SPINE Volume 25, Number 14, pp 1782–1787

Early Intervention in Whiplash-Associated Disorders

A Comparison of Two Treatment Protocols

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Study Design. A prospective randomized trial in 97 patients with a whiplash injury caused by a motor vehicle collision.

Objectives. The study evaluates early active mobilization *versus* a standard treatment protocol and the importance of early *versus* delayed onset of treatment.

Summary of Background Data. There is no compelling evidence to date on the management of acute whiplash-associated disorders. The few studies describing treatment, however, provide evidence to support the recommendation that an active treatment in the acute stage is preferable to rest and a soft collar in most patients.

Methods. Patients were randomized to four groups. Active *versus* standard treatment and early (within 96 hours) *versus* delayed (after 2 weeks) treatment. Measures of range of motion and pain were registered initially and at 6 months.

Results. Eighty-eight patients (91%) could be followed up at 6 months. Active treatment reduced pain more than standard treatment ($P < 0.001$). When type and onset of treatment were analyzed, a combined effect was seen. When active treatment was provided, it was better when administered early, and if standard treatment was provided, it was better when administered late for reduction of pain ($P = 0.04$) and increasing cervical flexion ($P = 0.01$).

Conclusions. In patients with whiplash-associated disorders caused by a motor vehicle collision treatment with frequently repeated active submaximal movements combined with mechanical diagnosis and therapy is more effective in reducing pain than a standard program of initial rest, recommended use of a soft collar, and gradual self-mobilization. This therapy could be performed as home exercises initiated and supported by a physiotherapist. [Key words: neck injuries, whiplash injuries, whiplash injury complications, whiplash injury therapy] **Spine 2000;25:1782–1787**

The term whiplash injury was introduced in 1928 by the American orthopedist H. E. Crowe.[4] It was defined as the effects of sudden acceleration–deceleration forces on the neck and upper trunk due to external forces exerting a "lash-like effect." Crowe emphasized that the term whiplash "describes only the manner in which a head was moved suddenly to produce a sprain in the neck."

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Financial support was provided by Swedish National Health Insurance.
Acknowledgment date: December 4, 1998.
First revision date: June 28, 1999.
Acceptance date: September 27, 1999.
Device status category: 1.
Conflict of interest category: 14.

The Quebec Task Force on Whiplash-Associated Disorders (WAD) redefined "whiplash" in 1995: "Whiplash is an acceleration–deceleration mechanism of energy transfer to the neck which may result from rear-end or side impact, predominantly in motor vehicle collisions, but also from diving accidents, and from other mishaps. The energy transfer may result in bony or soft tissue injuries (whiplash injury), which in turn may lead to a wide variety of clinical manifestations (whiplash-associated disorders)."[18]

Despite the improvement of protective properties in vehicles, the number and proportion of acceleration–deceleration injuries to the cervical spine have increased substantially from the 1970s to the 1990s.[10] There is no compelling evidence to date on the management of acute whiplash injuries.[1,2] Nonetheless, there are a few studies describing treatment that provide evidence in favor of early active movement and/or encouragement to perform at the preinjury activity level.[3,14–16,18]

Despite studies showing the detrimental effect of rest and a cervical collar,[3,15,16] this treatment method is still commonly recommended to patients in Sweden in the early management of WAD.[6,9]

The McKenzie system,[13] or mechanical diagnosis and therapy, classifies spine-related disorders on the basis of the mechanical (such as range of motion) and symptomatic responses (such as pain) to repeated movements, positions, and activities derived from the history and during assessment. Treatment is predicated on the result of the analysis of these symptomatic responses, and the emphasis is on home exercises. Therapist techniques may be added if home exercises are insufficient in reducing symptoms. The McKenzie treatment protocol has the advantage of emphasizing self-treatment, and thus using only small resources of the health care system. It has not, however, been validated in patients with acute whiplash injuries.

The present study's purpose was to compare the efficacy of an active treatment protocol, as outlined by McKenzie, with that of a standard treatment protocol for acute whiplash injuries and to investigate the importance of early *versus* delayed initiation of treatment.

Method

Beginning in March 1995, consecutive patients with an acute whiplash injury were enrolled in the study. The patients were referred to the study from the southern half of Elfsborg County in southwestern Sweden, a mixture of urban, village, and rural populations. After initial measurements, the patients were randomized into the different treatment groups. The Ethics Committee, Göteborg University, approved the study.

Selection of Patients. The patients were selected consecutively by physicians in 29 primary care units, 3 emergency wards, and several private clinics. The criterion for inclusion was an acute neck sprain caused by rapid movements of the head resulting from acceleration forces produced by the impact of a motor vehicle collision. Cervical spine radiographs were obtained in all patients. Patients with cervical fractures, cervical dislocation, head injury, previously known symptomatic chronic neck problems, alcohol abuse, dementia, serious mental diseases, or diseases that could be expected to cause death before the study's completion were not included. After obtaining the patient's consent, those patients who could be randomized within 96 hours after trauma were referred to the study.

Measurements. Patients were then called to a primary care unit where they were assessed for range of motion (ROM) by a medical laboratory technologist or a registered nurse. A cervical measurement system was used to measure lateral flexion, extension–flexion, and rotation. In the cervical measurement system, an inclinometer is used to measure ROM in the sagittal and frontal plan and a compass to measure cervical rotation. The retest reliability of the system has been established.[5] The patients were also assessed for intensity of head, neck, or shoulder pain by means of a visual analog scale (VAS). The patients were measured a second time 6 months after trauma. At the 6-month follow-up, the patients were asked whether they had received cointerventions from other sources outside the control of the study.

Randomization. Immediately after the initial measurements were taken, the patients were randomized into one of four groups: active treatment received within 96 hours after trauma (Group 1), standard treatment given within 96 hours (Group 2), active treatment with a delay of 14 days after trauma (Group 3), and standard treatment given after 14 days (Group 4). The patients were not prescribed any treatment during the delay period of 14 days, apart from any instructions given by the physician who initially referred them to the study.

To minimize withdrawals after randomization, the initial measurements were made before randomization. However, no withdrawals occurred between initial measurements and randomization. The previously named personnel made the initial measurements. Different personnel then performed the randomization. The outcome of the initial measurements did not affect the randomization procedure in any way.

Treatment. *Active Protocol.* The treatment protocol tested is an active exercise and posture protocol considered consistent with McKenzie's principles[13] and developed in personal communication with Mark Laslett, New Zealand Registered Physiotherapist. The treatment protocol was presented at a course in mechanical diagnosis and therapy in Sweden by Laslett in May 1993 (Part B, Mechanical Diagnosis and Therapy: The Cervical and Thoracic Spine). The early and repeated movement concept comes from Laslett's interpretation of Salter's work on continuous passive motion[17] and Laslett's clinical experience in whiplash injuries.

Patients were instructed to perform gentle, active, small-range and amplitude rotational movements of the neck, first in one direction, then the other. The movements were repeated 10 times in each direction every waking hour. The movements were performed up to a maximum comfortable range. Patients were instructed to perform these home exercises in the sitting position if symptoms were not too severe. The unloaded supine position was used when the sitting position was too painful. Guidelines were provided for safe home exercising by teaching the patient to identify warning signs that could lead to exacerbation or recurrence of symptoms. In the event of an increase of symptoms, treatment was adjusted by either reducing the amplitude of the movements, by reducing the number of movements, or both.

If symptoms persisted 20 days after the motor vehicle collision, the patient was examined by a dynamic mechanical evaluation consistent with the McKenzie protocol.[12] An individual treatment program also based on McKenzie principles and further developed by Laslett[11] was added to the initial program of rotational movements. These movements could be cervical retraction, extension, flexion, rotation, lateral flexion, or a combination of these, depending on which movements were found to be beneficial during the assessment.

Standard Protocol. The patients receiving standard treatment were given a leaflet providing information about injury mechanisms, advice on suitable activities, and instructions on postural correction. This leaflet was produced at the Neck Injury Unit, the Orthopedic Clinic Sahlgrenska University Hospital, Göteborg. The advice provided in this leaflet during the first weeks after the injury was to rest the neck. Furthermore, patients were informed that a soft collar could provide comfort and prevent the neck from excessive movement. In the leaflet the patients were instructed to begin performing active movements, two or three times daily a few weeks after the injury. The recommended movements were: elevation of shoulders, retraction of the shoulder blades, rotation of the torso, lateral flexion of the head, rotation of the head and combined flexion–rotation of the head.

Statistical Analysis. Differences in initial measurements among the four groups (Table 1) were determined by analysis of variance (Kruskal–Wallis one-way analysis of variance was used in case of statistically significant differences in variance between groups) or χ^2. Improvements during the first 6 months after trauma in ROM and pain level (Table 2) were compared between the groups with two-way analysis of variance by computer (SAS ver. 6.11; SAS, Cary, NC)

■ Results

Of 102 consecutive patients randomized and included in the study within 96 hours after an acute neck sprain incurred in a motor vehicle collision, five patients were later excluded when it was discovered that they did not fulfill the inclusion criteria and were incorrectly included. Of these five patients, two had chronic neck pain and three had injury mechanisms other than motor vehicle collision. Of the remaining 97 qualifying patients, 88 (91%) could be followed-up after 6 months. The reasons for loss of follow up were: one person moved abroad, one person could not be traced, one person sustained a new neck injury and was then excluded, one was dissatisfied with the information concerning the study, and one was dissatisfied with the treatment protocol. Two patients had fear of traveling after their involvement in a

Table 1. Groups of Patients With Whiplash Injury Included in the Study

Type of treatment Treatment initiated	Group 1 Active within 96h	Group 2 Standard within 96h	Group 3 Active after 2 weeks	Group 4 Standard after 2 weeks
Number	21	23	22	22
Mean age (years)	39	33	32	38
Sex (male/female)	8/13	8/15	8/14	5/17
Initial pain level[1]	37 (43)	30 (34)	35 (40)	39 (42)
No initial pain[2]	1	2	0	1
Low initial pain[3]	1	5	0	4
High initial pain[4]	0	0	1	2
ROM-Lateral Flexion[5]	65.2	66.2	64.2	53.7
ROM-flexion[6]	40.4	44.5	49.8	41.3
ROM-extension[7]	50.0	51.4	49.1	48.1
ROM-flexion + ext.[8]	90.4	95.9	98.9	89.4
ROM-rotation[9]	114	119	121	101
ROM-total[10]	270	282	285	244
Follow-up[11]	213	244	219	256

[1] Visual Analogue Scale (VAS) indicating level of cervical pain. Length 100 mm. Higher values indicate higher pain levels. Median (mean) values.
[2] Number of patients stating 0 in VAS.
[3] Number of patients stating 0–10 in VAS.
[4] Number of patients stating ≥90 in VAS.
[5] Range of motion (ROM) - Lateral flexion in the cervical spine. Mean values.
[6] ROM - Extension in the cervical spine. Mean values.
[7] ROM - Flexion in the cervical spine. Mean values.
[8] ROM - Extension + flexion in the cervical spine. Mean values.
[9] ROM - Rotation in the cervical spine. Mean values.
[10] Total ROM in the cervical spine. Lateral flexion, extension/flexion, and rotation were summed. Mean values.
[11] Mean number of days from inclusion in the study to the follow-up.

collision and did not want to continue participation in the study. Two persons gave no explanation for withdrawing from the study.

The differences among the four groups in age, sex, initial pain level, lateral flexion, flexion, extension, flexion–extension, rotation, total ROM or interval between inclusion and follow-up were not statistically significant (Table 1).

Of the patients receiving active treatment, 2 needed one instruction and treatment session, 13 needed two sessions, and 10 needed three sessions. The remaining patients received more than three sessions. The mean number of instruction–treatment sessions in the active treatment groups was 3.95. Symptoms persisting more than 20 days were seen in 63% (27/43) of the patients in the active treatment group. They were further examined and treated as described previously.

Evaluation of the two treatment protocols showed that 6 months after treatment, the reduction in pain was greater for those receiving active treatment than in those receiving standard treatment ($P < 0.001$; Table 2). No differences could be seen in the improvement of cervical ROM between the active treatment protocol and the standard treatment protocol (Table 2).

Table 2. Follow-Up at 6 Months in the Four Groups of Patients With Whiplash Injury

Type of treatment Treatment initiated	Group 1 Active within 96h	Group 2 Standard within 96h	Group 3 Active after 2 weeks	Group 4 Standard after 2 weeks
Number	21	23	22	22
Change in pain level[1]	−30	+0.74	−15	−7.1
No pain at follow-up[2]	38% (8/21)	17% (4/23)	23% (5/22)	5% (1/22)
Low pain at follow-up[3]	52% (11/21)	30% (7/23)	36% (8/22)	9% (2/22)
Change in ROM-lateral/flexion[4]	+10.1	+4.7	+7.3	+10.1
Change in ROM-flexion[5]	+9.8	−1.1	+0.3	+8.0
Change in ROM-extension[6]	+8.4	+7.1	+8.2	+3.7
Change in ROM-flexion + ext.[7]	+18.2	+6.0	+8.5	+11.7
Change in ROM-rotation[8]	+23.6	+14.4	+7.5	+22.8
Change in ROM-total[9]	+51.9	+25.2	+23.3	+44.6
Cointerventions[10]	3/21	9/23	5/22	9/21

[1] The mean change in Visual Analogue Scale (VAS). Negative values indicate a decrease in pain level.
[2] Proportion of patients stating 0 in VAS.
[3] Proportion of patients stating ≤10 in VAS.
[4] The mean change in range of motion (ROM) - lateral flexion in the cervical spine. Positive values indicate increased ROM.
[5] The mean change in ROM - flexion in the cervical spine. Positive values indicate increased ROM.
[6] The mean change in ROM - extension in the cervical spine. Positive values indicate increased ROM.
[7] The mean change in ROM - extension + flexion in the cervical spine. Positive values indicate increased ROM.
[8] The mean change in ROM - rotation in the cervical spine. Positive values indicate increased ROM.
[9] The mean change in total ROM. Positive values indicate increased ROM.
[10] The number of patients who received cointerventions from other manual therapists outside the control of this study. Data is missing from one patient in group 4.

Evaluation of the time factor showed that it alone had no influence on the outcome. Analysis of combining the treatment factor and the time factor, showed that there was a combined effect on the reduction of pain ($P = 0.04$) and on the improvement of cervical flexion ($P = 0.01$). When active treatment was provided, results were was better when it was administered early, and if standard treatment was provided, results were was better when it was administered late (Table 2). The number of patients who received cointerventions from sources, outside the control of this study did not differ statistically among the groups (Table 2).

■ Discussion

The main finding in this study was that active treatment of WAD resulted in a significantly greater pain reduction than standard treatment ($P < 0.001$). This finding may have implications for the treatment of patients with WAD.

Methodologic Aspects

In 1993 and 1994 in an accident-prevention study in the southern half of Elfsborg county, the total number of motor vehicle collision associated whiplash injuries was estimated to be approximately 200 every year.[7,8] Because of cervical fractures, chronic neck pain, and other reasons, not all 200 would have been suitable for inclusion in the current study. Of the remaining patients who could be included, not all visited a physician early enough to be able to be randomized within 96 hours. It is estimated that the majority of all patients with a motor vehicle collision–associated whiplash injury in this area who fulfilled the inclusion criteria and sought a physician early enough were included.

In earlier studies investigating the effect of active mobilization on patients with WAD, the effect of active mobilization and the effect of early onset of treatment are mixed. In the current study, the treatment factor and the time factor were separated by using a linear model with two-way analysis of variance.

The influence of cointervention outside the control of this study is difficult to establish. However, at the time of the study, only 1.1% of all physiotherapists in Sweden had enough competence in McKenzie principles (A and B level examinations) to perform the treatment prescribed to the patients in this study. The authors, in addition, had personal contact with all the McKenzie practitioners in the study area. Thus, it is highly unlikely that the patients in the control groups received treatment similar to the active treatment protocol.

For ethical reasons, patients must be allowed to leave a study without giving any reason and must not be coerced to continue participation. From this perspective, the follow-up rate of 91% was thought to be acceptable. To estimate a worst-case scenario, all patients in the active treatment groups (Group 1 and 3) who could not be followed up (2 patients in each group) were assigned the highest increase in pain that was seen among the patients who could be followed up (+64 mm on the VAS). Correspondingly, patients in Group 2 and 4 who could not be followed up (3 and 2 patients, respectively) were assigned the greatest observed decrease in pain (−84 mm). In this worst-case scenario, analyzed with two-way analysis of variance, no differences could be seen between active and standard treatment.

Active Versus *Standard Treatment*

The differences between active and standard treatment were primarily in the number and nature of the home exercises. The active treatment protocol included rotation exercises to be performed 10 times every hour as soon as symptoms allowed. If symptoms persisted, other movements were added. The patients in the standard treatment group were instructed to begin exercises first, 2 weeks after injury. The standard treatment folder included several exercises to be performed only a few times every day. The exercises, as described earlier, differed somewhat from the active treatment protocol.

Another major difference was the implementation of mechanical diagnosis and therapy in the active treatment protocol. If symptoms persisted, a more extensive examination was performed, and treatment was modified according to the findings of this examination.

Mealy et al[16] found that early active physiotherapy using the active mobilization technique improved pain reduction and increased mobility compared with a control group receiving 2 weeks' rest with a soft cervical collar and gradual mobilization thereafter. The follow-up in their study was limited to 8 weeks. McKinney et al[15] found physiotherapy or exact instructions in self-mobilization to be better than 2 weeks' rest with a soft collar at 1 and 2 months of follow-up. A similar result was found at the 2-year follow-up.[14] Borchgrevink et al[3] found that patients encouraged to continue with daily activities had a better outcome than patients prescribed sick leave and immobilization.[3]

It seems that active mobilization is important. The current result confirms that frequent active mobilization exercises decreases symptoms more than a gradual mobilization program. Thus, a soft collar for the first period after injury is not the best treatment for WAD.[3]

Is the standard treatment detrimental? This study cannot answer that question. The patients receiving standard treatment improved slightly, but perhaps improvement would have been better without those instructions. For ethical reasons, it would be unfeasible to conduct a study with a group of patients who receive no information or instructions whatsoever.

Early Versus *Late Treatment*

No study before this one has isolated the time factor. The time factor does not seem to be as important as the choice of treatment. However, it could be shown that active treatment provided early was slightly better than that administered with some delay (Table 2).

Range of Motion

Although there was no difference in improvement of ROM after 6 months between active and standard treat-

ment, a difference in effect on ROM during the first months could not be excluded. Other investigators have found that active treatment improves ROM if the second measurement is made within the first 1 to 2 months.[15,16] However, it seems that in time, most patients will regain ROM, irrespective of treatment.

■ Conclusions

In patients with WAD caused by a motor vehicle collision, early treatment with frequently repeated active submaximal movements combined with mechanical diagnosis and therapy is more effective in reducing pain than treatment with initial rest, recommendation of a soft collar, and a gradual introduction of home exercises. If this therapy is performed as home exercises, initiated and supported by a physiotherapist, it could demand relatively small resources. Although no cost analysis was made in this study, it is reasonable to assume that patients with less pain use fewer resources in the health care system.

■ Key Points

- In a randomized controlled study, early mobilization after a whiplash injury decreased neck pain more than a standard treatment protocol.
- The early mobilization consisted of frequently repeated active movements, followed by assessment and treatment according to the McKenzie protocol.
- An average of four sessions was needed in the group that underwent active treatment.

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Point of View

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Rosenfeld and colleagues have provided further evidence for us that an "active" approach of home exercises is more beneficial in acute whiplash patients than rest and soft cervical collars. In their randomized controlled trial, those patients that received advice on home treatment within 96 hours of the injury, did better than those provided with an information leaflet and advice to rest the neck and wear a soft collar. These results agree with previous studies by McKinney and Borchgrevink et al that show that minimal practitioner intervention com-

bined with advice on home exercises and to return to usual activities is the best approach for acute whiplash associated disorders (WAD).[1,2] These results confirm one of the major recommendations of the Quebec Task Force on Whiplash Associated Disorders that "early return to usual activities for WAD patients should be vigorously encouraged by clinicians."[3]

Another important finding from this study is that the right advice needs to be given to WAD patients within a few days of the injury. Again, the Quebec Task Force on WAD recommended guidelines for patient care that highlighted "prescribed activity" and "return to usual activities" for acute WAD patients at their initial contact with the health care system. As Rosenfeld and colleagues rightly point out, too many patients continue to receive advice to rest and wear a soft collar as the standard in acute care settings. In their trial, only 10% of properly managed patients continued to have clinically important symptoms at 6 months, compared to over 50% of patients given standard care. Since whiplash constitutes a common injury affecting a significant proportion of the population yearly, there should be considerable concern about improper management of acute WAD.[4] Furthermore, a recent study has identified WAD as a potential cause for the high prevalence of chronic neck pain and related disability in a North American population.[5,6] Readers of this journal need to take the initiative to promote proper acute care for WAD as a public health measure.

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Whiplash-associated disorders (WADs) include a number of clinical features, including neck pain, nonspecific headache, and temporomandibular joint pain. Clinical findings in WADs include myofascial tenderness, trigger points in the affected musculature, increased pain with function, and cervical muscle spasm.120 Onabotulinum toxin A has been studied in small trials of WADs and has been found to relieve pain and increase range of motion.Â â€¢ Positional release is also a good treatment choice in the early stages of whiplash injury because it does not require invasive pressure and uses gentle neurological responses to achieve treatment objectives. â€¢ Due to excessive neuromuscular tension following WAD injuries, thermal modalities are useful adjuncts to soft-tissue treatment. This article is currently under review and may not be up to date. Please come back soon to see the finished work! (25/06/2021). Original Editor - Hannah Norton. Top Contributors - Rachael Lowe , Kim Jackson , Okebanama Nelson Onyebuchi , Lucinda hampton , Tarina van der Stockt , Admin , Hannah Norton , Van Horebeek Erika , Sigrid Bortels , Anouck Leo , WikiSysop , Steffen Kistmacher , Ine Van de Weghe , Simisola Ajeyalemi , Rucha Gadgil , Wanda van Niekerk , Jess Bell and Joshua Samuel. Conclusions: The scientific evidence on whiplash associated disorders is of variable quality, but sufficiently robust and consistent for the purpose of guiding patient information and advice. While the delivery of appropriate messages can be both oral and written, consistency is imperative, so an innovative patient educational booklet, The Whiplash Book, has been developed and published.Â Whiplash injuries and in particular the development of chronic pain and disability, are an increasing clinical and social problem. During treatment, clinicians typically provide patients with some information and advice but its form, content, and possible value vary considerably. The concept of evidence based health care has fostered an increasing interest in patient information. of whiplash-associated disorders. (WAD). It is not clear if the treatÂ Mark Rosenfeld. Ronny Gunnarsson. A review of treatment interventions. in whiplash-associated disorders. Received: 24 December 2003. Accepted: 4 March 2004.