

The Incidence of TMJ Dysfunction in Patients Who Have Suffered a Cervical Whiplash Injury Following a Traffic Accident

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Forty consecutive patients with a cervical whiplash injury were examined and compared with 40 matched controls. The incidence of signs and symptoms was high in both groups. Temporomandibular joint pain ($P < .001$), limitation of mouth opening ($P < .01$), and masticatory muscle tenderness ($P > .01$) were found significantly more frequently in the patient group, while the presence of joint sounds, deviation during mouth opening, and the overall presence of a symptom were not significantly different between groups. When asked whether they would seek treatment for the observed signs and symptoms, a significantly higher number of the whiplash group responded positively when compared to the control group. These findings warrant further study and suggest the benefit of a routine examination of the temporomandibular joint and masticatory system in patients with cervical whiplash injury.

J OROFACIAL PAIN 1993; 7:209-213.

The presence of TMJ dysfunction after cervical whiplash was first recorded by Frankel¹ in 1965. In 1973 Roydhouse² reported on the similarity between some symptoms of whiplash and TMJ dysfunction and on the good results obtained when patients with whiplash were also treated for TMJ dysfunction. However, in 1983 Farrar and McCarthy³ reported that patients presenting with cervical and TMJ dysfunction after a cervical whiplash injury were only receiving treatment for the cervical region; as a consequence, many developed a chronic complaint.

In the many published articles concerning cervical whiplash injury,⁴⁻⁶ very little significance is placed on TMJ dysfunction, perhaps because it lies in a "grey" area between the medical and dental professions. However, clinical evidence and a recent report on an experimental model⁷ suggest simultaneous involvement of the TMJ at the time of cervical whiplash injury.⁸ Failure to examine the TMJ at the time of the accident, because of other life-threatening emergencies, may be the reason that TMJ is diagnosed at a later stage.

The aim of this study was to compare the incidence of signs and symptoms of TMJ dysfunction, as well as the subjective need for treatment, in a group of patients who received a cervical whiplash injury as a result of an automobile collision with that of a matched control group.

Materials and Methods

The test group (group 1) consisted of 40 consecutive patients (26 men and 14 women, aged 17 to 53 years, mean age 32.2 years) who were admitted to the Accident and Emergency Department, St James' Hospital (Dublin, Ireland) with a diagnosis of acute cervical whiplash injury during a 10-week period (January to March 1990). The delay between the accident and the examination ranged from 6 to 38 days (mean 15.6 days). No treatment for eventual signs or symptoms of TMJ dysfunction was given. The matched control group (group 2) consisted of 40 patients (26 men and 14 women, age range 16 to 55 years, mean age 33.4 years) who were being treated with physiotherapy for various reasons (Table 2) at the same department.

The criteria for exclusion for both groups were (1) history of general joint disease such as rheumatoid arthritis or osteoarthritis, (2) history of fracture in the craniomandibular region, or (3) previous injury or trauma to the head. The history and clinical examination were carried out by the author on all patients and controls using the examination protocol formulated by the European Academy of Craniomandibular Disorders.⁹

During the history, the patients answered questions regarding the presence or absence of facial pain, head pain, ear pain, eye pain, neck pain, regular headache, clicking sounds or other noises in the TMJ, disturbances of mandibular function (ie, difficulties in chewing, opening or closing the mouth, muscular fatigue and stiffness of the jaw), and presence of oral habits (nail or lip biting).

Clinical examination of the masticatory system included measurement of maximal mouth opening by means of vernier calipers. The active maximal opening was measured between the incisal edges, and overbite was taken into account. The cutoff point for "limitation of opening" was set at 40 mm. Overt deviation (more than 2 mm) of the mandible to the right or left during opening was noted. Examination of the TMJ comprised lateral palpation for the presence of pain or joint sounds (clicking or crepitation). The latter were also examined by auscultation. The presence of tenderness or pain during palpation of the superficial and deep masseter and temporalis muscles was noted. Examination of the dental occlusion and maxillo-mandibular relationships were omitted because of the author's inexperience in this area.

For statistical reasons, the parameters included in the analysis were limited to (1) TMJ pain during clinical examination, (2) objective joint sounds, (3) limitation of mouth opening, (4) deviation during

opening, (5) masticatory muscle tenderness upon palpation, and (6) any of the above symptoms. Differences between groups were tested using non-parametric statistical analysis (chi-square). $P < .05$ was considered significant and $P \geq .05$ as not significant (NS).

Results

Figure 1 shows the incidence of the clinical signs in groups 1 and 2. The relevant data are listed in Tables 1 and 2.

Joint pain was present in 12 patients (30%) and 1 control subject (2.5%); this difference was significant (chi-square = 12.722, $P < .001$). Joint sounds were frequent and equally distributed in both groups (15 patients versus 17 control subjects, chi-square = 0.208, $P > .05$). Limitation of mouth opening was significantly more frequent in the patients (37.5%) than in the controls (7.5%) (chi-square = 10.322, $P < .01$). Deviation of the mandible during opening was present in 16 patients (40%) and 9 control subjects (22.5%) (chi-square = 2.851, NS). Masticatory muscle tenderness was found in 12 patients of group 1 (30%) and 3 subjects of group 2 (7.5%), which was significantly different (chi-square = 6.646, $P < .01$). When the presence of any of the above clinical signs was compared between the groups, the results showed an incidence of 21 patients (52.5%)

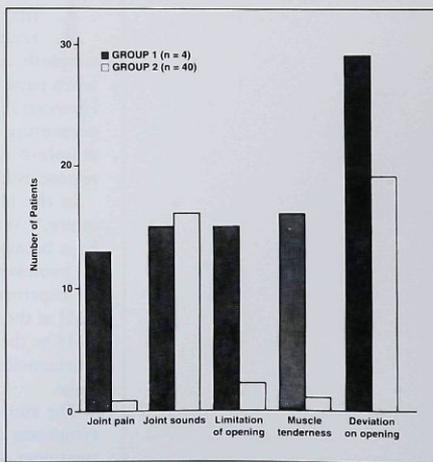


Fig 1 Frequency of signs of TMJ dysfunction in groups 1 and 2.

Table 1 Group 1 Signs of TMJ Dysfunction

Patient no.	Age	Sex	Joint pain	Joint sounds	Limitation of opening	Deviation on opening	Masticatory muscle tenderness
1	53	M		X	X	X	
2	31	F		X	X	X	
4	25	M	X	X		X	X
5	27	M			X	X	
6	19	F	X	X	X	X	X
7	22	M	X		X		X
8	21	M			X		
10	22	M	X	X	X	X	X
13	33	F	X		X	X	X
16	28	F		X	X	X	X
19	37	F	X	X	X	X	X
20	34	F			X	X	X
25	45	F	X	X		X	X
28	17	F	X	X		X	
29	33	M	X	X	X	X	
30	37	M		X			
32	43	M	X	X		X	X
36	19	F		X	X		X
37	32	M			X		
38	49	F	X	X	X	X	X
39	48	M	X	X		X	

Table 2 Group 2 Signs of TMJ Dysfunction

Patient no.	Age	Sex	Physiotherapy	Joint pain	Joint sounds	Limitation of opening	Deviation on opening	Masticatory muscle tenderness
1	48	M	Ankle		X			
3	23	M	Back		X			X
4	42	F	Knee			X	X	
5	24	M	Ankle		X			
8	32	M	Ankle		X	X		X
9	26	F	Ankle		X		X	
11	41	F	Lower limb	X	X	X	X	X
13	34	F	Ankle		X			
15	30	F	Knee		X			
17	47	M	Back		X		X	
18	16	F	Shoulder	X	X		X	
19	38	M	Knee		X		X	
28	34	F	Shoulder/ hand syndrome	X		X		
29	20	M	Ankle		X		X	
31	45	M	Tibia fracture		X		X	
34	23	M	Ankle		X			
37	33	M	Knee		X			
45	30	M	Back		X			

in group 1 and 18 subjects (45%) in group 2 (chi-square = 0.450, NS).

When the subjects were asked whether they would seek treatment for the TMJ pain, the limitation of opening, or the TMJ sounds, a positive response was obtained by 30% of the patients and only 2.5% of the controls (chi-square = 11.11, $P < .001$).

Discussion

This study evaluated the incidence of signs and symptoms of TMJ dysfunction in a group of patients suffering a recent whiplash injury compared to a control group matched for age and sex. The incidence of clinical signs was high in both groups, confirming most epidemiologic studies.¹⁰⁻¹² Joint sounds showed a high incidence in both groups 1 and 2 (32% and 42.5%), which is in agreement with earlier investigations of general populations and of patients.^{13,14} As the only sign, it is considered to be subclinical.

The degree of mouth opening was considered limited if less than 40 mm. This cutoff point was set arbitrarily, reflecting the criteria of an earlier epidemiologic study.¹³ A significant difference was found between the patients and controls, and this warrants further study. One can only speculate on the mechanism underlying this finding. Alteration of the condylar head position and the craniocervical relationship as a result of the whiplash injury, reflex muscle guarding as a result of joint pain, and soft tissue trauma from direct impact or stretching have been suggested as possible mechanisms, while an experimental model for the biomechanics involved has been proposed.⁷ On the other hand, one may question the relevance of a strict cutoff point for a range of movement, especially since it was only measured on active opening. Taking into account the passive range of movement obtained by assisting the opening movement could have substantiated the measurement, allowing for better discrimination between myogenous and arthrogenous limitation of opening. The passive range of movement, however, was not evaluated in this study.

The incidence of deviation during opening in groups 1 and 2 was not significantly different. The validity of deviation as a sign of TMJ dysfunction is questionable, as it is frequently present in the nonpatient population due to an imbalance of skeletal morphology and muscle coordination.

Pain on palpation of both the TMJ region and the masticatory muscles occurred significantly

more frequently in group 1. More research is necessary to understand the etiology; trauma to the joint following the whiplash injury may be the cause of the pain. There may also be referred pain from the cervical region.

The difference between the groups was also apparent when the subjective need for treatment was evaluated: 30% of the patients would seek treatment. This figure is far more than the estimated 5% need for treatment mentioned in epidemiologic surveys.¹⁵ However, recently the need for treatment, as judged by the examiners, was rated as 27% in a group of young nonpatients.¹⁶ The demand for treatment by the nonpatients in that study was different than the present results.

Conclusion

The present findings concerning a significantly higher presence of cardinal signs and symptoms of TMJ dysfunction, together with a relatively high demand for treatment, warrant further study and, from a clinical point of view, are a valid argument for the routine examination of the TMJ and masticatory system in all patients with a cervical whiplash injury.

Acknowledgments

The author offers sincere thanks to Mr P. Plunkett, consultant in Accident and Emergency Medicine, St James' Hospital; Mrs Marese Cooney, lecturer and tutor, Dublin School of Physiotherapy; and Prof Antoon De Laat and Prof Harold T. Perry, for reading her thesis and encouraging her to write this article.

References

1. Frankel VH. Temporomandibular joint pain syndrome following deceleration injury to the cervical spine. *Bull Hosp Joint Dis* 1965; 26:47-51.
2. Roydhouse RM. Whiplash and temporomandibular dysfunction. *Lancet*, 16 June 1973:1394-1395.
3. Farrar WB, McCarthy WL. A Clinical Outline of Temporomandibular Joint Diagnosis and Treatment, ed 7. Montgomery, Alabama: Normandie, 1983:84.
4. Macnab I. The whiplash syndrome. *Orthop Clin North Am* 1971; 2:389-403.
5. Hohl M. Soft tissue injuries of the neck in automobile accidents. *Bone Joint Surg* 1974; 56A(8):1675-1681.
6. Norris SH, Watt I. The prognosis of neck injuries resulting from rear-end vehicle collisions. *J Bone Joint Surg* 1983; 65B(5):608-611.
7. Schneider K, Zernick RF, Clark G. Modeling of jaw-head-neck dynamics during whiplash. *J Dent Res* 1989; 68:1360-1365.

8. Weinberg LA. The etiology, diagnosis and treatment of TMJ dysfunction pain syndrome. Part 1. Etiology. *Prosthet Dent* 1979;42:6-43.
9. European Academy of Craniomandibular Disorders EACD examination protocol. *J Craniomandib Disord Facial Oral Pain*. 1985;1:9-10.
10. Helkimo M. Epidemiological surveys of dysfunction of the masticatory system. *Oral Sci Rev* 1976;7:54-69.
11. Dworkin SF, Hanson-Huggins KH, LeResche LR, Von Korff M, Howard J, Truelove E, Sommers E. Epidemiology of signs and symptoms in temporomandibular disorders. Clinical signs in cases and controls. *J Am Dent Assoc* 1990;120:273.
12. Rugh JD, Solberg WK. Oral health status in the United States: Temporomandibular disorders. *J Dent Educ* 1985;89:398-404.
13. Solberg WK, Boo MW, Houston JB. Prevalence of mandibular dysfunction in young adults. *J Am Dent Assoc* 1979;98:25.
14. Hansson T, Nilner M. A study of the occurrence of symptoms of diseases of the TMJ, masticatory musculature and related structures. *J Oral Rehabil* 1975;2:239.
15. Schiffman E, Friction J, Haley D. Management of Temporomandibular Disorders and Occlusion, ed 2. In: Okeson JP (ed). St. Louis: Mosby, 1989:150.
16. Magnusson T, Carlsson GE, Egermark-Eriksson I. An evaluation of the need and demand for treatment of craniomandibular disorders in a young Swedish population. *J Craniomandib Disord Facial Oral Pain* 1991;5:57-63

Resumen

La incidencia de la disfunción temporomandibular en pacientes que han sufrido una lesión por un golpe con rebote cervical luego de un accidente de tráfico

Se examinaron 40 pacientes que habían sufrido lesiones ocasionadas por golpes con rebote de tipo cervical. Los pacientes fueron comparados y acoplados con un grupo de 40 controles. La incidencia de signos y síntomas fue alta en ambos grupos. Los problemas de dolor en la articulación temporomandibular ($P < .001$), la limitación en la apertura bucal ($P < .01$), y la sensibilidad de los músculos masticatorios ($P < .01$) fueron significativamente más frecuentes en el grupo experimental, mientras que los sonidos articulares, la desviación durante la apertura bucal, y en general la presencia de un síntoma no fueron diferentes significativamente entre los dos grupos. Cuando a los pacientes se les preguntó si ellos tratarían de buscar tratamiento para la sintomatología observada, se determinó que en el grupo experimental se registraron un mayor número de respuestas positivas lo cual fue significativo en comparación al grupo de control. Estos hallazgos indican que se deberían hacer más estudios; también sería provechoso ejecutar exámenes rutinarios del sistema masticatorio en pacientes que han tenido lesiones por golpes con rebote.

Zusammenfassung

Inzidenz von Myoarthropathien des Kausystems bei Patienten mit Schleudertrauma nach einem Verkehrsunfall

Vierzig aufeinanderfolgende Patienten mit Schleudertrauma wurden untersucht und mit vierzig passenden Probanden verglichen. Die Inzidenz der Symptome war in beiden Gruppen hoch. Kiefergelenksschmerzen ($P < .001$), Einschränkung der Mundöffnung ($P < .01$) und druckempfindliche Kaumuskel ($P > .01$) traten signifikant häufiger in der Patientengruppe als in der Kontrollgruppe auf. Jedoch konnte kein signifikanter Unterschied zwischen den Gruppen bezüglich Kiefergelenksgeräuschen, Seitabweichung des Unterkiefers bei der Mundöffnung und Vorhandenseins von einem Symptom festgestellt werden. Eine signifikant höhere Anzahl Personen aus der Schleudertrauma-Gruppe als aus der Kontrollgruppe beantwortete die Frage, ob sie für die beobachteten Symptome eine Behandlung suchen würden, zustimmend. Diese Ergebnisse rechtfertigen weitere Untersuchungen und deuten auf den Vorteil einer routinemässigen Untersuchung des Kausystems bei Patienten mit Schleudertrauma hin.