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AN EMG STUDY ON TMJ DISORDERS

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RESUME

Le cas clinique d'un patient atteint du Syndrome de TMJ classique a été présenté, avec tous les symptômes odontologiques et autres. Le patient a été soumis à une séries de teste emg avant la reconstruction avec du matériel du plan de contact interdental; aprés la reconstruction trois mois de l'application de la prothése, les tests emg ont montré que toute la symptomatoloie complexe du patient avait son origine au plan de contact interdental. Ce dernier, une fois corrigé, a conduit à la disparition des symptomes odontologiques, mais pas du syndrome de TMJ.

ABSTRACT

The Authors have described a clinical case involving a patient with a classical TMJ syndrome and a full range of typical symptoms, both dental and non-dental. The patient underwent a set of EMG tests before his occlusal plane was restored using a special material, immediately following reconstruction and, lastly, three months following the application of a prosthesis. The findings of these EMG tests have shown that the complex symptoms reported by the patient could be traced back to his occlusal plane. Once it was reconstructed, all the typical dental and non-dental symptoms of TMJ disorders subsided.

INTRODUCTION

Any research on the functional links between the stomatognathic apparatus and the distant osteoarthromuscular structures is bound to arouse great interest, because the functioning of the stomatognathic apparatus is strongly dependent on changes in the posture of the cervical spine, and vice versa (Bondemark L. 1999, Choi B. et al. 2000, Ercoli C. et al. 1999, Gangloff P. et al. 2000, George PT et al. 2001, Kondo E. et al. 1999, Sandoval P. et al. 1999, Tangsrud SE et al. 2001) but also of the entire spinal cord down to the sole of the foot. Important precedents for major breakthroughs in this field were set by new insights concerning the complex functions of osteoarthromuscular chains (Busquet L. 1992) and the neuron pathways governing them. Well-known connections are those between the trigeminal nerve and nerve XI, whose relevance for our case will be discussed below (Valentino B. et al. 2001). Similar connections between the reticular system and the trigeminal nerve(Valentino B. et al. 2001) are at the basis of synaptic exchanges right across the nervous system and may account for many of the typical symptoms associated with TMJ disorders (Eriksson L. et al. 2001, Fuentes R. et al. 1999, Herken H. et al. 2001, Nitzan DW et al. 2001, Pradham NS et al. 2001, Sonnesen L. et al. 2001). This study discusses the clinical case of a patient suffering from a classical TMJ Syndrome. It highlights the relationship between the stomatognathic apparatus and other parts of the body, using postural analyses obtained via EMG tests.

MATERIAL AND METHODS

Our patient (P.C., aged 59) reported a two-year history of myotensive headache, especially in the temporal region, associated with reduced cervical spine mobility and backache and with ear disorders including tinnitus, buzzing and loss of equilibrium which had first appeared a few years earlier. Upon dental examination, the patient was found to be without molars in any of the dental arches and to have lost the first premolar tooth of the upper left dental arch. The patient also reported a crunching sound on the TMJ when his mouth was wide open. The patient's static and dynamic TMJ x-rays came with a diagnosis of "bilateral partial TMJ dislocation'. An x-ray of the cervical spine indicated loss of the physiological curve. Doppler ultrasound tests performed on the vertebral arteries ruled out any form of vertebro-basilar artery system failure. For our tests we used a four-channel Myotronic EM2 electromyograph with bipolar surface electrodes.

Three groups of postural tests were performed at

three successive stages of our study:

- tests on the masticatories at rest and in motion;
- tests on the proximal sternocleidomastoid muscles carried out by placing the electrodes 3 centimetres from the mastoid, since it is here that the motor nerve of this muscle (XI) comes nearest to the surface before going deep into the neck;
- tests on the cervical trapezius tract which is engaged when the neck is extended;
- tests on the paravertebral thoracolumbar muscles carried out by placing the electrodes at the level of the third and seventh thoracic and second lumbar vertebrae, at 2 centimetres from the spinous process.

These groups of tests were first performed before the occlusal plane was reconstructed with a suitable material, immediately following reconstruction and three months after the application of a prosthesis.

RESULTS

A) Before the 'reconstruction' of the occlusal plane (Tab. 1):

- With masticatories at rest: marked anterior temporal muscle hypertony;
- With masticatories in motion: reversal of the masseter–anterior temporal muscle ratio on both sides;
- Functional deficit of the sternocleidomastoids during flexion and of the cervical trapezius portion during extension;
- Thoracic paravertebral muscles: good right-left balance;
- Lumbar paravertebral muscles: preponderance of the left side over the right side.

B) Tests carried out after the 'reconstruction' of the occlusal plane (Tab. 2)

Markedly improved findings for all of the tests performed.

C) Tests performed three months after the application of a prosthesis (Tab. 3).

Unremarkable results, plus the disappearance of symptoms such as myotensive headache, dizziness, tinnitus, buzzing and articular click. The patient regained normal use of his neck muscles and recovered from his former condition of acute depression.

DISCUSSION AND CONCLUSIONS

Our first observation is that all of the patient's postural alterations were generated by the stomatognathic apparatus, in particular from the adverse impact of his markedly edentulous occlusal plane. As we had anticipated, once the occlusal plane had been artificially restored all the test results improved appreciably. The most striking result was observed three months following

a: emg masticatories at rest (TA=temporal; MM=masseter)
b: masticatories in function
c: tests emg on the proximal sternocleidomastoid muscles (TA) and on cervical trapezius tract when the neck is extended.
d: tests emg on the paravertebral muscles carried out by placing the electrodes at the level of the seventh thoracic (TA) and second lumbar vertebrae (MM) at 2 centimetres from the spinous process.

a) RIGHT		LEFT		b) RIGHT		LEFT		c) RIGHT		LEFT		d) RIGHT		LEFT	
TA	MM	MM	TA	TA	MM	MM	TA	TA	MM	MM	TA	TA	MM	MM	TA
4.8	7.0	3.3	4.5	1	0	0	0	0	0	0	0	4	4	2	4
7.4	3.5	2.1	3.9	2	8	12	1	1	0	12	0	7	13	2	6
4.0	4.0	1.6	3.6	4	10	16	5	0	0	4	0	7	19	8	6
4.5	6.7	1.7	3.3	6	11	18	9	1	2	7	0	12	13	28	17
4.5	6.0	1.6	2.9	6	9	16	7	0	8	23	0	7	7	20	10
4.6	5.9	1.6	3.4	6	10	18	7	1	13	34	0	9	5	10	5
4.2	2.2	1.7	3.4	6	7	15	8	2	11	46	0	9	5	12	8
4.8	2.6	2.1	5.1	6	6	13	7	2	7	21	0	6	6	3	6
				6	7	14	8	1	6	40	0	10	7	13	9
				5	7	12	6	0	6	29	0	11	11	33	12
Micronvolts				**5**	**8**	**14**	**6**	**0**	**5**	**24**	**0**	**8**	**9**	**14**	**8**

Tab 1: Test EMG before the reconstruction of occlusal plane

a) RIGHT		LEFT		b) RIGHT		LEFT		c) RIGHT		LEFT		d) RIGHT		LEFT	
TA	MM	MM	TA	TA	MM	MM	TA	TA	MM	MM	TA	TA	MM	MM	TA
2.4	3.8	5.7	2.5	7	5	8	7	11	15	7	7	11	11	6	6
2.2	3.6	4.1	2.4	11	14	8	16	22	14	7	8	18	20	12	6
2.5	3.9	4.0	2.5	9	7	7	8	19	9	7	9	13	23	12	6
2.4	3.0	3.8	2.6	8	6	6	9	14	6	5	9	7	125	16	11
2.5	4.0	3.5	2.7	7	5	6	9	11	4	4	4	8	37	13	5
2.7	3.9	3.4	2.7	8	5	6	10	2	2	3	1	7	73	11	7
2.7	3.9	3.5	2.7	8	5	6	9	2	1	2	0	3	56	16	5
2.6	3.7	3.4	2.7	8	5	6	9	0	0	0	0	6	37	5	1
				8	5	5	8	0	0	0	0	3	16	5	0
				6	4	5	8	0	0	0	0	4	10	3	0
Micronvolts				**8**	**6**	**6**	**9**	**7**	**4**	**3**	**3**	**7**	**44**	**10**	**4**

Tab 2: Test EMG carried out after the reconstruction of the occlusal plane with a suitable material

a) RIGHT		LEFT		b) RIGHT		LEFT		c) RIGHT		LEFT		d) RIGHT		LEFT	
TA	MM	MM	TA	TA	MM	MM	TA	TA	MM	MM	TA	TA	MM	MM	TA
3.7	4.9	5.9	4.2	0	4	4	0	3	1	2	2	0	1	3	0
4.0	4.4	4.2	4.1	1	8	16	0	12	7	5	7	2	3	14	1
4.2	3.6	2.8	4.3	1	14	15	1	3	2	2	3	2	3	18	0
5.6	5.0	4.3	6.3	0	17	21	2	7	7	7	7	1	5	51	3
5.1	3.7	3.4	4.4	1	22	24	2	7	12	9	7	2	4	19	3
5.4	3.1	3.1	4.5	0	22	22	2	3	12	16	8	4	4	40	3
5.5	3.2	3.5	4.7	0	17	19	1	4	9	12	7	4	12	50	5
5.5	3.2	3.5	4.6	1	17	23	1	7	16	10	10	2	10	64	2
				0	15	24	1	7	13	8	14	1	112	35	5
				0	14	23	1	10	18	12	27	2	118	66	9
Micronvolts				**0**	**16**	**20**	**1**	**6**	**10**	**9**	**10**	**2**	**30**	**39**	**3**

Tab 3: Test emg performed three months after application of a prosthesis

a: emg masticatories at rest (TA=temporal; MM=masseter)
b: masticatories in function
c: tests emg on the proximal sternocleidomastoid muscles (TA) and on cervical trapezius tract when the neck is extended.
d: tests emg on the paravertebral muscles carried out by placing the electrodes at the level of the seventh thoracic (TA) and second lumbar vertebrae (MM) at 2 centimetres from the spinous process.

the application of a prosthesis, when all test results were normal and the typical symptoms of TMJ disorders (articular click, myotensive headache, tinnitus, buzzing and dizziness) had disappeared. At this point, it is worth describing our patient's symptoms in greater detail.

• Dizziness (Fig. 1). This symptom was generated by reduced cervical spine mobility resulting from disturbed endolymph functioning in the semicircular canals of the vestibular apparatus, i.e. the system from which the vestibulospinal tract - which plays a role in posture maintenance - originates. The activated neuron pathway appears to be: stimulation of the alveolar pressoceptors – Gasser's ganglion – spinal root of V – synapse with some motor neurons of the spinal accessory nerve, which innervate the mastoid portion of the sternocleidomastoid and cervical portion of the trapezium muscle.

• Tinnitus, buzzing (Fig. 2). These acoustic hallucinations could originate from the following sequence of events: incomplete TMJ dislocation – compression of the mandibular-malleolar ligament (also known as Pinto's ligament) which can be identified with the tympanomandibular ligament (in turn part of the sphenomandibular ligament) – via the Glaserian fissure – tension of the muscle governing the malleus handle. It is assumed that the following neuron pathway is activated: stimulation of the mandibular-malleolar

ligament proprioceptors – reflex response of the malleus tensor muscle innervated by V.

• Myotensive headache (Fig. 3). This symptom originates from trigemino-reticular connections and from the strong psychosomatic components of other afferents of the so-called Ascending Reticular Activating System, the system where afferent and efferent reticular substance pathways pool and depart from. The following neuron pathway is probably activated. A pain stimulus in the trigeminal nerve endings – an afferent pathway to Gasser's ganglion – nucleus of the spinal root of V – activation of the trigemino-reticular-thalamic pathway and then of the ascending RAS – activation of the gamma-alfa – muscular hypertony and spasm-myotensive headache. One psychosomatic component of myotensive headache may originate from the convergence of hypothalamic and limbic pathways to the nucleus of the raphe magnum (NRM) and the periaqueductal grey substance (PAG), both of which link up to the RAS. In conclusion, the TMJ disorders reported by our patient were mainly generated by postural alterations which were also responsible for non-dental disorders. The EMG tests performed at successive stages of our analysis provided evidence that most of these postural

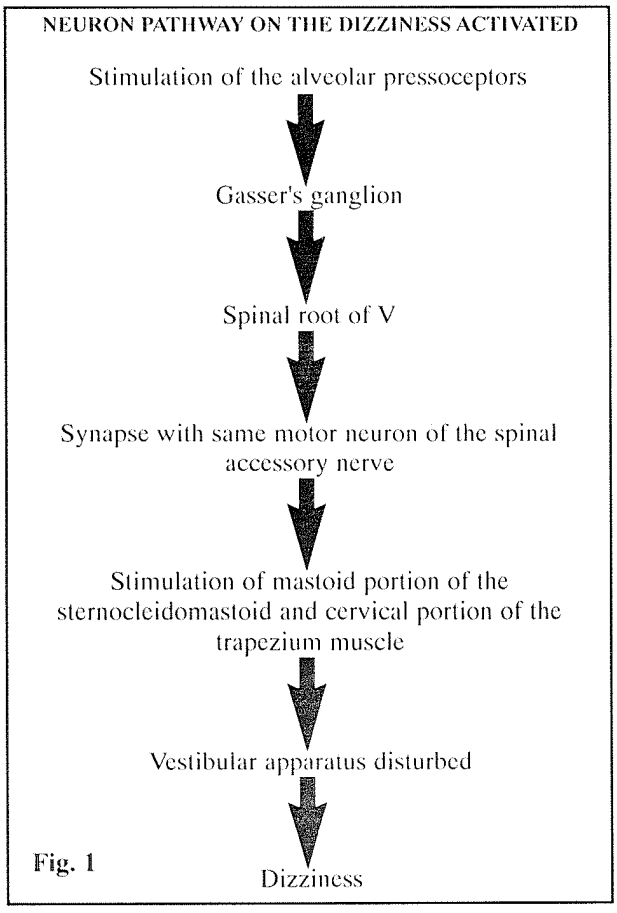

Fig. 1

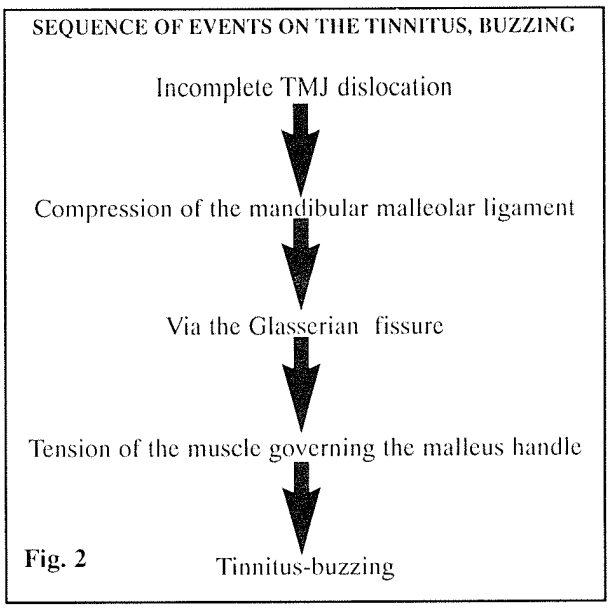

Fig. 2

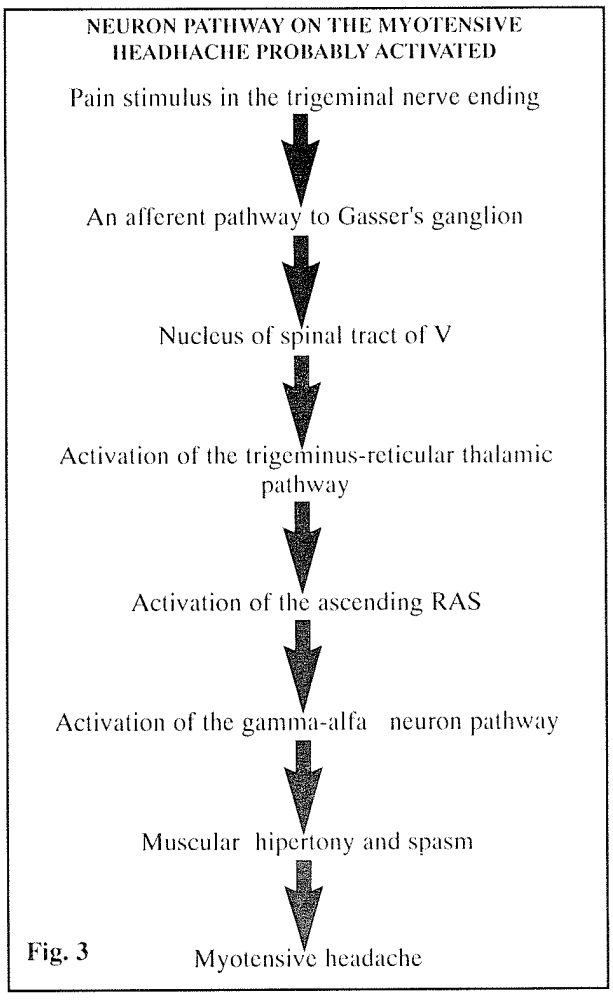

Fig. 3

alterations could be traced back to changes of the occlusal plane. And this may in turn explain why the application of a suitable prosthesis effectively solved the patients problems and put an end to the vicious circle which is typical of TMJ disorders.

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