

# Chiropractic treatment of patients in motor vehicle accidents: a statistical analysis<sup>†</sup>

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*Motor vehicle accidents (MVA) are a major cause of spinal injuries treated by chiropractors. In this study the files of one chiropractor were reviewed retrospectively to generate a data base on the MVA cases (n = 149). The effect of age, sex, vehicle damage, symptoms and concurrent physiotherapy on the dependent variables of number of treatments, improvement and requirement for ongoing treatment was computed using an analysis of variance. Overall the average number of treatments given was 14.2. Patients who complained of headache or low back pain required more treatments than average. Improvement level was lowered by delay in seeking treatment, the presence of uncomplicated nausea and advancing age. Ongoing treatment to relieve persistent pain was required in 40.2 percent of the cases. None of the factors studied had a significant effect on this variable. The results of this study are comparable to those reported in the medical literature.*  
(JCCA 1992; 36(3):139-145)

**KEY WORDS:** motor vehicle accident, chiropractic, manipulation.

*Les accidents de voitures représentent la cause majeure des blessures de la colonne vertébrale traitées par les chiropracteurs. Dans cette étude, les dossiers d'un chiropracteur ont été revus de manière rétrospective pour créer une banque de données de cas d'accidents de la route (n = 149). Les effets de l'âge, du sexe, des dégâts du véhicule, des symptômes et de la physiothérapie courante sur les variables dépendantes du nombre de traitements, des améliorations et des besoins de traitement continu ont été calculés en utilisant l'analyse de variance. Au total, le nombre moyen de traitements était de 14,2. Les patients qui se plaignaient de maux de tête et de douleurs du bas du dos ont nécessité plus de traitements que la moyenne. Le niveau d'amélioration était inférieur dans les cas où les patients ont attendu avant de se faire soigner, en présence de nausée simple et chez les personnes plus âgées. Un traitement continu pour soulager une douleur persistante a été nécessaire dans 40,2 pour cent des cas. Aucun des facteurs étudiés n'a d'effet significatif sur cette variable. Les résultats de cette étude sont comparables à ceux rapportés dans la documentation médicale.*  
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## Introduction

Motor vehicle accidents (MVA) are a major cause of spinal injury, with a significant percentage of those injured having persistent pain regardless of treatment.<sup>1-5</sup> Widespread seatbelt use has reduced injury from violent contact but has led to an increase in soft tissue injuries to the neck.<sup>6</sup> Chiropractors are well suited to the management of injury from motor vehicle accidents; however there is little data available on the use of spinal manipulation in this regard. Opinions regarding treat-

ment vary from: early manipulation in less severe injuries,<sup>7</sup> manipulation only of areas distal to the injury site until later in the treatment regime<sup>8</sup> and no manipulation until at least the post acute stage, if at all.<sup>9</sup> One prospective randomized trial of early mobilization using Maitland technique had a significant decrease in pain and increase in movement at four and eight week intervals after the accident when compared to a control group receiving a collar and rest.<sup>10</sup>

A retrospective study of chiropractic treatment of patients in MVA is presented. This study was undertaken to assess the treatment outcome where spinal manipulation was the major treatment modality.

## Materials and methods

All patients of one chiropractor from 1981 to 1991 were reviewed individually to identify those files in which patients were involved in car accidents. Files were eliminated if patients did not complete treatment, could not be reached for follow up

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† Poster presentation, World Chiropractic Congress, May 1991, Toronto, Canada.

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or had seen another chiropractor. This yielded 149 eligible files from a total of 3,224. Treatment consisted mainly of manipulation, begun immediately after examination. If radiographs were taken, manipulation was delayed until the following day. The injured segments were manipulated as well as those distal to the injury site, as determined by motion palpation. In some cases ultrasound, cervical collar, ice or heat were used. Later in the treatment regime, some patients had to begin an exercise program, make changes to work or sleep environment, have foot orthotics fitted or undergo massage therapy. The only treatment received uniformly by all patients was manipulation.

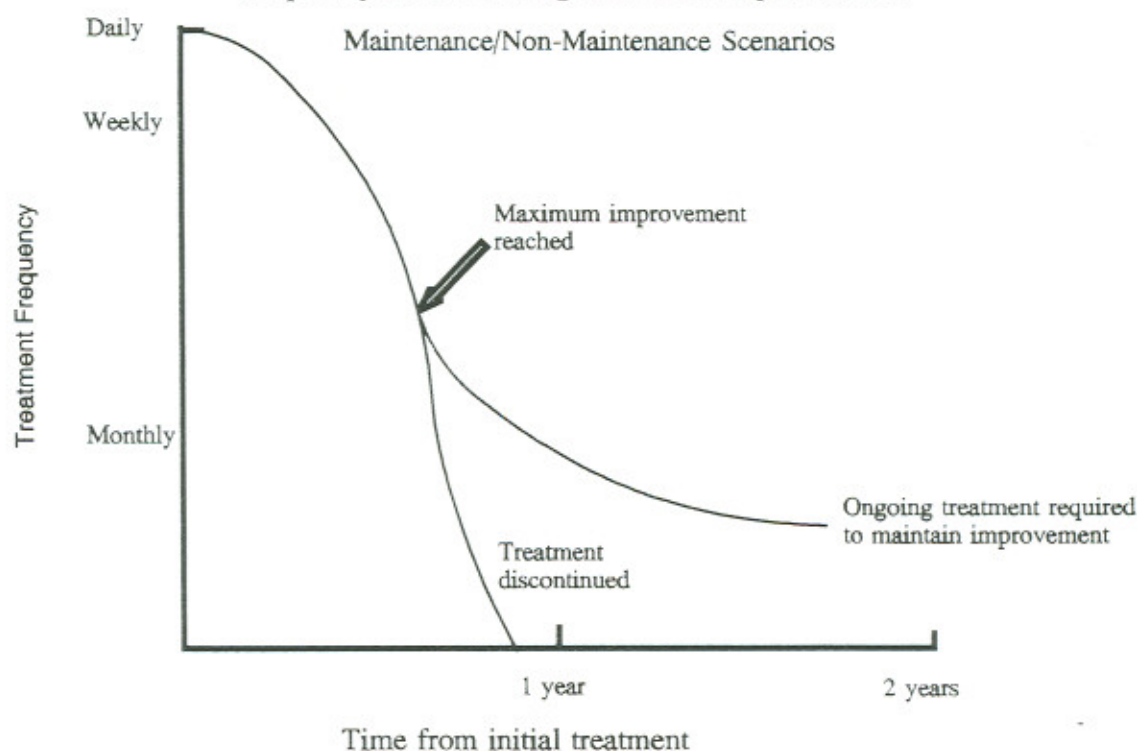
Data on age, sex, delay in seeking treatment, pain location and presence of headache were obtained from the clinical notes. Symptoms other than pain were recorded under the heading neurological symptoms. These included nausea, dizziness or vertigo, paresthesia or a combination of symptoms. Symptoms were only included if they were present at the time of examination. Note was also made of patients who had received physiotherapy or were still undergoing physiotherapy.

Vehicle damage was determined from patient histories and categorized as: no damage (repairs under one thousand dollars and no police report), some damage (vehicle damage but repaired, police report completed) and written off (damage too extensive to repair the vehicle).

Treatment outcome was classified as follows: no improvement (usually referred for orthopedic evaluation), somewhat improved (improvement in pain and mobility but not returned to the pre-accident state) and much improved (returned to the pre-accident state). The patients were classified into three categories on the basis of patient histories, progress notes on reported pain and physical limitations, and on clinical findings such as ranges of motion, orthopedic tests and motion palpation findings.

The number of treatments was defined as those completed at the time maximum improvement was realized. For patients who were much improved this would correspond to a symptom free state, while for the no improvement group this would be the point at which treatment was discontinued. For the somewhat improved group the maximum improvement was identified as the point at which the symptoms did not subside any further although treatment continued. After maximum improvement was reached the treatment was gradually eliminated and either discontinued (non-maintenance)—or continued on a periodic basis to maintain the improvement (maintenance). This pattern is illustrated in Figure 1. The maintenance patient is one who had a return of symptoms if treatment was discontinued, and corresponds to the patients reporting persistent pain in other studies.

**Figure 1 A simple treatment response model.  
Patients with persistent pain fail to drop down to a zero treatment frequency after reaching maximum improvement.**



**Table 1** Comparison of similar results in the literature.

	n	Average Age	% Male	% Female	% of Patients with Persistent Pain
Macnab(1971) <sup>1</sup>	266	-	-	-	45
Hohl (1974) <sup>2</sup>	146	30.4	37	63	43
Norris and Watt (1983) <sup>3</sup>	61	37	50	50	66
Deans et al. (1986) <sup>4</sup>	85	-	-	-	42
Maimaris et al. (1988) <sup>5</sup>	102	37	43	57	34.3
<b>This Study</b>	149	34.9	41	59	40

**Table 2** General population statistics.

		n	%
Delay in seeking treatment	0-7 days	46	30.9
	8-30	32	21.5
	31-60	16	10.7
	61-90	10	6.7
	91-180	13	8.7
	181-365	8	5.4
	> 365	24	16.1
Damage to Vehicle	Little or none	36	24
	Damage but repairable	97	65
	Written off	16	11
Physiotherapy	Ongoing or previous	21	14
	Chiropractic treatment only	128	86
Pain	Neck and/or thoracic	73	49
	Low back and neck/thoracic pain	60	40
	Low back pain only	16	11
Neurological Symptoms	None	112	75.1
	Nausea	5	3.4
	Paresthesia	16	10.7
	Dizziness or vertigo	8	5.4
	Mixed Symptoms	8	5.4
Headache	Absent	95	64
	Present	54	36

Journal entries of data were transferred to a computer data base with improvement levels assigned numbers as follows: 1 – no improvement, 2 – somewhat improved, 3 – much improved. The data were analyzed using a Multifactor Analysis of Variance.\* Output is listed for the individual variables of improvement, treatment numbers and maintenance requirement showing values in the categories of age, sex, delay in seeking treatment and symptoms. F ratios, degrees of freedom and confidence levels were calculated. Interaction between the outcome variables was also tested (e.g. improvement versus maintenance), as well as two factor interactions (e.g. improvements vs headache and damage).

### Results

The average age of the sample group was 34.9 years, ranging from 7–74 years, with females constituting 59 percent of the sample. This is comparable to other studies in the literature shown in Table 1. Forty (40) percent of patients had persistent pain (maintenance), again comparable to values reported in the literature.

The average number of treatments was 14.2, ranging from 1–70. Improvement was as follows: none 4.0%; somewhat improved, 12.1%; much improved, 83.1%. The general population statistics are presented in Table 2. Over half of the patients were seen less than 4 weeks after the accident and the majority of patients had not had physiotherapy. Neck pain was the most common symptom followed by low back pain and headache. Seventy-five (75) percent did not have any significant neuro-

logical symptoms at the time of their first examination.

Confidence levels derived from computerized F ratios are shown in Table 3. For simplicity, only the confidence levels are listed. The significant confidence levels of 95% or higher are highlighted. No statistically significant interactions between improvement, maintenance or number of treatments were observed. There was no significant two factor interactions.

Improvement was affected by age, delay in seeking treatment and neurological symptoms as shown in Figure 2. There is a trend toward decreasing improvement with increasing age until the 6th decade. It should be noted that the number of patients in the highest age categories was small at  $n = 3$  for 61–70 years and  $n = 1$  for the  $> 71$  group. Delay in seeking treatment resulted in poorer improvement until the 60 day point where average improvement increased again and then declined thereafter. The values all fell midway from somewhat to much improved. Neurological symptoms had very little effect on improvement with the exception of nausea. Those that experienced nausea and pain in the absence of paresthesia, vertigo or dizziness had the worst average improvement of any group in this analysis.

The number of treatments required to attain the improvement was affected by pain site only (Figure 3). Patients with headache required more treatments than those without. Patients with combined neck, thoracic and low back pain required substan-

\* Statistical Graphics Corporation, 2115 East Jefferson Street, Rockville, Maryland, USA 20852.

**Table 3 Confidence levels (%)  
for factors affecting treatment outcome.\***

	Number of Treatments	Improve- ment	Maintenance Requirement
Age	47.0	<b>98.1</b>	20.4
Sex	62.3	1.7	86.6
Delay	79.0	<b>98.3</b>	74.1
Damage	94.1	63.7	89.4
Symptoms:			
Pain	<b>99.1</b>	30.4	14.5
Neurological	78.9	<b>&gt;99.9</b>	55.7
Headache	<b>95.2</b>	15.7	50.5
Previous or ongoing physiotherapy	58.6	52.5	94.9

\* Note: No statistically significant two-factor interactions were observed. There were no significant interactions between the outcome variables.

Figure 2 Statistically significant factors affecting improvement.

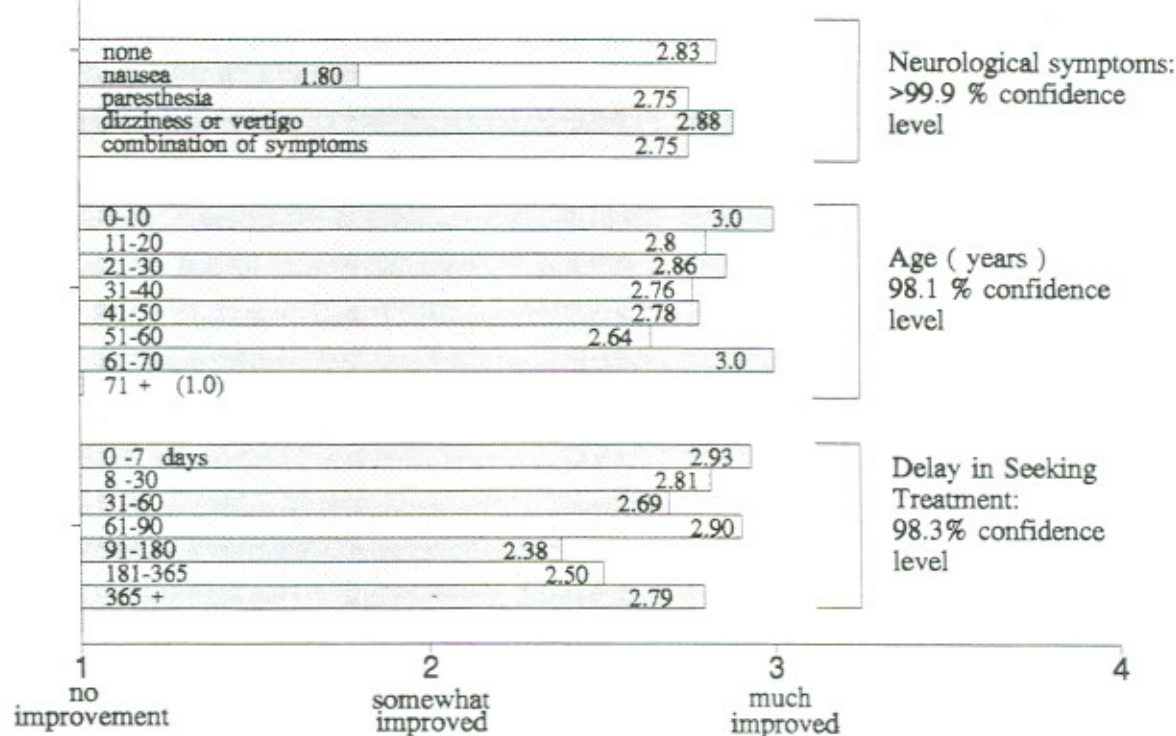
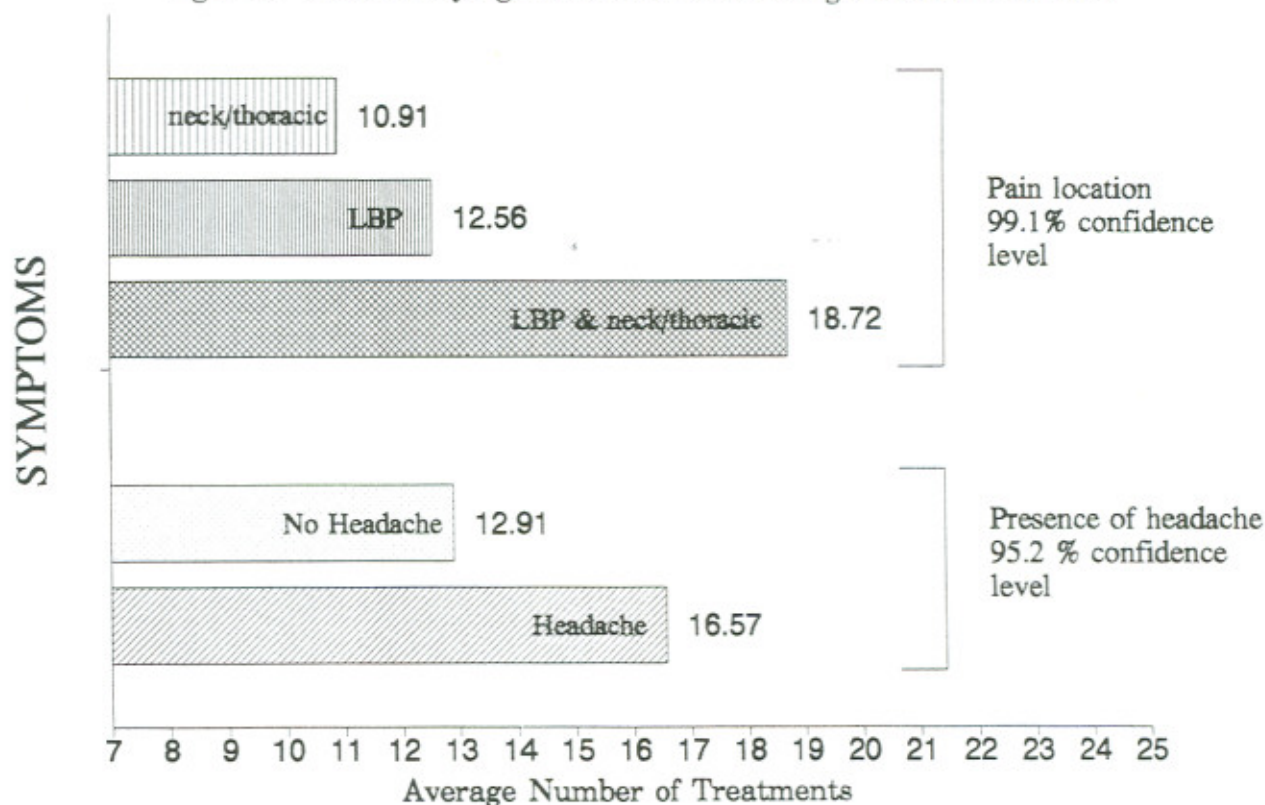
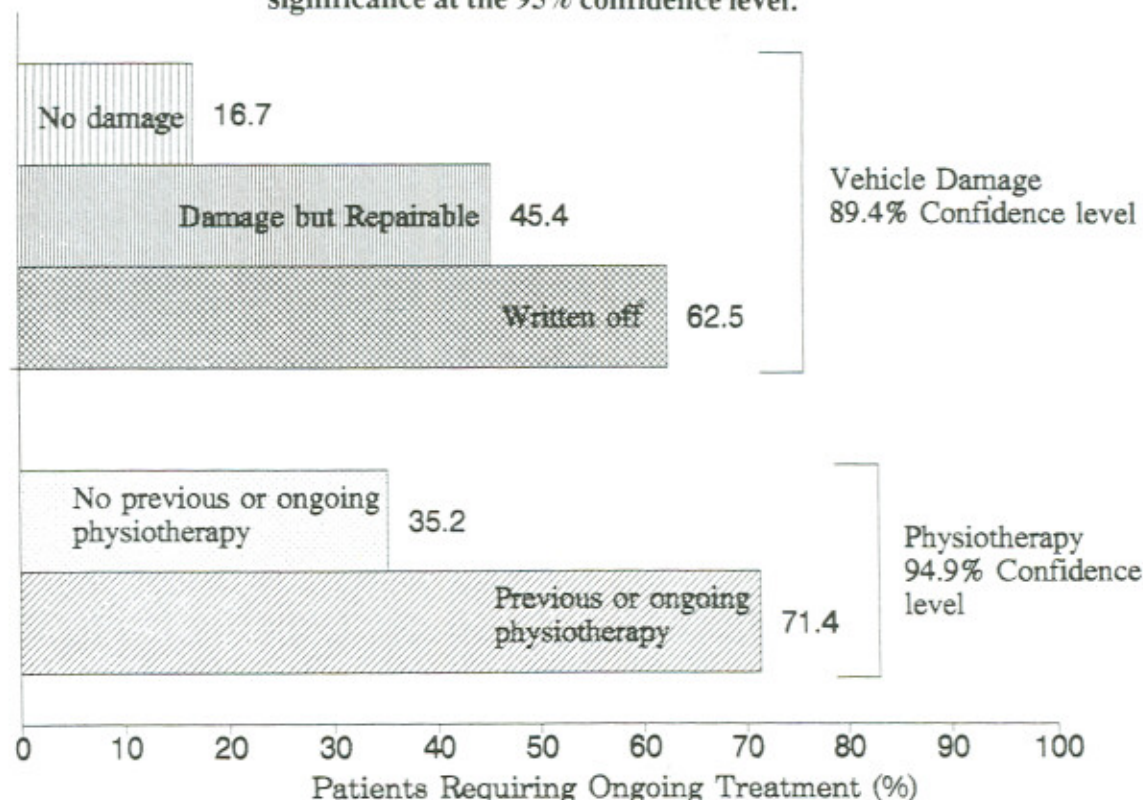


Figure 3 Statistically significant factors affecting treatment numbers.



**Figure 4** Factors affecting maintenance requirement that approach significance at the 95% confidence level.



tially more treatments than those that had pain in either location alone. Treatment numbers were unaffected by any other factors studied.

There were no factors that significantly affected the requirement for maintenance. Two factors that approached significance were vehicle damage at the 89.4 percent confidence level and previous or ongoing physiotherapy at 94.9 percent, as shown in Figure 4. The percentage of patients requiring maintenance increased with vehicle damage and if there was previous or ongoing physiotherapy. Age, sex, delay in seeking treatment, pain location, presence of neurological symptoms, headache, relative improvement and number of treatments given did not have any discernable effect on the requirement for maintenance.

### Discussion

The results of this study compare with those in the medical literature in regards to the number of subjects, average age, sex distribution and percentage of patients who have persistent pain. There appear to be some specific differences in treatment outcome in our data that may be a result of the type of manipulation being employed. Persistent pain as reported in the medical literature is synonymous to a requirement for maintenance in the

present study. Patients who required periodic treatment to maintain their improvement had the pain re-occur if treatment was discontinued, which would have placed them in the persistent pain group in other studies. It appears that manipulation may have a role to play in long term pain relief for these patients. Possibly they have had some form of permanent soft tissue damage as a result of their accident. These patients typically are treated once every 1–3 months to remain pain free. Manipulation has been shown to increase pain tolerance<sup>11</sup> and produce a small increase in beta-endorphins,<sup>12</sup> although these are thought to be only short term effects. This is an area which requires further investigation.

The improvement rating was employed in this study in an attempt to determine which factors have an effect on manipulative treatment in accident cases. The medical studies quoted have typically relied on pain/no pain classifications, and it was thought in this study that a middle ground between them would generate more useful data. The level of improvement of a patient is not entirely objective or accurate in every case and this may in part be responsible for the variations between categories in the age, delay and neurological groups. There appears to be some rationale for the early use of manipulation after a motor

vehicle accident. The data indicate the best overall improvement on those who are treated within one week of the accident. Croft and Foreman<sup>7</sup> have referred to this time period as the "golden week" because the inflammatory reaction which occurs during this period, if left unchecked, will produce scars and adhesions that make future management more difficult.

A general trend toward less improvement with advancing age was observed. Hohl<sup>2</sup> and Maimaris et al.<sup>5</sup> found that those patients with persistent symptoms had a higher mean age than the symptom free group; while Dean et al.<sup>4</sup> did not see a statistically significant correlation between age and persistent neck pain.

The presence of nausea without paresthesia or balance disturbances reduced the improvement level greatly. The reason for this observed effect is unknown. The origin of the nausea must be outside structures affected by manipulative treatment.

Treatment numbers used in this study are not total treatments given each patient, only those given up to the point at which maximum improvement was achieved. Pain site significantly affected the treatment numbers. Neck and/or thoracic pain or low back pain occurring separately required fewer treatments than when they occurred together in the same patient, which is probably an indication of a more severe injury. The presence of low back pain increased the number of treatments needed. Headache increased the number of treatments required but did not affect improvement or maintenance requirements. Maimaris<sup>5</sup> found that the presence of headache was a statistically significant factor in producing a poor prognosis. It may be that the lack of that effect in our data is due to the efficacy of manipulation in the treatment of cervicogenic headache.<sup>13</sup>

The requirement for periodic treatment to maintain improvement level does not seem to be affected by any of the factors in this study. Vehicle damage approached significance with more damage seeming to infer an increased need for maintenance. The fact that a patient had or was having physiotherapy may simply indicate that the physiotherapy did not produce symptom relief because of the severity of the injury, causing the patient to seek alternative care. Both instances suggest that some form of permanent soft tissue damage has occurred which makes permanent biomechanical correlation less likely. This cannot be confirmed by the present data.

### Conclusions

The data obtained from this study are comparable to similar studies reported in the medical literature. The inclusion of manipulation in the treatment regime seems to help control persistent pain from injuries due to motor vehicle accidents when continued periodically. Early treatment may improve the treatment outcome; while the results are slightly favourable with advancing age. Nausea in absence of balance disturbances or paresthesia indicated a poor improvement according to our data. Treatment numbers were increased with the presence of headache or low back pain.

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