Do head-restraints protect the neck from whiplash injuries?

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SUMMARY

Over an 11-month period a study was made of all patients presenting to an accident and emergency department who had sustained whiplash as a result of rear-bumper impacts. The patients were analysed with respect to the presence of head-restraints in their vehicles. A significant increase in the incidence of whiplash was found in patients whose vehicles did not have head-restraints fitted. Legislation requiring all passenger cars to have head-restraints fitted as standard would have a major impact in reducing the number of whiplash injuries sustained in rear bumper impacts.

INTRODUCTION

Whiplash is a common and frequently underestimated injury, often giving rise to prolonged disability (Mersky, 1984). Rear bumper impacts are responsible for 85% of all whiplash injuries (Jackson, 1966; States *et al.*, 1970; Hohl, 1974) and as many as 38% of vehicle occupants exposed to this type of impact will develop symptoms (States *et al.*, 1972).

It is estimated that there are 3 800 000 rear-end collisions in the USA annually (National Safety Council, 1971) (there are no comparable figures available from the UK Department of Transport), clearly constituting a major health problem. In an attempt to reduce the incidence of neck injuries sustained in this fashion, the US Department of Transportation required all passenger cars manufactured after 31 December 1968 to have head-restraints fitted as standard. However, the evidence that head-restraints play a major role in protecting vehicle occupants from whiplash injury was, and remains, unconvincing. Several studies, most notably States *et al.*, (1972), O'Neill *et al.*, (1972) and Larder *et al.*, (1985) having demonstrated promising results but the reduction in whiplash was disappointingly low, 5-24%. O'Neill had a large database,

but the study had the inherent flaw that all information came from insurance claims, potentially a very unreliable source (Gotlen, 1956; Miller, 1961).

This study was designed to investigate the protective nature, if any, of the head-restraint with regard to whiplash sustained in rear bumper impacts.

DEFINITION

Whiplash is an imprecise term, often used by the lay person to denote any injury to the neck sustained in a road-traffic accident. It implies that the neck behaves as a whip, that is, a low-velocity, high-energy input at the base producing a high-velocity excursion at the tip. An alternative phrase, used in 1965 by McNab, is 'acceleration extension injury'. However, 'acceleration hyperextension injury' would be a more precise term and this is the definition implied when whiplash is used in the text.

METHODS

During an 11-month-period, a study was made of all patients who presented of their own volition to the Accident & Emergency Department at Oldchurch Hospital, Romford, complaining of neck symptoms after rear-bumper impact. Patients who had sustained their injury in any other type of impact, or who did not have neck symptoms, were not included. The accident & emergency senior house officers then filled in a *pro forma*, stating both personal details: age, address, A & E number, and so forth, and accident details: car type, seat-belt usage, position in car, estimated speed of impact, and finally whether a head-restraint was fitted. Once completed, the *pro forma* was filed separately from the patients' notes. The patients were examined, X-rays taken of the cervical spine only if it was deemed necessary, and the patients were treated symptomatically with cervical collars, analgesia, reassurance and asked to return within a week for review.

The review was undertaken by the author, when neck movements, neurology of the upper limbs and X-ray findings were noted. Only the patients' notes were available and therefore the patients' head-restraint status was unknown. Treatment then consisted of an explanation of the nature of the injury and the symptoms experienced, followed by encouragement of active movements, heat application, massage and swimming. All patients who still had significant symptoms at 2 weeks were sent to physiotherapy. No attempt was made to recall patients who failed to return for review.

As there are no official figures at the Department of Transport, concerning the head-restraints status of passenger cars, on 16 October 1987 a total of 5000 passenger cars were counted in Romford, Essex and the percentage fitted with head-restraints tabulated. A total of 2500 consecutive passenger cars were counted on the A12 (the nearest 'A' road to the hospital) from 0800 h, and a further 2500 consecutive passenger cars on Waterloo Road, Romford (the 'B' road on which the hospital stands), directly afterwards.

Table 1

	Whiplash injury	Cars moving on 'A' roads
Cars not fitted with head-restraint	68 (64%)	1552 (31%)
Cars fitted with head-restraint	38 (36%)	3448 (69%)

$\chi^2 = 52.7$ with a significant $P < 0.0001$.

RESULTS

A total of 106 consecutive patients who had sustained whiplash injury due to rear bumper collision were studied. Twenty-eight patients (24%) did not return for review. Only six (5.6%) patients were seated in the rear seats at the time of the impact; these, together with five (4.7%) front-seat passengers, were not restrained by seat-belts. Sixty-eight (64%) patients did not have a head-restraint fitted. The number of cars not fitted with a head-restraint was 1522 (31%).

The results were analysed statistically on an IBM personal computer with a SPSS-PC programme using the χ^2 test.

This illustrates that there was a highly significant difference between the expected number of people (31%) who would not have a head-restraint fitted when they sustained whiplash, and the actual number of people who did not have a head-restraint when they sustained whiplash (64%).

None of the patients studied clinically or radiologically were suspected of having sustained bony injury to the cervical spine and in the group of patients in whom they were prolonged symptoms, there was no clinical evidence that any other new pathology, for example disc protrusion, had been provoked. However, a number of patients had symptoms compatible with cervical spondylosis.

DISCUSSION

The majority of new cars sold in this country are fitted with head-restraints, but as approximately 30% of all passenger cars on the road in this country do not have them fitted as standard, it is of importance to know whether they convey any protection against whiplash, particularly as there is some evidence to suggest that seat-belt restraint may increase the severity of whiplash (Hobbs, 1981; Rutherford *et al.*, 1985).

The significant difference in incidence of whiplash demonstrated in this study might be partially explained by the fact that some people complaining of neck symptoms after a rear-bumper injury went elsewhere for their primary care. It might be postulated that a disproportionate number of these people not only could afford new cars (with head-restraints) but also alternative private medical care. Of the 28% of patients who failed to return for review, it is possible that their symptoms had resolved, or that they made alternative arrangements for follow-up and it is interesting to note that of these 28

patients, 15 (54%) were without head-restraint at the time of impact, and 13 (45%) did have head-restraints.

Rear-bumper impacts account for 20–30% of all types of car accidents (Langwieder *et al.*, 1982; McNab, 1977; States, 1979) and it has been stated (Deans, 1987) that these give rise to a disproportionately high incidence of neck injury compared with other mechanisms of impact. The reported percentage of rear-bumper injury in this country is in fact lower, but an analysis of car-accident reporting in this country shows how this discrepancy can be accounted for. The Transport and Road Research Laboratory, Crowthorne, collects data on road-traffic accidents reported to them by the police, who only routinely attend accidents where there has been obvious injury, their presence at other accidents depending upon manpower availability. Given that whiplash symptoms may not be present initially, and that rear-end impacts of as little as 5 mph can give rise to significant symptoms, the true figure is probably higher. For practical reasons, no attempt was made to ensure that head-restraints fitted to the cars in the study were:

- (1) at an optimal height for the vehicle occupants (in one study, 75% of all adjustable head-restraints were found to be in the down position at the time of the impact) (Garrett & Morris, 1972);
- (2) fitted so that there was less than 25 mm between the occupants' occiput and the head-restraint;
- (3) were not faulty in design, or fitting, all points which have shown to be of some importance (O'Neill *et al.*, 1972; Fox *et al.*, 1976).

The demonstrated marked difference of incidence of whiplash between the two groups may be even more significant if the above considerations were taken into account.

CONCLUSIONS

This study has shown a marked increase in the incidence of whiplash in the unrestrained neck compared with the restrained neck. the symptoms can persist for long periods, especially in the ageing cervical spine, and it constitutes an easily preventable health problem. Legislation requiring all passenger cars in this country to have head-restraints fitted as standards would be a major factor in reducing whiplash injuries from rear bumper injury.

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