# A Comparison of TMD Patients With or Without Prior Motor Vehicle Accident Involvement: Treatment and Outcomes

**Dean A. Kolbinson, DMD, MSD**
Associate Professor
Department of Diagnostic and Surgical Sciences
University of Saskatchewan
College of Dentistry
Saskatoon, Saskatchewan
Canada

**Joel B. Epstein, DMD, MSD**
Medical/Dental Staff
British Columbia Cancer Agency
Head, Department of Dentistry
Vancouver Hospital and Health Sciences Centre
Vancouver, British Columbia, Canada
Research Associate Professor
Department of Oral Medicine
University of Washington
School of Dentistry
Seattle, Washington

**Ambikaipakan Senthilselvan, BSc, MSc, PhD**
Associate Professor
Department of Community Health and Epidemiology
University of Saskatchewan
College of Medicine
Saskatoon, Saskatchewan
Canada

**Jeffrey A. Burgess, DDS, MSD**
Clinical Associate Professor
Department of Oral Medicine
University of Washington
School of Dentistry
Consultant
Multi-Disciplinary Pain Center
University of Washington Medical Center
Seattle, Washington

**Correspondence to:**
Dr Dean A. Kolbinson
Dental Clinic
University of Saskatchewan
105 Wiggins Road
Saskatoon, Saskatchewan S7N 5E4
Canada

*The influence of previous trauma in the management of patients with temporomandibular disorders (TMD) is controversial. The objectives of this study were to compare treatment regimens and outcomes in motor vehicle accident trauma-related versus non-trauma-related TMD patients. Files of 50 trauma and 50 matched nontrauma TMD patients were reviewed. Information concerning treatment received, progress of symptoms with treatment, and findings from the final examination were recorded. As a whole group, posttraumatic TMD patients tended to receive more types of treatment ($P < .0001$), have more medications prescribed (including analgesics, $P < .001$; nonsteroidal anti-inflammatory drugs, $P = .001$; muscle relaxants, $P = .001$; and tricyclic antidepressants, $P < .001$), have more oral medicine clinic visits ($P = .07$) over a longer period of time ($P = .06$), and have a poorer treatment outcome ($P < .001$) as compared to the nontrauma group. When the patients were separated into TMD diagnostic classification subsets, only some of these differences between trauma and nontrauma patients were seen, but the subset group sizes were small and only a few of the groups could be compared. There did not seem to be a significant effect from settling insurance claims prior to the last clinic visit. Trauma may be an important prognostic factor in the management of some TMD patients.*
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**key words:** temporomandibular disorders, trauma, motor vehicle accident, treatment, outcomes

The role of trauma as one of the etiologic factors of temporomandibular disorders (TMD) is questioned by some[1–4] but is believed to be important by others,[5–15] some of whom include trauma from cervical whiplash injuries.[16–22] The mechanism by which whiplash (cervical flexion-extension) injuries affect the head and neck and the temporomandibular joint (TMJ) areas has been widely studied,[16,17,23–26] but the response of posttraumatic TMD patients to intervention remains unclear. It has been reported that patients with trauma as a predisposing or precipitating factor are not significantly different from nontrauma patients in their response to treatment.[13,27–29] However, a poorer rate of recovery of posttraumatic TMD patients as compared to nontrauma TMD patients has also been reported.[30–32]

The objectives of this study were to compare motor vehicle accident (MVA) trauma-related TMD patients with nontrauma-related TMD patients in terms of treatment regimens and outcomes.

## Materials and Methods

Fifty patient files from one private oral medicine practice were randomly selected while their charts were manually searched alphabetically to identify those who met the following criteria: symptoms of one or more TMD; involvement in an MVA as the likely cause of the TMD for which they were referred; pending litigation related to the MVA; a minimum of three office visits; an interval of at least 4 months since the last office visit. All of the patients had been seen by one practitioner, had been interviewed in a narrative fashion, and had undergone an accepted TMD physical examination. Treatments provided were generally currently accepted TMD treatments.[33]

The charts were reviewed, and the following information was recorded: treatment modalities used by the patient (as provided at the oral medicine practice and by other health care practitioners since the time of the MVA); progress of symptoms with treatment (as recorded by interview at the last assessment); number of months after the MVA of the final clinic visit; number of clinic visits; treatment duration in the oral medicine office; insurance claim information; time from the MVA to the initial presentation; and findings from the final examination. Some of the data were not included in some records, so not all parameters resulted in 50 entries for the statistical analyses.

Fifty "nontrauma" TMD patients, age- and sex-matched to the trauma group, were selected from the same office. These patients gave no prior history of an MVA or of a significant blow to the head or neck region, and no litigation was identified. The nontrauma patients also had to meet the criteria of having had a minimum of three office visits and having not been seen for an office visit within the past 4 months. These nontrauma patients had received assessments and treatment approaches similar to those of the trauma group, and there were also missing data in the nontrauma group. Similar information as was described for the trauma group was recorded for the nontrauma patients.

Following completion of the initial analyses for the groups as a whole, the trauma and nontrauma groups were separated into various TMD diagnostic categories as described in the Research Diagnostic Criteria (RDC) for clinical TMD conditions.[34] Because the majority of subjects had multiple TMD diagnoses, the various combinations of subcategories were pooled, and the number of subjects in each subcategory grouping was determined. There were 19 subcategory combinations, but the total number of subjects was greater than 10 in only 4 of them. (It was decided that any number less than 10 would not result in meaningful statistical analyses.) The same analyses concerning treatment regimens and outcome issues were then undertaken for these four diagnostic groupings, comparing the trauma and nontrauma subjects.

Analyses regarding treatment regimen and outcome data were then undertaken to compare the patients who had settled their insurance claims prior to their last visit with patients in the nontrauma (control) group.

### Statistical Methods

The data for the trauma and nontrauma groups were entered into Dbase IV (Ashton Tate, Torrance, CA) and subsequently transferred to an SPSS package[35] for statistical analysis. Chi-square statistics were used to test the significance of the differences in discrete variables between trauma and nontrauma groups. If the expected value was less than 5 in the chi-square tests, then Fisher's Exact tests were used. Continuous variables were expressed by means and standard deviations (SD). Two-sample independent $t$ tests were used to test the differences between two means. If the data were skewed, Mann-Whitney $U$ tests were used to test the differences between the trauma and nontrauma groups. Statistical significance was determined by a $P$ value of .05 or less.

## Results

As part of their management regimen, all 50 trauma patients had a form of occlusal splint therapy (90% stabilization splint only, 10% stabilization and Gelb splints), as did all 50 of the nontrauma patients (90% stabilization splint only, 4% anterior repositioning splint [ARS], 2% stabilization and Gelb splints, 4% "other," ie, stabilization and anterior repositioning splints, and stabilization and soft splints) (Table 1). Ninety-two percent of the trauma group received physiotherapy as compared to 38% of the nontrauma group ($P < .001$). Fifty percent of the trauma patients received massage therapy as compared to 14% of the nontrauma group ($P < .001$). Twenty percent of the trauma patients received chiropractic treatments as compared to 10%

**Table 1** Treatments

| Parameter | Trauma no. (%) | Nontrauma no. (%) | *P* value |
|---|---|---|---|
| Occlusal splint | 50 (100%) | 50 (100%) | NA |
| Physiotherapy | 46 (92%) | 19 (38%) | <.001* |
| Massage therapy | 25 (50%) | 7 (14%) | <.001* |
| Chiropractics | 10 (20%) | 5 (10%) | .16* |
| Myofascial trigger point injections | 5 (10%) | 1 (2%) | .20† |
| TMJ injection | 2 (4%) | 0 | .50† |
| TMJ surgery | 2 (4%) | 1 (2%) | 1.00† |
| Analgesics | | | |
| Nonopioid | 9 (18%) | 3 (6%) | |
| Mild opioid | 10 (20%) | 0 | <.001‡ |
| Strong opioid | 4 (8%) | 2 (4%) | |
| Combination of above | 12 (24%) | 3 (6%) | |
| Nonsteroidal anti-inflammatory drugs | 37 (74%) | 21 (42%) | .001* |
| Muscle relaxants | 24 (48%) | 9 (18%) | .001* |
| Tricyclic antidepressants | 26 (52%) | 6 (12%) | <.001* |
| Pain-management team | 8 (16%) | 2 (4%) | .046* |
| Counseling | 2 (4%) | 0 | .50† |

*Chi-square test with 1 degree of freedom.
†Fisher's Exact test.
‡Chi-square test with 4 degrees of freedom.
NA = not applicable.

of the nontrauma group. Ten percent of the trauma group received myofascial trigger point injections as compared to 2% of the nontrauma patients. Four percent of the trauma patients received an injection into the TMJ, whereas none of the nontrauma patients received this treatment. Four percent of the trauma patients underwent TMJ surgery (one underwent unilateral arthroscopy, one underwent more than one type of surgery), while one nontrauma patient underwent a unilateral open-joint procedure.

At one time or another, 70% of the trauma patients were taking analgesics other than nonsteroidal anti-inflammatory drugs (NSAIDs), including nonopioid (18%), mild opioid (20%), strong opioid (8%), or a combination of these types of analgesics (24%), while 16% of the nontrauma patients were taking either nonopioid (6%), strong opioid (4%), or a combination of these analgesics (6%) ($P < .001$). Seventy-four percent of the trauma group were taking NSAIDs as compared to 42% of the nontrauma group ($P = .001$). Forty-eight percent of the trauma group received muscle relaxants as compared to 18% of the nontrauma patients ($P = .001$). Fifty-two percent of the trauma group used a tricyclic antidepressant as compared to 12% of the nontrauma group ($P < .001$).

Sixteen percent of the trauma group received treatment from a pain-management team as compared to 4% of the nontrauma group ($P = .046$). Four percent of the trauma group, and none of the nontrauma group, received counseling.

Nineteen patients in the trauma group received a variety of other treatments, including various combinations of benzodiazepine/antianxiety agents, anticonvulsants, alpha-adrenergic blockers, beta-adrenergic blockers, corticosteroids, (other) antidepressants, calcium channel blockers, vascular headache prophylaxis agents, antianxiety antihistamines, serotonin agonists, and other medications; acupuncture; relaxation; balance therapy; craniosacral manipulation; autogenics; hypnosis; and other "miscellaneous" approaches.

Thirteen patients in the nontrauma group received a variety of other treatments, including various combinations of benzodiazepine/antianxiety agents, calcium channel blockers, vascular headache prophylaxis agents, corticosteroids, serotonin agonists, alpha-adrenergic blockers, beta-adrenergic blockers, and other medications; (electro-)acupuncture; relaxation; cranial therapy; transcutaneous electrical nerve stimulation (TENS); occlusal adjustments; and other "miscellaneous" approaches.

The mean number of treatment visits to the oral medicine clinic by the trauma group was 9.9 (± 6.1) as compared to 7.6 (± 6.1) for the nontrauma group ($P = .07$). The mean treatment duration was 104.2

**Table 2** Progress of Symptoms With Treatment*

| Parameter | Trauma | | Nontrauma | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Same | 20 | 40 | 6 | 12 |
| Worse | 1 | 2 | 0 | 0 |
| Improved | 27 | 54 | 37 | 74 |
| Resolved | 2 | 4 | 7 | 14 |

*"Same + worse" versus "improved + resolved" for trauma versus nontrauma, $P < .001$ (chi-square test, 1 degree of freedom).

**Table 3** Examination Findings at Last Clinic Visit (Mean ± Standard Deviation)

| Parameter | Trauma | Nontrauma | *P* value |
|---|---|---|---|
| Masticatory muscle tenderness score (0–3) | 0.86 (± 0.56) | 0.33 (± 0.42) | <.001* |
| Neck muscle tenderness score (0–3) | 0.65 (± 0.74) | 0.11 (± 0.28) | <.001* |
| TMJ tenderness score (0–3) | 0.66 (± 0.68) | 0.37 (± 0.54) | .02* |
| TMJ clicking score | 0.58 (± 0.74) | 0.47 (± 0.57) | .41* |
| TMJ crepitus score | 0.21 (± 0.37) | 0.33 (± 0.54) | .38† |
| Maximum jaw opening (mean, mm) | 36.9 (± 6.8) (n = 43) | 41.3 (± 7.1) (n = 50) | .003* |

*Two-sample independent *t* test.
†Mann-Whitney *U* test.

weeks (± 62.3) for the trauma patients and 77.0 weeks (± 78.0) for the nontrauma patients ($P = .06$). Calculations were also made to determine the mean number of treatment types per patient (eg, a patient who received two different types of splint would be counted as having received one type of treatment); trauma patients received a mean number of 5.8 (± 2.4) treatment types each as compared to 2.8 (± 2.1) treatment types each for the nontrauma patients ($P < .0001$).

Regarding progress of symptoms with treatment for the trauma group, 40% were evaluated as being the same, 2% as worse, 54% as improved, and 4% as resolved (Table 2). For the nontrauma group, 12% were evaluated as being the same, 0% as worse, 74% as improved, and 14% as resolved. Grouping together those who were the same or worse and those who were improved or resolved, 42% of the trauma group and 12% of the nontrauma group were the same or worse and 58% of the trauma group and 88% of the nontrauma group were improved or resolved ($P < .001$).

Examination at the last clinic visit revealed that the trauma group had significantly higher mean masticatory muscle tenderness, mean neck muscle tenderness, and TMJ tenderness scores (Table 3). There were no between-group differences for the TMJ clicking score or for the mean TMJ crepitus score. The mean "final" maximum jaw opening for the trauma group (n = 43) was 36.9 mm as compared to 41.3 mm for the nontrauma group (n = 50) ($P = .003$).

The 19 different TMD subcategory combinations are listed in Table 4. The trauma versus nontrauma comparisons were carried out for only four of these combinations because of the small numbers in the other groupings. Table 5 shows the statistically significant between-group findings for the myofascial pain (MPD)/disc displacement with reduction/arthralgia and the MPD-only subgroup comparisons. There were no statistically significant differences for the MPD/disc displacement with reduction or the MPD/arthralgia subgroup comparisons.

For the trauma group, 18% had settled an insurance claim prior to the last visit, 22% had settled an insurance claim since the last visit, and 60% had not settled by the time of the chart review. When the patients who had settled their claims prior to the last visit (n = 9) were compared to the nontrauma patients (n = 50), only a few differences from the previous analyses were found. The trauma patients who had settled claims had a greater number of treatments (6.1 ± 2.6 versus 2.8 ± 2.1; $P = .005$) and a longer treatment duration (132.6 ± 65.3 weeks versus 77.0 ± 78.0 weeks; $P = .04$) as compared to the nontrauma group. These two variables showed a trend in this direction when the entire trauma

**Table 4** Combinations of TMD Diagnostic Subcategories

| TMD combination | Trauma (N = 50) | Nontrauma (N = 50) |
|---|---|---|
| MPD, DDwr | 11 | 14 |
| MPD, DDwr, arthralgia | 9 | 5 |
| MPD, arthralgia | 9 | 3 |
| MPD | 6 | 5 |
| MPD, DDwr, OA | 3 | 3 |
| MPD, DDwr, OA, arthralgia | 3 | 2 |
| MPD, DDwor | 3 | 2 |
| MPD, DDwor, OA, arthralgia | 1 | 2 |
| MPD, OA | 0 | 3 |
| DDwr, arthralgia | 0 | 3 |
| MPD, DDwr, DDwor, arthralgia | 1 | 1 |
| MPD, DDwr, DDwor | 0 | 2 |
| MPD, DDwor, arthralgia | 2 | 0 |
| MPD, OA, arthralgia | 2 | 0 |
| MPD, DDwor, OA | 0 | 1 |
| DDwr, DDwor | 0 | 1 |
| DDwr, OA, arthralgia | 0 | 1 |
| DDwor | 0 | 1 |
| OA | 0 | 1 |

TMD = temporomandibular disorder; MPD = myofascial pain; DDwr = disc displacement with reduction; OA = osteoarthritis; DDwor = disc displacement without reduction.

**Table 5** Subcategory Combination Comparisons With Statistically Significant Differences

| Subcategory combination/ parameter | Trauma | Nontrauma | *P* value |
|---|---|---|---|
| MPD/DDwr/arthralgia | | | |
| Final jaw muscle score (mean ± SD) | 0.94 (± 0.49) | 0.50 (± 0.17) | .03* |
| Treatment number (mean ± SD) | 6.11 (± 2.32) | 3.20 (± 0.84) | .006* |
| MPD only | | | |
| Analgesic use (no.) | 5 | 0 | .02† |
| Final jaw opening (mm) (mean ± SD) | 32.25 (± 3.10) | 42.00 (± 6.67) | .03* |
| Treatmment number (mean ± SD) | 6.33 (± 1.37) | 2.40 (± 1.52) | .002* |

*Two-sample independent *t* test.
†Fisher's Exact test.
MPD = myofascial pain; DDwr = disc displacement with reduction.

group versus nontrauma group was compared, but these differences were not statistically significant. In addition, the differences shown in Table 1 regarding the use of NSAIDs and in Table 3 regarding the final TMJ tenderness score and maximum jaw opening were not seen when comparing the settled trauma and nontrauma groups (but there were similar, although not statistically significant, trends in the same direction for these tests when considering the settled trauma versus nontrauma patients).

The trauma patients' last visit was, on average, 32.5 months after the MVA (range 7 to 83 months).

## Discussion

The patients with posttraumatic TMD in this study differed from the nontrauma patients in many aspects of treatment and outcome. Significantly more patients in the trauma group received physiotherapy, massage therapy, medications (including analgesics, NSAIDs, muscle relaxants, and tricyclic antidepressants), and treatment by the pain-management team. There was a trend for the trauma patients to receive more treatment visits and have a longer treatment duration. They also received more treatment types than the nontrauma

patients; reported poorer outcomes than the nontrauma group; scored higher for masticatory and neck muscle and TMJ tenderness; and had a lower mean jaw opening at the final examination. There were similarities between the groups regarding occlusal splint use, chiropractic treatment, myofascial trigger point injections, TMJ injections, TMJ surgery, and counseling, as well as TMJ clicking and crepitus final examination findings. It should be mentioned that while many of the therapies were administered or prescribed by the oral medicine practitioner, some of the treatments were either suggested by the patient or recommended by other health care workers in relation to back or neck complaints (eg, chiropractic treatment).

Romanelli and coworkers[30] compared posttraumatic TMD patients with TMD patients who had no history of trauma. Forty-eight percent of the posttraumatic TMD patient group had an overall improvement, significantly fewer than the 75% improvement in the nontrauma control group. The total number of modes of therapy for the trauma group was 160, with a mean of 3.1 (± 0.18) different therapies instituted for each individual, which was significantly different from 129 different modalities, with a mean of 2.5 (± 0.18) treatment modes per patient, for the control group. The most frequently used modes of treatment were the flat-plane mandibular biteplane, physiotherapy, NSAIDs, and moist-heat application and massage. Fifty-eight percent of the MVA group received a mandibular biteplane as compared to 64% of the control group; 69% of the MVA group received physiotherapy as compared to 44% of the control group; 64% of the MVA group received NSAIDs as compared to 48% of the control group; and 52% of the MVA group received moist-heat therapy as compared to 42% of the control group. Overall, posttraumatic TMD patients received significantly more therapy, both on an individual basis and as a group, than did control patients, but their response rate was significantly lower.[30] These results are generally comparable to the results obtained in the present study.

Brooke and coworkers[31] and Brooke and Stenn[32] concluded from their studies comparing myofascial pain dysfunction syndrome (MPDS) patients with and without a history of precipitating injury that the prognosis for postinjury MPDS was less favorable than for MPDS in general; these findings support the results obtained in this study.

DeBoever and Keersmaekers[13] compared two groups of TMD patients, one with and one without a history of trauma to the head and neck region directly linked to the onset of symptoms. Both groups responded equally well to conservative treatment as evaluated after 1 year; this finding contradicts the results in the present study, perhaps partly because of differences in the numbers of patients in each group studied (98 in the trauma group versus 302 in the nontrauma group); the patient make-up of the study groups; and the outcome measures used (the Helkimo dysfunction index was used in that study).

The TMD patients were separated into various diagnostic classification subsets in order to assess them as a heterogeneous group. There were few patients with a single diagnosis and several with more than two TMD diagnoses each (this is consistent with the nonhierarchical RDC approach for the clinical TMD conditions, which allows for multiple diagnoses for individual patients[34]). Because of the small numbers of subjects in most of the subgroups, only a limited number of subgroup comparisons could be made. When all of these analyses were performed, there was a total of only four statistically significant parameters, in contrast to the large number of tests actually performed. However, the number of treatments was greater for both the MPD/disc displacement with reduction/arthralgia and for the MPD-only–trauma versus nontrauma group comparisons. There was one variable in each of these groups that showed the trauma subgroups to have examination findings of greater severity at the last clinic visit. There were also several other variables that showed a trend for the trauma group to do less well than the nontrauma group and, in many instances, to receive more treatments.

Seligman and Pullinger[36] used a number of factors, including MVA and non-MVA trauma, to try to define female TMD populations. They used a hierarchical system with mutually exclusive TMD diagnoses (eg, the intracapsular diagnoses groups could include myofascial pain, but the MPD group could not include intracapsular disorders). Motor vehicle accident trauma was a significant factor in defining MPD, but it explained only a very small percentage of the MPD patients. Motor vehicle accident trauma did not remain in the regression equation for intracapsular TMD. Non-MVA trauma was the major defining feature of the TMJ intracapsular disorders. Seligman and Pullinger believed that MVA trauma had weak effects on the TMJ and its associated musculature when studied in group analysis (but they did not indicate the number of MVA trauma subjects included in their analyses), and they also added that their deduction from grouped data

cannot be applied so precisely to individual case histories.[36] It was difficult to classify the trauma (and nontrauma) patients in this study into a single diagnostic category (eg, 88% of the trauma patients were classified as having myofascial pain plus at least one other joint-related diagnosis). The results of the present study also tend to show some role for MVA trauma as a determining factor for the between-group differences, but it may not be as definite when considering the TMD subgroup comparisons as opposed to the trauma and nontrauma groups as a whole. A possible reason for the lack of statistical significance in some of the TMD subgroup comparisons may be the small sample size in each of the subgroups. Further study of larger numbers of subjects in each of several TMD subgroups would be warranted to more fully investigate this question.

An attempt was made to compare trauma patients who had settled an insurance claim prior to their last clinic visit with the nontrauma patients. Some of the literature suggests that litigants recover soon after their claims have been settled.[37] The number of tests that showed differences that were statistically significant was small relative to the number of comparisons performed between these two groups as opposed to the analyses involving the entire trauma group regardless of litigation status. This finding suggests that litigation likely had little, if any, effect on the treatment regimens and outcomes as were able to be determined in this study. This finding would also be consistent with the findings of a separate study of 30 of the same post-MVA TMD patients who participated in the present study,[38] as well as with the conclusions reached following an extensive review of this topic,[39] which suggested that patients do not generally improve shortly after their claims are settled. Although the number of patients who had settled their claims prior to the last visit is small (n = 9), the results in the present study are similar to the other reports cited.

Burgess and Dworkin[40] found in their posttraumatic TMD patient sample that those who were in litigation were in treatment significantly longer, requested more clinical sessions, endorsed greater pain on the visual analog scale (VAS) at the conclusion of treatment, had significantly less pre/post-treatment percentage change in self-reported pain, and indicated significantly less overall percentage improvement than the nonlitigating group. In the present study, patients who settled their claims prior to the last visit were compared to the nontrauma group, but only a few differences were noted. It is appreciated, however, that differences between trauma and nontrauma treatment responses may have been confounded by the variable of litigation.

There are limitations to this study. This is a retrospective chart review of patient files in a private practice, with 50 patients in each of the two groups. There were small numbers of subjects in some of the comparisons (eg, TMD diagnostic classification subsets and trauma patients who had settled their claims prior to the last visit). There were no calibrated or validated means of recording the treatments, treatment outcomes, or final-examination findings, with some of the variables having less than 50 entries. However, all of the patient assessments and treatments were performed by one practitioner, and reasonable efforts were made to be consistent between patients. There was no knowledge at the time that the "final examination" would indeed be the final examination, and certainly not for research purposes. There was no blinding. However, the practitioner saw these patients in the context of a private practice and not with the primary purpose of conducting research on these files in the future. Data were collected and recorded as consistently as possible for all patients in both groups. The composite scores were arbitrarily devised, although they are not unlike those used in the craniomandibular index.[41]

## Summary

The posttraumatic TMD patients in this study, as a group, tended to receive more treatments, have more medications prescribed, have more oral medicine clinic visits over a longer period of time, and have a poorer treatment outcome as compared to the nontrauma TMD patient group. These differences were not as evident when the patients were separated into TMD diagnostic classification subsets, but this may be a result of the small sample size in each of the subgroups.

The poorer treatment outcomes for the trauma patients in this study may have been related to a number of factors, including a greater severity of pretreatment TMD findings, the presence of non-TMD pain (eg, neck) in all trauma-associated TMD patients, and ongoing litigation (although litigation did not seem to have a significant effect when the small numbers involved in this study were assessed).[37,42,43] Nonetheless, 4% of the TMD trauma patients experienced complete resolution of symptoms; 54% reported improvement, with essentially noninvasive therapy that did not include dental procedures (eg, occlusal adjustment, fixed prosthodontics, orthodontic procedures); 40% were essentially unchanged; and only 2% were worse. In contrast, in the nontrauma group, where similar approaches to treatment were prescribed, 14%

resolved, 74% improved, 12% were unchanged, and none was worse at the final follow-up visit. This study thus suggests that while some MVA trauma and nontrauma patients experience complete resolution or significant improvement in symptoms, more trauma patients than nontrauma patients report their posttreatment status as either unchanged or worse. Hence, the results of this study suggest that the prognosis for management of MVA trauma-associated TMD may be more guarded than that associated with non-MVA TMD.

## References


1. Heise AP, Laskin DM, Gervin AS. Incidence of temporomandibular joint symptoms following whiplash injury. J Oral Maxillofac Surg 1992;50:825–828.
2. Probert TCS, Wiesenfeld D, Reade PC. Temporomandibular pain dysfunction disorder resulting from road traffic accidents: An Australian study. Int J Oral Maxillofac Surg 1994;23:338–341.
3. Dornan R, Clark GT. Incidence of trauma induced disease in a TMD clinic population. J Dent Res 1991;70:441.
4. Locker D, Slade G. Prevalence of symptoms associated with temporomandibular disorders in a Canadian population. Community Dent Oral Epidemiol 1988;16:310–313.
5. Goddard G. Articular disk displacement of TMJ due to trauma. J Craniomand Pract 1993;11:221–223.
6. Harkins SJ, Marteney JL. Extrinsic trauma: A significant precipitating factor in temporomandibular dysfunction. J Prosthet Dent 1985;54:271–272.
7. Bakland LK, Christiansen EL, Strutz JM. Frequency of dental and traumatic events in the etiology of temporomandibular disorders. Endod Dent Traumatol 1988; 4:182–185.
8. Schellhas KP. Temporomandibular joint injuries. Radiology 1989;173:211–216.
9. Norman JED. Post-traumatic disorders of the jaw joint. Ann Royal Coll Surg Eng 1982;64:29–36.
10. Weinberg LA, Lager LA. Clinical report on the etiology and diagnosis of TMJ dysfunction-pain syndrome. J Prosthet Dent 1980;44:642–653.
11. Burgess J. Symptom characteristics in TMD patients reporting blunt trauma and/or whiplash injury. J Craniomandib Disord Facial Oral Pain 1991;5:251–257.
12. Pullinger AG, Seligman DA. Trauma history in diagnostic groups of temporomandibular disorders. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1991;71:529–534.
13. De Boever JA, Keersmaekers K. Trauma in patients with temporomandibular disorders: Frequency and treatment outcome. J Oral Rehabil 1996;23:91–96.
14. Goldberg MB, Mock D, Ichise M, Proulx G, Gordon A, Shandling M, et al. Neuropsychologic deficits and clinical features of posttraumatic temporomandibular disorders. J Orofacial Pain 1996;10:126–140.
15. Wiens JP. Acquired maxillofacial defects from motor vehicle accidents: Statistics and prosthodontic considerations. J Prosthet Dent 1990;63:172–181.
16. Weinberg S, Lapointe H. Cervical extension-flexion injury (whiplash) and internal derangement of the temporomandibular joint. J Oral Maxillofac Surg 1987;45: 653–656.
17. Schneider K, Zernicke RF, Clark G. Modeling of jaw-head-neck dynamics during whiplash. J Dent Res 1989; 68:1360–1365.
18. Braun BL, DiGiovanna A, Schiffman E, Bonnema J, Fricton J. A cross-sectional study of temporomandibular joint dysfunction in post-cervical trauma patients. J Craniomandib Disord Facial Oral Pain 1992;6:24–31.
19. Kronn E. The incidence of TMJ dysfunction in patients who have suffered a cervical whiplash injury following a traffic accident. J Orofacial Pain 1993;7:209–213.
20. Pressman BD, Shellock FG, Schames J, Schames M. MR imaging of temporomandibular joint abnormalities associated with cervical hyperextension/hyperflexion (whiplash) injuries. J Mag Res Imag 1992;2:569–574.
21. Lader E. Cervical trauma as a factor in the development of TMJ dysfunction and facial pain. J Craniomand Pract 1983;1:85–90.
22. Roydhouse RH. Whiplash and temporomandibular dysfunction. Lancet 1973;1:1394–1395.
23. McKenzie JA, Williams JF. The dynamic behaviour of the head and cervical spine during 'whiplash'. J Biomech 1971;4:477–490.
24. Williams JF, McKenzie JA. The effect of collision severity on the motion of the head and neck during 'whiplash'. J Biomech 1975;8:257–259.
25. Howard RP, Benedict JV, Raddin JH, Smith HL. Assessing neck extension-flexion as a basis for temporomandibular joint dysfunction. J Oral Maxillofac Surg 1991;49:1210–1213.
26. Howard RP, Hatsell CP, Guzman HM. Temporomandibular joint injury potential imposed by the low-velocity extension-flexion maneuver. J Oral Maxillofac Surg 1995;53:256–262.
27. Wang V, Truelove EL. Trauma in development of temporomandibular disorders. J Dent Res 1988;67:144.
28. Truelove E, Burgess J, Dworkin S, Lawton L, Sommers E, Schubert M. Incidence of trauma associated with temporomandibular disorders. J Dent Res 1985;64:339.
29. Truelove E, LeResche L, Dworkin S, Sommers E. Trauma in painful TMD: Objective and subjective measures of injury. J Dent Res 1989;68:259.
30. Romanelli GG, Mock D, Tenenbaum HC. Characteristics and response to treatment of posttraumatic temporomandibular disorder: A retrospective study. Clin J Pain 1992;8:6–17.
31. Brooke RI, Stenn PG, Mothersill KJ. The diagnosis and conservative treatment of myofascial pain dysfunction syndrome. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1977;44:844–852.
32. Brooke RI, Stenn PG. Postinjury myofascial pain dysfunction syndrome: Its etiology and prognosis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1978;45:846–850.
33. Okeson JP (ed). Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management. Chicago: Quintessence, 1996.
34. Dworkin SF, LeResche L (eds). Research diagnostic criteria for temporomandibular disorders: Review, criteria, examinations and specifications, critique. J Craniomandib Disord Facial Oral Pain 1992;6:301–355.
35. SPSSX. SPSS-X User's Guide. 3rd ed. Chicago: SPSS, 1988.
36. Seligman DA, Pullinger AG. A multiple stepwise logistic regression analysis of trauma history and 16 other history and dental cofactors in females with temporomandibular disorders. J Orofacial Pain 1996;10:351–361.
37. Miller H. Accident neurosis. BMJ 1961;1:919–925, 992–998.

38. Kolbinson DA, Epstein JB, Burgess JA, Senthilselvan A. Temporomandibular disorders, headaches, and neck pain after motor vehicle accidents: A pilot investigation of persistence and litigation effects. J Prosthet Dent 1997;77: 46–53.
39. Kolbinson DA, Epstein JB, Burgess JA. Temporomandibular disorders, headaches, and neck pain following motor vehicle accidents and the effect of litigation: Review of the literature. J Orofacial Pain 1996;10:101–125.
40. Burgess JA, Dworkin SF. Litigation and post-traumatic TMD: How patients report treatment outcome. J Am Dent Assoc 1993;124:105–110.
41. Fricton JR, Schiffman EL. The craniomandibular index: Validity. J Prosthet Dent 1987;58:222–228.
42. Parker N. Accident neurosis. Med J Aust 1970;2:362–365.
43. Berry H. Psychological aspects of chronic neck pain following hyperextension-flexion strains of the neck. In: Morley TP (ed). Current Controversies in Neurosurgery. Philadelphia: Saunders, 1976: 51–60.

## Resumen

### Signos Iniciales, Síntomas y Cualidades Diagnósticas: Comparación de los Pacientes con Desórdenes Temporomandibulares con o sin Antecedentes de Accidentes Automovilísticos

La influencia del trauma previo en el manejo de los pacientes con desórdenes temporomandibulares (DTM) es controversial. Los propósitos de este estudio fueron los de comparar los régimenes de tratamiento y sus resultados en pacientes con DTM que habían sufrido trauma ocasionado por accidentes automovilísticos en comparación con pacientes sin historia de trauma, y con DTM. Se revisaron los archivos de pacientes con DTM: 50 pacientes con trauma y 50 sin trauma. Se registró la información relacionada al tratamiento recibido, al progreso de los síntomas al recibir tratamiento, y a los hallazgos del examen final. En general los pacientes que habían sufrido trauma tendían a recibir mas tipos de tratamiento ($P < 0,0001$), más medicaciones (incluyendo analgésicos, $P < 0,001$), drogas antiinflamatorias no esteroides, $P = 0,001$; relajantes musculares, $P = 0,001$; y antidepresivos tricíclicos, $P < 0,001$); tendían a visitar más la clínica de medicina oral ($P = 0,07$) y durante un período más largo ($P = 0,06$), también tendían a presentar unos resultados de tratamiento más pobres ($P < 0,001$) en comparación con el grupo que no había sufrido trauma. Cuando los pacientes fueron separados de acuerdo a las subgrupos de clasificación diagnóstica de los DTM, sólo se observaron algunas de estas diferencias entre los pacientes con trauma y sin trauma, pero los tamaños del conjunto de subgrupos fueron pequeños y sólo algunos de los grupos pudieron ser comparados. No parecía haber un efecto significativo al efectuar la conciliación de los reclamos de seguros, antes de la última visita clínica. Parece ser que el trauma puede ser un factor de pronóstico importante en el manejo de algunos pacientes con DTM.

## Zusammenfassung

### Ein Vergleich von TMD-Patienten mit oder ohne frühere Beteiligung an einem Autounfall: Anfangszeichen, Symptome und diagnostische Charakteristika

Der Einfluss früherer Traumata in der Behandlung von Patienten mit temporomandibulären Erkrankungen (TMD) ist umstritten. Die Ziele dieser Studie waren der Vergleich von Behandlungsabläufen und Folgen bei durch einen Autounfall verursachten gegenüber von nichttraumatischen TMD-Patienten. Die Unterlagen von 50 Trauma-Patienten und 50 entsprechenden Nichttrauma-Patienten wurden untersucht. Informationen betreffend erhaltener Therapie, Fortschreiten der Symptome mit Therapie und Befunde der letzten Untersuchung wurden aufgenommen. Als ganze Gruppe neigten die posttraumatischen TMD-Patienten dazu, mehr Behandlungstypen erhalten zu haben ($P <$ .0001), mehr Medikamente verschrieben bekommen zu haben (einschliesslich Analgetika, $P <$ .001; nichtsteroidale Entzündungshemmer, $P <$ .001; Muskelrelaxantien, $P <$ .001; sowie trizyklischen Antidepressiva, $P <$ .001), häufiger zahnärztliche Kliniken ($P <$ .07) über eine längere Zeitperiode ($P <$ .06) aufzusuchen und ein schlechteres Behandlungsergebnis zu erreichen ($P <$ .001) verglichen mit der Nichttrauma-Gruppe. Wenn die Patienten in Untergruppen nach diagnostischer TMD-Klassifikation aufgeteilt werden, bestehen nur einige dieser Unterschiede zwischen den Trauma- und Nichttrauma-Patienten, aber die Grösse der Untergruppen war klein und nur wenige der Gruppen konnten verglichen werden. Es scheint keine signifikante Auswirkung zu geben, Versicherungsansprüche vor der letzten Kliniksitzung zu regeln. Traumata mögen ein wichtiger prognostischer Faktor in der Behandlung von einigen TMD-Patienten darstellen.