rear-end impacts causing only neck strain were low-energy accidents, and significant neck injury was able to occur with rear-end impacts as little as 10 miles per hour (no formal statistical analyses were included).[74]

Literature Review

Bannister and Gargan[75] reviewed the literature related to the prognosis of whiplash injuries. Following their review, they listed several conclusions, including the following[75]:

1. The majority of symptoms presented within 2 days.
2. Acute symptoms and signs were not helpful prognostic indicators.
3. Neck pain, occipital headache, shoulder radiation, lower back pain, and interscapular discomfort were the most common symptoms.
4. A total of 57% of reported cases recovered completely, and 8% remained unable to work.
5. The vast majority of patients reached their final state within a year.
6. During a 2-year period, 65% of occipital headache, 60% of neck pain, and 31% of upper limb pain resolved.
7. Factors that predicted poorer prognosis included extended duration and greater severity of symptoms, age greater than 50 years, upper limb radiation, and thoracic or lumbar back pain.
8. Radiologic findings were not useful prognostic indicators.
9. Symptoms recovered slightly less frequently among litigants.
10. There was no evidence from validated psychologic questionnaires that patients were mentally disturbed around the time of injury.
11. There was no evidence that symptoms resolved on conclusion of litigation.
12. Neck pain was influenced little by pre-existing degenerative changes.
13. Head rests may reduce the incidence and severity of symptoms.[75]

Barnsley et al,[6] in their review, reported that whiplash is a relatively benign condition, with most patients recovering; those patients destined to recover do so in the first 2 to 3 months after injury. They stated that the rate of recovery appears to slow dramatically after 3 months, with no further change in symptoms after 2 years. Between 14% and 42% of patients with whiplash injuries were noted to develop chronic neck pain, with approximately 10% having constant severe pain indefinitely. They estimated a prevalence in the entire population of about 1% with chronic pain and 0.4% with severe pain related to whiplash injury. They proposed a model that embraces two types of injury: acute muscle tears and sprains, which they feel probably affect the majority of whiplash victims and which resolve favorably with time; and injuries of the intervertebral disks or zygapophysial joints, which may affect a minority of patients and may become a source of chronic pain. They concluded that these latter patients are likely to be older, to have more severe pain immediately following the injury, and to have injury-related cognitive impairment.[6]

Temporomandibular Disorders

At present, the TMD literature inadequately addresses the issues of the impact of litigation on the outcome of injury-related TMD symptoms, the course of postinjury TMD symptoms, and prognostic factors in patients with postinjury TMD. Only a few studies have been conducted to assess various aspects of TMD, trauma, outcome, and litigation. These studies are detailed below and are summarized in Table 1.

Table 1 Summary of Studies Dealing With Temporomandibular Disorders and Trauma and/or Litigation*

Reference	Type of study	Study population	Follow-up rate (%)	Duration of F/U	Study findings
Heise et al (1992)[76]	Prospective	155 MVA/whiplash patients initially seen at acute surgical trauma emergency department; 63 with positive cervical radiographs (group 1); 92 with negative cervical radiographs (group 2)	Group 1: 81% at 1 mo, 70% at 1 year; Group 2: 85% at 1 mo, 65% at 1 year	1-mo and 1-year follow-ups	Group 1: initial, 8 (12.7%) with masticatory muscle and TMJ pain, 0 with clicking; 1 mo, 8 (15.7%) with (diminished) pain, 2 (3.9%) with clicking; 1 year, 0 with pain, 2 (4.5%) with clicking. Group 2: initial, 14 (15.2%) with masticatory muscle and TMJ pain, 1 (1.1%) with clicking; 1 mo, 14 (17.9%) with (decreased) pain, 1 (1.3%) with clicking; 1 year, 0 with pain, 1 (1.7%) with clicking
Brooke et al (1977)[77]	Retrospective	194 (of 274) patients referred with TMJ symptoms diagnosed with MPDS, 20 of whom had recent trauma (MVA or similar accidents)	99.5	16 to 44 months	60% of postinjury group had persistent symptoms still requiring treatment, 10% had no symptoms; compared to 14% of noninjury group with persistent symptoms, 42% with no symptoms
Brooke and Stenn (1978)[78]	Retrospective	37 (of 401) patients seen in oral medicine clinic with MPDS following injury (MVA or similar accident), compared to 173 noninjury MPDS patients (from their 1977 study)	97.3	N/A (patients selected over 4-year period)	36% of postinjury patients were "successfully" treated, compared to 86% of noninjury patients
Pullinger and Seligman (1991)[79]	Retrospective	230 consecutive TMD private practice patients (with MVA or "other" head or neck trauma); control groups: symptomatic (n = 161), asymptomatic (n = 61) students, "random" general dental patients (n = 150)	88.3 (27 not in correct groups and were excluded)	N/A	Disc displacement (DD) with reduction 63% with positive trauma history, DD without reduction 79%, osteoarthrosis (OA) with prior derangement history 44%, primary OA 53%, myalgia only 54%—all $P < .001$ compared with control groups; subluxation 29%—trauma history did not typify TMD group; symptomatic (18%) and asymptomatic (13%) for student control group; 11% for general dental patients
Romanelli et al (1992)[80]	Retrospective	52 (selected) postMVA and 52 (matched) nontrauma TMD patients	100	N/A (study period: 2 years); duration of therapy range; 4 mo to 5 years after MVA	48% of posttraumatic TMD patients reported overall improvement, compared to 75% of nontrauma TMD patients ($P < .001$)
Burgess and Dworkin (1993)[81]	Retrospective	100 consecutive postinjury TMD patients (overt trauma or whiplash); 53 litigants, 43 nonlitigants, 4 undefined (not followed)	96	N/A (mean treatment duration = 15 weeks)	Litigants were in treatment longer (18.4 vs 12.7 weeks; $P < .05$), requested more clinical sessions (7 vs 5, $P < .002$), endorsed greater pain on VAS at conclusion of treatment (24.9 vs 10.7, $P < .001$), had less pretreatment to posttreatment percentage change in self-reported pain (43.9% vs 76.3%, $P < .003$), and had less overall percent improvement (67% vs 87%, $P < .001$) compared to nonlitigants

Table 1 *continued*

Reference	Type of study	Study population	Follow-up rate (%)	Duration of F/U	Study findings
Probert et al (1994)[82]	Retrospective	20,672 subjects involved in MVAs in 1987 registered with compulsory insurance company; 2,198 (10.6%) with whiplash injuries	100	5 years	28 (0.14%) subjects identified with TMD after MVA; whiplash most frequent injury (42.9%) associated with subsequent TMD; symptoms of TMD noted by subjects immediately after accident in 75% of cases
Benoliel et al (1994)[83]	Retrospective (and prospective)	22 "representative" patients with persistent pain following trauma; 12 after MVA (10 followed)	82	N/A	4/18 (1/10 with MVA) with no pain relief; 3/18 (0) with mild improvement; 7/18 (6/10) with moderate or marked improvement; 4/18 (3/10) with total pain relief

*F/U = follow-up; MVA = motor vehicle accident; TMJ = temporomandibular joint; MPDS = myofascial pain dysfunction syndrome; N/A = not available; TMD = temporomandibular disorders; VAS = visual analog scale.

Prospective Studies

Heise and coworkers[76] studied 155 patients who had sustained whiplash injuries in MVAs. All patients were examined clinically at an emergency department, with assessment including cervical spine radiographs. Patients were then divided into two groups, those with and those without radiologic evidence of cervical skeletal injury. Part of the examination included assessment of the TMJ and of masticatory and neck muscles. Patients were then contacted by telephone 1 month following their injuries and again 1 year later. The same questionnaire was used in all three interviews. Eight of 63 patients (12.7%) with radiologic evidence of cervical skeletal injury (group 1) complained of masticatory muscle and TMJ pain, but none had clicking or popping. Fourteen of 92 patients (15.2%) with no radiographic evidence of cervical spine injury (group 2) complained of masticatory muscle and TMJ pain; one reported a unilateral click that was not present before the accident. Two of 51 (3.9%) of group 1 patients able to be contacted at 1 month following initial examination reported clicking, and no additional patients (of those able to be contacted, n = 44) reported TMJ pain and clicking at 1 year. The eight patients who had previously reported masticatory and TMJ pain reported diminished symptoms at 1 month and no myofascial pain at 1 year. No additional cases of TMJ pain and clicking were found in the group 2 patients who were able to be contacted at 1 month (n = 78). The 14 patients who previously had TMJ and masticatory pain reported a decrease in these symptoms. At 1 year, no new cases of TMJ pain and clicking were reported, and there were no complaints of persistent myofascial pain (n = 60). The authors concluded that the incidence of TMJ pain and clicking following whiplash injury was low, and that patients with whiplash who did not have clicking on resolution of their initial pain/dysfunction did not subsequently (eg, at 1-year follow-up) develop this problem (no formal statistical analyses were included).[76]

Retrospective Studies

Brooke and coworkers[77] reviewed 194 cases of myofascial pain dysfunction syndrome (MPDS) of 274 referrals to a university-based oral medicine clinic. Twenty of the patients had been involved in traffic or similar accidents resulting in direct or indirect injury to the TMJ, with the symptoms following these accidents. The other 174 patients comprised the noninjury group. Sixty percent of the 20 postinjury MPDS patients continued to experience symptoms that required treatment when examined from 16 to 44 months following their first visit, with only 10% being asymptomatic. This compared to 14% requiring treatment and 42% who were symptom free in the noninjury group. A statistically significantly poorer prognosis in patients who were involved in accidents was reported.[77]

In a follow-up to this study, Brooke and Stenn[78] evaluated 37 postinjury (trauma to the face or neck in MVAs or similar accidents) MPDS patients (of a series of 401 cases seen in an oral medicine clinic) and compared them to the noninjury patients in their previous study.[77] Eighty-six percent of noninjury MPDS patients were completely symptom free or required no further treatment,

whereas only 36% of the postinjury patients responded to conservative therapy. Treatments generally consisted of reassurance, ultrasound, occlusal splints, minor tranquilizers, or correction of gross malocclusion (no formal statistical analyses were included).[78]

Pullinger and Seligman[79] studied trauma history for association with disease among six diagnostic subgroups of 230 consecutive patients with TMD from a private practice setting (27 were classified into other categories and were excluded from the analysis; any mention by the subject of a past traumatic event, either MVA or "other" head or neck trauma, classified the subject as trauma positive, whether or not the trauma was associated with immediate TMD symptoms). Except for subluxation (29%), trauma history typified these TMD patient groups: disc displacement with reduction (63%), disc displacement without reduction (79%), osteoarthrosis with prior derangement history (44%), primary osteoarthrosis (53%), and myalgia only (54%). These patient cohorts were then compared to the positive trauma histories of 13% and 18% for the asymptomatic (n = 61) and symptomatic (n = 161) student control subjects and 11% for the general dental patients (n = 150), with significant differences ($P < .001$) being seen between the control groups and all of the TMD groups, except for the subluxation group. Disc displacement without reduction (43%) and with reduction (38%) had the highest prevalences of MVA trauma. Patients with disc displacement without reduction were in the only group to report multiple trauma (29%). The authors reported that trauma may be an important cumulative and precipitating event in TMD.[79]

Romanelli and coworkers[80] compared 52 patients with postMVA trauma TMD to an age- and sex-matched population of patients with TMD whose conditions developed independent of trauma. Treatment ranged from 3 to 5 years after the MVA and included multimodal management, such as moist heat and massage, nonsteroidal anti-inflammatory drugs, muscle relaxants, analgesics, physiotherapy, mandibular flat-plane bite planes, antidepressant medication, trigger point injections, biofeedback, surgical treatment, and prosthodontic treatment for correction of vertical dimension. Data analysis revealed that significantly fewer posttraumatic TMD patients (48%) as compared to nontrauma TMD patients (75%) reported recovery with treatment ($P < .001$). The patients with posttraumatic TMD required significantly more treatment. The authors also thought their data suggested that patients with posttraumatic TMD developed significantly more symptoms suggestive of affective disorder than did control TMD patients, with this being proposed as one possible explanation why posttraumatic TMD patients did not seem to respond to therapy as well as the control subjects.[80]

Burgess and Dworkin[81] evaluated 100 consecutive TMD patients who reported facial pain and joint dysfunction precipitated by physical trauma to the head, face, jaw, or TMJ region, or cervical whiplash with or without overt trauma to the head or face. Fifty-three of these patients were involved in litigation. Significantly more nonlitigating subjects reported overt trauma than those litigating (51% versus 13%, $P < .05$). Whiplash was more likely to be significantly associated with litigating subjects (87% versus 13%, $P < .001$). Litigating subjects indicated a significantly greater number of pain sites (5.6 versus 3.9, $P < .02$) and reported significantly higher rates for pain in the neck (55% versus 26%, $P < .01$) and face (92% versus 72%, $P < .04$) region than nonlitigants. Litigation patients appeared to have greater sleep disturbance (66% versus 40%, $P < .03$) and level of somatization (1.08 versus 0.76, $P < .008$) as measured by the Symptom Checklist–90 Revised (SCL-90R). Litigating patients were found to be in treatment significantly longer than those not litigating (18.4 weeks versus 12.7 weeks, $P < .05$), requested more clinical sessions (seven versus five, $P < .002$), endorsed greater pain on the visual analog scale (VAS) at the conclusion of treatment (24.9 versus 10.7, $P < .001$), and had significantly less pretreatment-to-posttreatment percentage change in self-reported pain (43.9% versus 76.3%, $P < .003$). Although all patients reported improvement, litigating subjects indicated significantly less overall percent improvement (67% versus 87%, $P < .001$). The authors concluded that litigation may affect pretreatment presentation and posttreatment status.[81]

Probert and colleagues[82] conducted a retrospective analysis of the records from the Transport Accident Commission (TAC) of Victoria, Australia, in 1987 to identify those subjects who received treatment for TMD following an MVA. The TAC provides compulsory transport injury insurance for motor vehicles registered in that state, covering those injured in an MVA, regardless of fault and assuming responsibility for rehabilitation of the injured. In 1987, a total of 20,672 subjects involved in an MVA had claims accepted by the TAC for compensation. Whiplash injuries occurred in a total of 2,198 subjects (10.6%); 237 (1.1%) subjects who were involved in an MVA sustained mandibular fractures, with a smaller number of subjects suffering maxillary, zygomatic,

and other facial fractures (n = 151). Twenty-eight (0.14%) subjects were identified as having TMD after the MVA. Twelve (42.9%) of the 28 subjects had whiplash as the injury associated with subsequent TMD. A total of 39.3% of these suffered no other injury to the head or neck, with one sustaining a whiplash injury and a concomitant zygomatic fracture. Three other subjects had facial bone fractures, three had skull fractures, and an additional three had closed head injuries. Seven sustained only facial bruises and lacerations. Symptoms of TMD were noted by the subjects immediately after the accident in 75% of cases, with two additional subjects complaining of TMD developing within 1 week after the accident, four within 2 months, and one at 18 months. The authors concluded that TMD for which subjects sought treatment was an uncommon result of an MVA and was infrequently associated with mandibular fracture or whiplash injury (no formal statistical analyses were included).[82]

Benoliel and coworkers[83] reviewed 22 "representative" cases of persistent pain after trauma to the head and neck, collected retrospectively and prospectively during 1 year. Twelve of the patients were involved in MVAs. Follow-up was possible in 18 of the patients, with four patients making a complete recovery and four patients reporting no relief. The remainder reported mild improvement (n = 3) or moderate or marked improvement (n = 7). Ten of the 12 MVA patients were followed; one reported no relief, six reported moderate to marked improvement, and three reported total pain relief. The patients were diagnosed with either musculoskeletal, neuropathic, and/or vascular pain. Those who had musculoskeletal pain and were referred for treatment early were reported to have the best prognosis. Most of the MVA patients had musculoskeletal pain, with or without another pain type (no formal statistical analyses were included).[83]

Literature Review

Brooke and Lapointe[84] estimated that no more than 20% to 30% of patients with TMD precipitated by injury obtain complete relief of the condition with conservative treatment (although they did not present supporting data). They reported that the majority of trauma patients continued to experience pain and dysfunction for months and even years after the accident. The condition could merge with chronic pain syndrome and require treatment appropriate for chronic pain. Litigation was reported to be frequent.[84]

Summary

The literature reviewed supports the following conclusions:

1. Temporomandibular disorders is a possible consequence of whiplash injuries, although the literature may lack conclusive evidence regarding the mechanism(s) of injury, the frequency of complaints, and the natural history of development of posttraumatic TMD.

2. Although conflicting opinions are often made available regarding pain following motor vehicle accidents, much of the literature supports a view that pain and dysfunction frequently become chronic. The majority of relevant studies demonstrate that patients do not necessarily improve shortly after the claim is settled. Two prospective studies[17,18] and several retrospective studies[19–30] show that patients frequently continue to experience chronic symptoms following litigation. Miller's 1961 article[8] seems to be the major work suggesting that patients recover shortly after a settlement is reached (or that patients will not recover until the claim is settled). However, the Miller study was retrospective, was not randomized or controlled, and used a biased patient sample. Only a few other (relatively weak) studies propose a similar viewpoint.[9–16] It is noteworthy that some of the studies reviewed specifically suggested that the Miller study is flawed, has had virtually no substantial support in the literature since its publication, and/or that the results of their own studies contradict Miller's hypothesis. This conclusion is supported by our current review of pain and dysfunction following an MVA. In addition, a significant number of subjects would appear to experience symptomatic recovery before their litigation is settled or return to work prior to settlement, and malingering is rare. However, no studies were reviewed that study the postsettlement course in posttraumatic TMD or mixed cervical whiplash/TMD patient populations.

3. Several but not all authors stated that early settlement of compensation claims or litigation may improve the prognosis.

4. Postinjury problems are reported by some authors to have an organic basis,[42,43] although some "opinions" do propose a psychologic basis.[25] Although some have the opinion that postinjury whiplash is purely psychologic in origin, this conclusion cannot be substantiated according to this review. This review of the literature, however, suggests that the causes of postinjury symptom presentation are complex and likely to be associated

with confounding biologic as well as psychologic factors. There appears to be insufficient evidence for the acceptance of either a purely psychologic or physiologic (biologic) model of disease in the subset of patients with chronic pain. Furthermore, given the vast literature related to nontrauma chronic pain, the longer pain persists, the more likely it is for the "trauma" patient to develop psychologic concomitants associated with pain chronicity.[32] In addition, this question of organicity is not resolved in the TMD literature.[6]

5. Whether differences exist between litigants and nonlitigants is not clear in the literature reviewed. This may be the result, in part, of the heterogeneity of the populations in the different studies (eg, litigants versus nonlitigants, those with resolved versus those with unresolved claims, those in adversarial systems versus those in nonadversarial systems). In addition, the results are conflicting with respect to pain duration, pain severity rating, and psychologic disturbances, with some authors reporting that there are differences between the groups and some reporting that there are not. Patients in an adversarial system appear to cope less well, especially in relation to emotional, behavioral, and daily functioning aspects.[50] Mills and Horne[13] suggested that patients in different legal systems respond differently. In addition, litigants were consistently reported to be younger.[49,51] In general, only a few (minor) differences were noted between litigants and nonlitigants (especially within the same type of legal system), but these were inconsistent and conflicting in many instances, as noted above. It is also stated by some authors that patients in litigation may be treated differently than those not so involved. The effects of a lack or loss of concern and compassion by the patients' provider on outcome deserves further study because this factor may have an effect on outcome.

Only one study of TMD following trauma specifically compared litigants versus nonlitigants.[81] In this study, litigants had more reported pain sites, had more severe neck and face pain, had greater sleep disturbance and level of somatization, received more and longer treatments, and had poorer treatment outcomes. The authors concluded that although an interaction between litigation and pretreatment presentation and posttreatment status may be present, the nature of this association remains unclear and needs additional study.

6. Postinjury neck symptoms and headache can be persistent in a considerable proportion of subjects, regardless of litigation status. If patients are going to recover, they often do so within the first year or two. Regarding TMD, the literature is conflicting, with some authors reporting that whiplash patients who developed TMD symptoms subsequently had their symptoms improve during the first postMVA year,[76] and others reporting that some postMVA patients had persistent pain.[83]

7. A number of factors are cited in relation to the prognosis of posttraumatic neck pain, with no consensus seen, except perhaps for older age and greater severity of injury. These factors include the presence of objective neurologic signs, stiffness of the neck, muscle spasm, pre-existing degenerative spondylosis, initial neck pain intensity, injury-related cognitive impairment, older age, previous history of head trauma and headache, more severe injury, front-seat position, pain within 12 hours of injury, past history of neck pain, degenerative changes on radiographs, female gender, married/cohabital status, greater number of dependents, not using a seatbelt, being in a vehicle other than a car or taxi, and the presence of multiple injuries. The effect of similar factors on posttraumatic TMD remains essentially unstudied and unclear. However, Benoliel et al[83] reported that patients in their study who had musculoskeletal pain and who were referred early had the best prognosis.

8. Employment significantly predicts long-term outcome, whereas compensation and litigation do not. Whether employment is a meaningful outcome parameter predicting results of posttraumatic TMD is unknown.

9. The literature is conflicting with respect to treatment outcome in patients with posttraumatic TMD, with only one study to date assessing this parameter with respect to litigation.[81] This study suggested that there is an association between compensation and symptom presentation initially and after short-term treatment. However, until patients with posttraumatic TMD are studied prospectively, it cannot be concluded that litigation causes symptom chronicity in this subset of trauma patients. The nonTMD literature suggests that patient improvement over time is not significantly associated with the presence or absence of litigation. The available literature does suggest that TMD may occur as a result of MVA trauma, although the mechanisms for injury remain unclear. The overall incidence of TMJ pain and clicking, when all the reported symptoms are considered (eg, nonTMD) following MVA, may be low immediately and 1 year postinjury.[76,82] However, one group reported some persistence of pain following head and neck trauma,[83] and Pullinger and Seligman[79] suggested that a history of trauma was important in several different TMD

types in their study population. In addition, a popular opinion held by some TMD practitioners is that there are many patients seeking treatment for TMD following MVAs. Once again, it must be emphasized that more research in the TMD area is needed to answer these trauma- and litigation-related questions. It should also be appreciated that while there is substantial literature suggesting that nontrauma TMD is generally self-limiting, this hypothesis has not been studied in patients with posttraumatic TMD. However, postinjury MPDS and TMD patients have reportedly responded less favorably to treatment than noninjury counterparts in a few studies.[77,78,80] The incidence, course, management, and prognosis of posttraumatic TMD require considerably more research before definitive conclusions can be drawn.

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Resumen

Trastornos Temporomandibulares. Dolores de cabeza y de Cuello Subsecuentes a Accidentes en Vehículos Motorizados y el Efecto de Litigio: Revisión de la Literatura

Una revisión de la literatura fué llevada a cabo con respecto a las relaciones entre accidentes en vehículos motorizados y trastornos temporomandibulares, effecto de latigazo, dolor de cabeza, dolor de cuello, y litigio. Muchos pacientes se recuperan o vuelven al trabajo previo a un arreglo legal, pero la mayoría de pacientes tratados sin éxito generalmente no se recuperan después del arreglo de demandas legales. Los problemas posteriores a la injuria no son estrictamente psicológicos. Demandantes y no demandantes tienden a no ser dramáticamente diferentes en las consideraciones más importantes (incluyendo dolor y retorno al trabajo), con los demandantes mereciendo el mismo tratamiento que otros pacientes con dolor crónico. Síntomas en el cuello y dolores de cabeza posteriores a la injuria pueden ser persistentes. El empleo parece ser un pronosticador de resultado a largo plazo mejor que la compensación y el litigio. Se dispone de un consenso limitado con respecto a factores de pronóstico. Pacientes con trastornos temporomandibulares con injuria posterior tienden a responder menos bién a tratamiento que los pacientes con trastornos temporomandibulares sin injuria, como ocurre con pacientes con trastornos temporomandibulares demandantes comparados con no demandantes, pero una relación causa y efecto se desconoce. La incidencia de trastornos temporomandibulares después de accidentes en vehículos motorizados puede no ser tan alta como se había afirmado en casos de efecto de latigazo. Se requiere más investigación en el area de trastornos temporomandibulares, accidentes en vehículos motorizados, y litigio.

Zusammenfassung

Myoarthropathie des Kausystems, Kopf- und Genickschmerzen nach Automobil Unfällen und der Effeckt vom Rechtsstreit: Überblick der Literatur

Ein Literatur Überblick wurde unternommen, betreffs dem Zusammenhang zwischen Automobil Unfällen und Myoarthropathie des Kausystems, Schleudertrauma, Kopf- und Genickschmerzen, und Rechtsstreit . Viele Patienten erholen sich und nehmen ihre Arbeit vor einer Festsetzung wieder auf. Doch im Allgemeinen erholen sich unerfolgreich behandelte Patienten nicht nach einer Festsetzung. Probleme nach Verletzungen sind nicht unbedingt psychologisch. Es besteht kein dramatischer Unterschied zwischen Prozessierende und Nicht-Prozessierende in den meisten wichtigen Beziehungen (einschliesslich Schmerzen und Rückkehr zur Arbeit). Prozessierende verdienen dieselbe Behandlung, wie andere Patienten mit chronischen Schmerzen. Genick Symptome und Kopfschmerzen nach Verletzungen, können beharrlich sein. Arbeitsausführung scheint ein besserer Vorhersager für ein langfristiges Ergebnis zu sein, als Entschädigung und Rechtsstreit. Verfügbare Übereinstimmung, betreffs Faktoren in Prognose, ist begrenzt. Myoarthropathie des Kausystems Patienten als Result von Verletzungen sind nicht so behandlungs empfänglich wie Myoarthropathie des Kausystems Patienten ohne Verletzungen, und Prozessierende weniger als Nicht-Prozessierende. Ein Grund und Wirkung zusammenhang ist unbekannt. Das Vorkommen von Myoarthropathie des Kausystems nach Automobil Unfällen ist nicht unbedingt so hoch, wie angegebene Klagebegehren nach Schleudertrauma. Mehr Nachforschung, auf dem Gebiet von Myoarthropathie des Kausystems, Automobil Unfällen und Rechtsstreit, ist erforderlich.