ORIGINAL ARTICLE

Comparison of the Relative Benefits of 2 Versus 10 Days of Soft Collar Cervical Immobilization After Acute Whiplash Injury

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ABSTRACT. Dehner C, Hartwig E, Strobel P, Scheich M, Schneider F, Elbel M, Kinzl L, Kramer M. Comparison of the relative benefits of 2 versus 10 days of soft collar cervical immobilization after acute whiplash injury. Arch Phys Med Rehabil 2006;87:1423-7.

Objective: To investigate the effects of 2-day and 10-day immobilization of the cervical spine on pain, range of motion (ROM), and disability of patients with Quebec Task Force (QTF) grade II whiplash injuries.

Design: Randomized controlled trial.

Setting: University hospital emergency department.

Participants: Seventy patients with acute QTF grade II whiplash injuries.

Interventions: At the intake examination within 24 hours after the whiplash trauma, the patients were randomized to 2 therapy groups (2-d or 10-d immobilization with a soft cervical collar). All patients received pain drugs (nonsteroidal antiinflammatory drugs) and after 7 days, all patients started a standardized physiotherapy program 2 to 3 times a week.

Main Outcome Measures: Patients' pain and disability scores were assessed using visual analog scales and ROM was assessed using a goniometer. All parameters were measured within 24 hours after injury and after 2 and 6 months.

Results: After 2 months, the different periods of immobilization (2d or 10d) were associated with comparable improvements in pain symptoms (median, 4.60 vs 4.65), ROM (median, 100.0° vs 117.5°), and disability score (median, 4.90 vs 5.15). No statistically significant differences could be identified between the 2 treatment groups. After 6 months, persistent pain was reported by 4 patients in each group (12.5%).

Conclusions: In patients with QTF grade II whiplash injuries, there is no short- or long-term difference between 2-day and 10-day immobilization with a cervical collar in terms of pain, ROM, or disability.

Key Words: Cervical pain; Immobilization; Rehabilitation; Whiplash injuries.

WHIPLASH INJURIES ARE AMONG the most common types of trauma in this age of increasing individual traffic mobility and their incidence continues to rise.[1-3] The symptoms after acute whiplash injury are primarily neck pain and pain-related restrictions of motion.[4-6] After a complaint-free interval of a few hours to 1 day (average, 5h), 47% to 88% of patients report pain in the neck.[5,7,8]

Both high initial pain intensities and short intervals between the accident and the onset of pain have been defined as strong predictive factors for the occurrence of chronic pain.[9-11] To reduce persisting pain, the emphasis in the acute phase should therefore focus on pain relief as a primary goal of therapy.[12] Besides the use of painkillers, immobilization is an important and mainly accepted component of acute pain reduction in muscular and skeletal injuries other than those of the cervical spine.[13-15]

The use of soft cervical collars for immobilization in whiplash injuries, however, has been generally rejected in the literature.[11,16-19] In 1995, the Quebec Task Force (QTF) was established in Canada, which investigated the available literature on many unsettled questions and problems of whiplash trauma of the cervical spine. The QTF not only developed a standard classification system, but also proposed diagnostic and therapeutic guidelines that were based on this system. This research group recommended that cervical collars not be used in the treatment of whiplash injuries graded as QTF I (patients with neck pain but no musculoskeletal signs) or QTF II (patients with neck pain and musculoskeletal signs).[11] Arguments in support of this position are based on the absence or inadequacy of data supporting an evidence-based positive effect for soft cervical collars.

Although several studies applied soft cervical collars as part of the therapy concept, very little concrete data could be extracted that related to their use.[18,20-22] In many studies, 1 group underwent immobilization with a cervical collar for periods of up to 2 weeks while, in a comparison group, treatment did not include this measure but involved active physiotherapy (PT) instead.[16,17,19,23-25]

A statement on the efficacy of cervical collars in the initial immobilization of the cervical spine in whiplash injuries cannot be made on the basis of these studies, because it remains unclear whether the therapeutic effect is due to the immobilization of the cervical spine or to the PT.

Only 1 study has focused on the isolated effects of cervical collars in the immobilization of patients with whiplash injury.[26] In this study, 65% of patients who had undergone initial immobilization reported positive pain relief in the acute phase of cervical spine injury. However, there is no definite statement as to whether this result is superior to that of the control group.

Against this background, the present study investigates the differences in pain, disability, and range of motion (ROM) between patients with acute QTF II whiplash injuries undergoing a 2-day immobilization, just for protection during the

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very acute initial state, and a 10-day, intermediate duration immobilization using a cervical collar. Measurement was done within 24 hours after the whiplash injury occurred and after 2 and 6 months.

METHODS

Participants

QTF grade II whiplash injuries of the cervical spine (patients with neck pain and musculoskeletal signs) were the only inclusion criterion that we defined for the study. Patients who had suffered previous injuries of the cervical spine or who had muscular, neurologic, or mental disorders were excluded from participation in the study. Patients who were unable to report for the minimum number of therapy visits during the therapy period (14 visits in 8wk) were also excluded from the study.

Study Procedure

All patients gave their written informed consent to study participation. At the intake examination within 24 hours after the whiplash trauma, we determined patients' pain score and disability score and assessed their ROM in the cervical spine. Osseous injuries were excluded by appropriate radiographic imaging. Patients were then randomized to 1 of 2 groups, one undergoing immobilization for 2 days and the other for 10 days, 24 hours a day. Immobilization was achieved by means of a soft cervical collar which was taken away when the immobilization period had been completed. All patients were given a standardized prescription for a nonsteroidal anti-inflammatory drug (NSAID) and the recommendation to take the medication for 10 days. The patients were asked to keep a record during that period of how long the cervical collar was worn every day and of the painkillers they took. We saw patients after 2 and 10 days. On these days, the period for which the collar had been worn and the NSAID intake were checked. All subjects in both therapy groups reported wearing the cervical collars for the specified period.

After 7 days, all patients started a standardized PT program for which they attended the clinic's PT department 2 to 3 times a week for a period of 6 weeks. The PT program consisted of soft-tissue treatment, joint mobilization, and measures for strengthening and stabilization of the cervical spine.

Pain score, disability score, and ROM were reassessed after 2 months and 6 months and compared with patients' initial findings.

Pain Score

We determined the patients' pain score by using 2 visual analog scales (VASs), each 100mm in length. Patients were asked to indicate their average degree of pain and their most severe pain, respectively. The pain score was calculated as the average of these 2 values.

Disability Score

We determined patients' disability score on the basis of seven 100-mm VASs.[27,28] Patients reported their respective limitation in family life, recreation and sports, social activities, occupation, sexuality, personal tasks (dressing, shopping), and life-sustaining activities (eating, breathing). The disability score was the median of the 7 individual scores.

Deficit in ROM

To improve the information content of the individual deficit in ROM, we assessed the mobility of the cervical spine for all 6 directions of motion (flexion, extension, rotation, lateral flexion) and these respective figures were added to obtain a single sum. The motion was always measured by the same investigator with a 2-armed goniometer. For the flexion and extension measurements, this was applied perpendicular to the connection line between the angle of the eye and the tragus. For the determination of rotation, the tangential alignment was performed on the side of the cranium. This sum was then subtracted from predefined normative values (sum, 330°) and the difference was considered to represent patients' deficit in ROM.

Data Analysis

We evaluated the data descriptively. Improvement in any given parameter was calculated as the difference in values before and after treatment. Results were tested for statistical significance using the Wilcoxon signed-rank test for linked samples.

We determined the percentage rate of persisting pain for both groups, using the results obtained at 6-month follow-up.

RESULTS

Subject Participation

Of the 470 patients with distortion injuries of the cervical spine who were treated in the emergency department, 93 patients fulfilled the inclusion criteria, of whom 6 patients declined to participate, and another 17 patients were unable to participate in the study because they lived a long way from the therapy units, so that 70 patients were randomized to the 2 therapy groups. In each therapy group, 3 patients had to be excluded from the study because they did not report for the minimum number of therapy visits (fig 1).

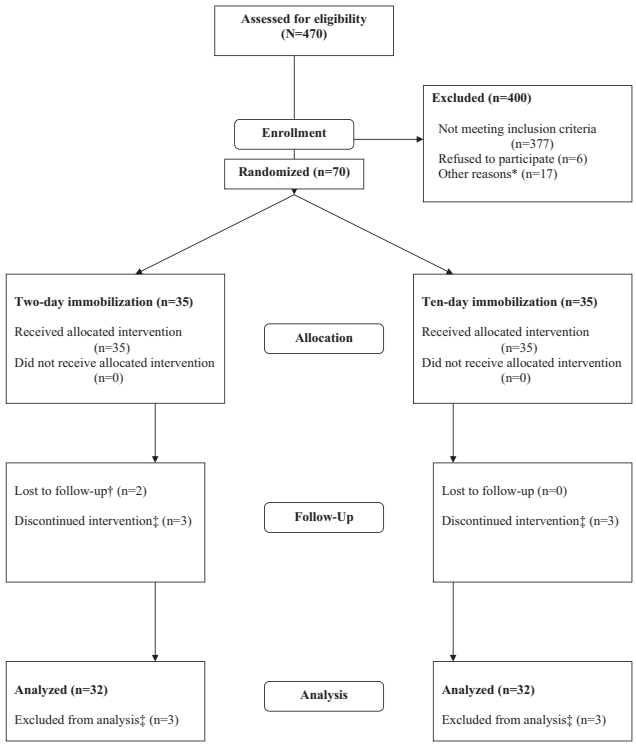

Fig 1. CONSORT flow diagram of study participants. *Distance too great to therapy sessions. †Patients not prepared to report for follow-up (investigation after 6mo). ‡Patients did not receive the minimum necessary PT sessions (14 times in 8wk).

Of the 64 patients who successfully participated in the study, 22 were men and 42 were women (median age, 28y; range, 18−52y). There were no differences in the patients' age and sex distribution between the 2 therapy groups. In 29 cases, patients had been injured in a rear-end collision while 23 patients had suffered a frontal collision and 12 patients a side collision. One patient reported isolated pain in the upper cervical spine (C0-2). In 35 cases, patients localized the pain to segments C3-7. Twenty-two patients reported pain over the entire cervical spine while 6 patients experienced pain limited to the paravertebral muscles.

Pain Score

There were no differences in pain score after injury or at 2 months in either group. After injury the median pain score assessed by VAS was 57 in both groups. At 2 months, the median pain score was 11.8 for the group treated with immobilization for 2 days and 6.8 for the group treated with immobilization for 10 days (fig 2). The median improvement was 46.0 in the 2-day immobilization group and 46.5 in the 10-day immobilization group (P=.519).

Disability Score

After injury, the median disability score in both groups was 60.7. At 2 months, the median disability scores for the 2-day and 10-day groups were 3.1 and 0, respectively (fig 3). The median improvement was 49.0 in the 2-day immobilization group and 51.5 in the 10-day immobilization group (P=.397).

Restriction in ROM

After injury, patients in the group with 2 days of immobilization showed a median restriction in ROM of 107.5°, compared with 120.0° in the group with 10 days of immobilization (fig 4). At 2 months, all patients exhibited improvement in their respective ROMs. Both groups as a whole showed no restriction in median ROM (see fig 4). The median improvement was 100.0° in the 2-day immobilization group and 117.5° in the 10-day immobilization group (P=.223).

Six-Month Follow-Up

Six months after their injuries, 56 (87.5%) patients were symptom-free with respect to pain, disability, and restriction in ROM. Eight patients (1 man, 7 women) continued to report persisting complaints. Of these 8 patients, 4 each were in the 2- and 10-day immobilization groups, which resulted in a rate of chronic pain of 12.5% for each group. Six of these 8 patients reported for the follow-up examination. The pain score was between 1.65 and 6.55, the disability score between 1.8 and 4.9, and the restriction in ROM between 10.0° and 55.0°.

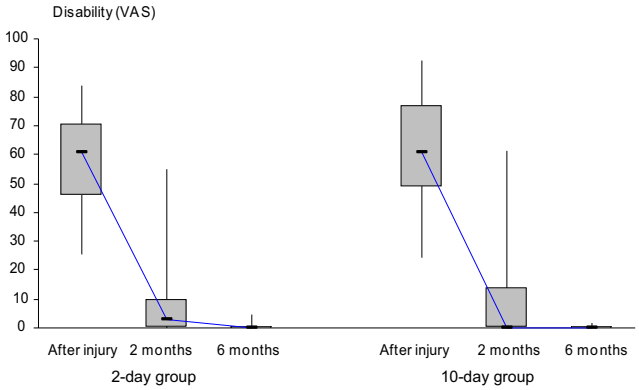

Fig 3. Disability score after injury, 2 months and 6 months—comparison of 2 days' and 10 days' immobilization. Evaluation was made within 24 hours after injury and after 2 and 6 months. Legend: box, 1st quartile and 3rd quartile; horizontal bar, median; vertical bars, maximum and minimum.

DISCUSSION

The present study investigates the short- and long-term effects of 2-day versus 10-day immobilization on pain, disability, and ROM in patients with QTF grade II whiplash injuries. Findings failed to identify statistically significant differences between the groups in any parameter at either 2 or 6 months.

We did not include a 0-day group (group without immobilization in a soft cervical collar), because in a recent study with QTF I and II mixed populations, 19% of patients in the therapy group that only received pain-relieving measures in the form of NSAIDs dropped out of the study and went to other therapy centers in their search for pain relief.[23] In our patient population with isolated QTF II injuries, an even greater dropout rate would have to be feared due to the higher overall severity of the group's injuries.

The literature concurrently calls for a short period of immobilization of the cervical spine after a distortion injury of the

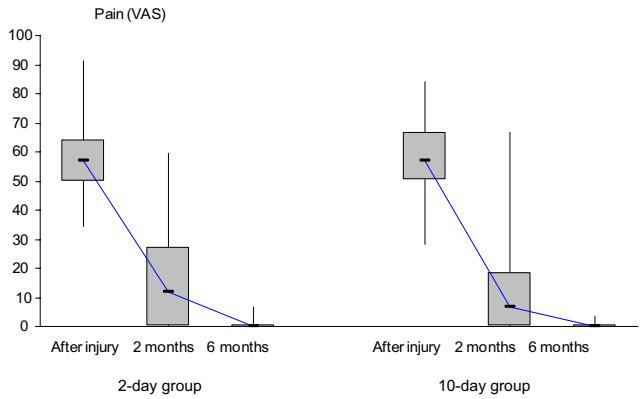

Fig 2. Pain score after injury, 2 months and 6 months—comparison of 2 days' and 10 days' immobilization. Evaluation was made within 24 hours after injury and after 2 and 6 months. Legend: box, 1st quartile and 3rd quartile; horizontal bar, median; vertical bars, maximum and minimum.

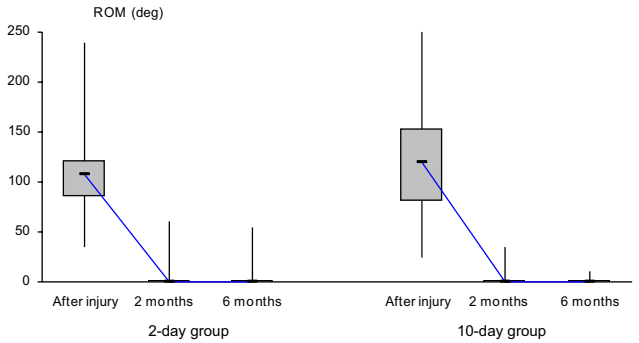

Fig 4. Restriction in ROM after injury, 2 months and 6 months—comparison of 2 days' and 10 days' immobilization. Evaluation was made within 24 hours after injury and after 2 and 6 months. Legend: box, 1st quartile and 3rd quartile; horizontal bar, median; vertical bars, maximum and minimum.

cervical spine. A long period of immobilization is rejected because it is assumed that this will result in atrophy-related secondary damage.[11,16-19] None of the studies have specified which tissues can suffer secondary damage due to atrophy, and after what time, because of the immobilization in a soft cervical collar.

Atrophy-related secondary damage after immobilization in closed plaster casts has been described in the muscles, in bone, and in capsular and tendinous tissue. Animal experiments have shown that structural changes can be detected in healthy muscle tissue after an immobilization period of only 1 week.[29,30] After immobilization periods of 6 weeks or more, atrophy-related effects have been described in capsular ligamentous structures[31,32] and bony structures.[33,34]

A transfer of this knowledge to the problems of whiplash is difficult, because wearing a soft cervical collar still allows a substantial degree of movement[35,36] and immobilization cannot be achieved to the same extent as with a rigid plaster cast. However, with the exception of 1 study, the immobilization period does not exceed 2 weeks,[16] so that the risk of secondary damage is most probably limited to atrophy of the neck muscles. But it is doubtful whether these muscular changes can be attributed to wearing a cervical collar alone or whether they may be explained, irrespective of this, by physiologic mechanisms of pain avoidance.

Neck pain is reported as the most common symptom after whiplash injuries of the cervical spine.[4-6] Systematic changes to the activation patterns of muscles with an agonistic and antagonistic action have been described as a reaction to this pain[37-39] and they represent control mechanisms in the acute initial phase to restrict the ROM in order to enable injured structures to heal.[40] During that period, the immobilization of the cervical spine is thus already at its maximum due to physiologic mechanisms, so that the immobilizing effect of the cervical collar is secondary and atrophy-related damage cannot be directly attributed to the cervical collar.

Study Limitations

A limitation of this study is the lack of proof of atrophy-related changes in the tissue. These changes could only be detected with biopsy tests, which could hardly be reasonably expected of the patient group. Because of the pain, strength measurements also are not reliable as an indirect proof of muscle atrophy. This only leaves the comparison of functional (ROM) and subjective (pain anamnesis) impairments that are assumed to be a result of the tissue atrophy.

In these parameters, the results of our study do not show any differences in the short- and long-term follow-up. The chronic pain and disability rate after 6 months is 12.5% in both groups, so that the feared atrophy processes in a 10-day interval apparently do not play a clinically significant role. It is likely that other non–atrophy-related causes can produce chronic symptoms.[41,42] Besides atrophy, psychologic factors are attributed to immobilization with soft cervical collars that could have a negative influence on the outcome and pain chronification. However, there are no known studies on this matter, so, at this time, these are merely hypotheses. On the basis of our results, a psychologic influence can thus not be ruled out.

CONCLUSIONS

This study shows that the results for pain, disability, and ROM in the cervical spine after 2 days of immobilization do not differ from the results after 10 days of immobilization. If a cervical collar is used in the acute treatment of whiplash trauma of the cervical spine, it is possible to offer the collar to the patient for a period of up to 10 days without any detrimental effect.

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