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CORRELATION BETWEEN INTERDENTAL OCCLUSAL PLANE AND PLANTAR ARCHES. AN EMG STUDY

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RESUME

Une étude experimentale a été menée sur un groupe homogéne des jeunes dans le but de montrer les corrélations fonctionnelles entre les muscles de la mastication et, indirectement, entre le plan de contact interdental et les modifications des arcades plantaires dans la condition de pied valgus ou pied plat. Les modifications fonctionnelles des masticateurs sont différentes dans les deux conditions. Il faut mettre ce fait en rapport avec l'activation de longues chaines osteo-arthromusculaires au départ de la stimulation différente des mécano-récepteus présents dans les structures tendineuses des muscles respnsables du maintien des arcades plantaires. Les odontologistes doivent tenir compte de ce corrélations en faisant une analyse correcte de la posture en vue du diagnostic du Syndrome de TMJ.

ABSTRACT

The Authors carried out an experimental study on a homogeneous group of young people to provide evidence of functional correlation among masticatory muscles and, indirectly, between changes to the interdental occlusal plane and modifications of the plantar arches due to talipes valgus and flat foot.

In the two analysed conditions, the masticatory muscles undergo different functional alterations. This is due to the fact that the mechanoreceptors in the tendons of the muscles governing the plantar arch configuration are stimulated in different ways during the activation of long osteoarthromuscular chains. Dental specialists will have to take these correlation into account when diagnosing TMJ disorders.

INTRODUCTION

Recent research on osteoarthromuscular chains (Busquet L. 1992) has provided significant insight into the functional connections between topographically distant structures. Coupled with the results of neurophysiological studies (Choi B. et al. 2000, Gangloff P. et al. 2000, Lyons MF et al. 2001, Makofsky HW 2000, Milani RS et al. 2000, Tangsrud SE et al. 2001) which shed light on the activation of the neuron pathways (Valentino B et al. 2001, Woda A. et al. 2001) that make these chains work, this insight illustrates the importance of posturology.

As TMJ disorders are a multifactorial syndrome in which posture is a prominent factor, our approach to this syndrome must necessarily build on these research results. It is well known that TMJ disorders may spark a vicious cause-effect cycle which makes it difficult to formulate a correct diagnosis. Posture, through plantar arch changes, plays a fundamental role in generating the above-mentioned cause-effect mechanism (Herken H. et al. 2001, Leonardi R. et al. 2001, List T. et al. 2001, Pow EH et al. 2001, Turp JC et al. 2001). It is in this light that we are examining the functional correlation between the interdental occlusal plane and experimental plantar arch changes. We also analysed the occlusal plane based on changes affecting the masseter and the temporal muscles, which are among the factors that most strongly affect the configuration of this plane.

MATERIAL AND METHODS

Our research was conducted on a homogenous group of 10 young people in their twenties, of both sexes and different body build. The main posture tests to which they were subjected yielded non-significant results because none of the subjects tested suffered from stomatognathic disorders. We used a four-channel EM2 Myotronic electromyograph with bipolar surface electrodes.We performed three groups of EMG tests under different experimental conditions. The first group included tests of the masticatories at rest and in motion, which were used as a benchmark. The second group included the same tests performed under experimental conditions simulating a talipes valgus, with the application of plasticine on the medial margin of the right plantar arch. The tests in the

third group were carried out under experimental conditions simulating a talipes varus.

RESULTS

A) Masticatory tests, conducted on both the masseter and the temporal muscles with plantar arches in a normal position. As these were benchmark tests, the results were obviously unremarkable (Tab 1).

B) Masticatory tests under experimental conditions simulating a talipes valgus. With the masticatories at rest, the results pointed to slight atony on the right side and hypertony on the left. With the masticatories in motion, there was increased activity on the left side and slightly diminished activity on the right side (Tab 2).

C) Masticatory tests under experimental conditions simulating a flat foot, performed again on the right arch. With the masticatories at rest there was hypertony of the right temporal muscle; with the masticatories in motion there was marked prevalence of the right temporal and masseter muscles (Tab 3) .

a RIGHT		LEFT		b RIGHT		LEFT	
TA	MM	MM	TA	TA	MM	MM	TA
5.2	1.4	2.2	2.0	0	0	0	0
3.1	1.4	2.3	1.7	10	1	2	20
2.6	1.4	2.4	1.7	144	84	98	123
4.1	1.3	3.2	1.6	224	137	137	170
3.4	1.3	2.2	1.9	218	159	160	205
3.8	1.4	2.0	1.9	238	160	164	205
3.6	1.3	2.6	1.8	247	193	199	187
3.3	1.3	3.3	1.5	240	172	168	208
3.6	1.3	2.2	1.7	255	183	199	219
				254	233	234	226
			Micronvolts	**203**	**146**	**151**	**173**

Tab. 1: Masticatory tests with plantar arches in a normal position.

a-masticatories muscles at rest (TA=temporal MM=masseter)

b-masticatories in function

a RIGHT		LEFT		b RIGHT		LEFT	
TA	MM	MM	TA	TA	MM	MM	TA
5.7	6.5	5.9	8.1	5	1	1	5
3.6	6.8	6.6	4.2	37	13	17	38
1.8	6.7	6.7	2.3	128	72	52	101
2.6	7.4	8.0	2.7	180	130	111	141
2.2	3.7	6.1	2.4	212	126	120	151
2.4	4.0	6.0	2.5	235	137	116	147
2.3	4.7	6.3	2.4	230	165	122	155
2.2	3.7	5.5	2.5	232	149	167	198
				248	150	179	213
2.8	**5.4**	**6.3**	**3.3** Micronvolts	245	195	197	246
			Micronvolts	**194**	**126**	**120**	**154**

Tab. 2: Masticatory tests under experimental conditions simulating a talipes valgus

a-masticatories muscles at rest

b-masticatories muscles in function

a RIGHT		LEFT		b RIGHT		LEFT	
TA	MM	MM	TA	TA	MM	MM	TA
8.5	1.5	1.7	3.7	0	0	0	0
2.9	.9	1.2	2.0	10	51	22	30
2.9	1.4	1.7	2.4	168	124	90	159
2.9	.8	1.1	2.3	173	151	129	190
3.0	.9	1.2	2.5	241	181	138	213
3.8	.9	1.2	3.8	255	201	168	199
5.4	1.5	2.0	3.6	255	220	184	206
3.5	1.3	1.8	3.4	255	220	212	197
				255	254	201	209
4.1	**1.1**	**1.4**	**2.9** Micronvolts	255	222	235	224
			Micronvolts	**207**	**180**	**153**	**179**

Tab. 3: Masticatory tests under experimental conditions simulating a talipes varus

a-masticatories muscles at rest

b-masticatories muscles in function

DISCUSSION AND CONCLUSIONS

Our findings point to a specific functional correlation between masticatory muscles and, indirectly, between the interdental occlusal plane and changes in the plantar arch. A particularly interesting observation is that the experimental conditions simulating talipes valgus and flat foot affect the functions of the masticatories in different ways because they generate opposing plantar arch changes. The talipes valgus condition of the right foot generates hypertony of the right masticatory muscles. With the masticatories in motion, the tests reveal a slight increase in activity on the same side as the talipes valgus. On the left there is a decrease in basic tonic activity.

Under experimental flat foot conditions, the functional alterations of the masticatories are both more marked and contralateral. Our conclusion is that different muscle chains are activated in each of the two experimental conditions, because the mechanoreceptors in the tendons of the muscles which govern the normal configuration of the plantar arch are stimulated in different ways. The complex neuron pathway that is activated can be summed up as follows (Fig 1): the experimental alteration of the plantar arch modifies the talocrural angle, thereby stimulating the mechanoreceptors in the tendons of the muscles governing the configuration of the plantar arch. The afferent proprioceptive impulse runs along the spinocerebellar tract and along the medullary nucleus gracilis and nucleus cuneatus. These nuclei form the medial lemniscus. This bundle of fibres synapses on the neural cells in the ventral nuclei of the thalamus. The last afferent tract of this reflex arc is the thalamocortical tract. Stimulation becomes conscious at the point where this reaches the sensory cortex. In terms of the efferent motor response, we must start out from the cortical neurons of the stomatognathic section of the motor cortex. These neurons synapse on the neurons in the motor nucleus of the trigeminal nerve that innervate the masticatory muscles (masseter and temporal) examined here. In conclusion, when postural tests are carried out in order to dignose TMJ disorder, it is essential that the specialist give proper consideration to these correlations.

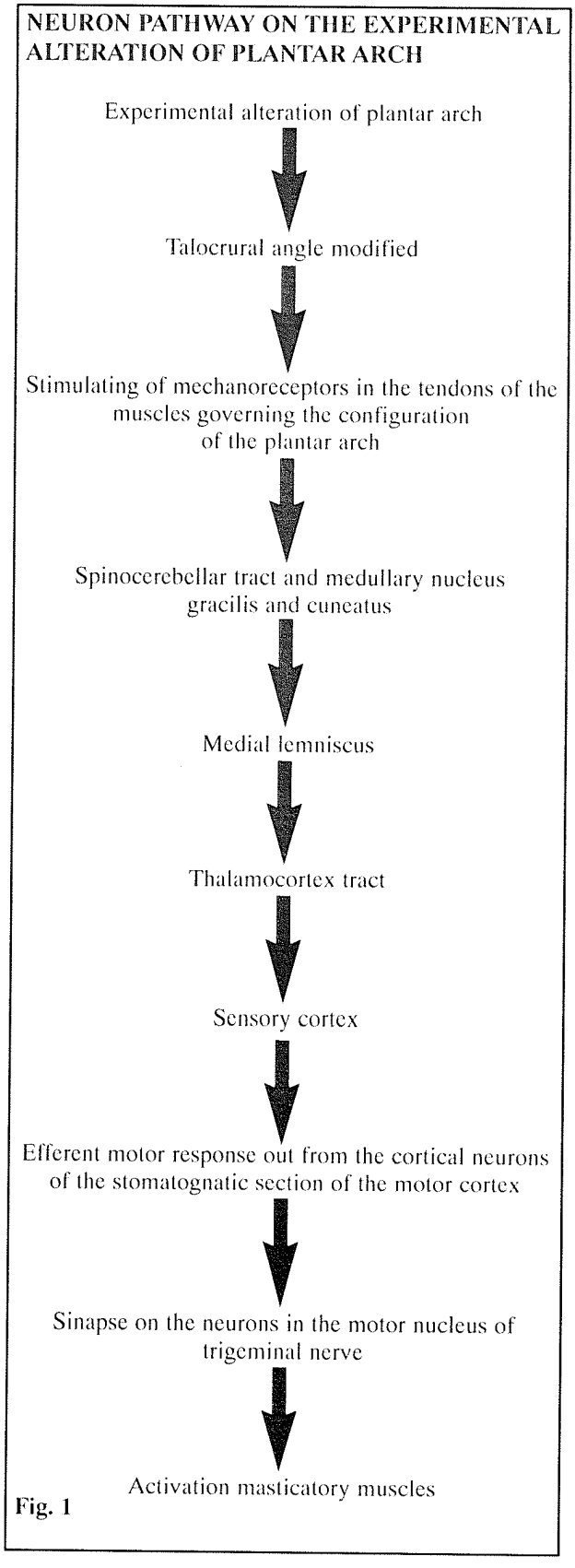

Fig. 1

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