research article

TMD IN MIGRANEURS: A STATIC STABILOMETRIC STUDY

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SUMMARY

TMD in migraneurs: a static stabilometric study.

Objective. Aims of the study were to assess the stabilometric pattern in a TMD population with migraine and to evaluate the role of static stabilometry as an important tool in the clinical practice to quantify postural analysis in TMD and migraine patients.

Materials and methods. We recruited 3 samples. The first one with TMD and headache symptom; the second one consisted in a migraneurs population and the third one was a healthy group. All subjects submitted to a stomathognatic visit for diagnosis of TMD in according to international RDC/TMD criteria, a neurological visit to make diagnosis of primary headache (IHS criteria, 2004) and stabilometric tests (1.open eyes, 2.closed eyes, 3. hyperextended head, 4.with cotton rolls).

Results. We found that TMD patients showed an high percentage of migraine diagnosis (90%) and that TMD patients with migraine presented a muscular involvement in the neck district, more than healthy controls.

Conclusions. We showed that there is a strong association between TMD and migraine and an increase of myogenous tension in the neck area is frequent in TMDs, particularly when they are associated with migraine. We suggest that stabilometry could represent a valid tool in the postural approach of TMD and migraine patients.

Key words: TMD, migraine, stabilometry.

RIASSUNTO

Disordini temporomandibolari ed emicrania: uno studio mediante stabilometria statica.

Scopo. Gli obiettivi dello studio sono stati evidenziare il pattern stabilometrico in una popolazione di pazienti affetti da DTM ed emicrania e valutare il ruolo della stabilometria statica come strumento utile nella pratica clinica per quantificare l'analisi posturale nei DTM ed emicrania.

Materiali e metodi. Sono state reclutate 3 popolazioni. La prima con DTM e cefalea; la seconda consisteva in una popolazione di pazienti emicranici e la terza costituiva il gruppo controllo. Tutti i soggetti sono stati sottoposti a visita gnatologica per diagnosi di DTM, in accordo ai criteri internazionali RDC/TMD, una visita neurologica per diagnosi di cefalea primaria (criteri IHS 2004) e test stabilometrici (1.occhi aperti, 2.occhi chiusi, 3. capo retroflesso, 4.con rulli salivari).

Risultati. Lo studio mostra che i pazienti con DTM hanno rilevato un'alta percentuale di diagnosi di emicrania (90%) e che i pazienti affetti da DTM con emicrania hanno presentato un coinvolgimento muscolare nel tratto cervicale, maggiore rispetto ai controlli sani.

Conclusioni. Gli Autori hanno rilevato una forte correlazione tra DTM ed emicrania e un frequente incremento della tensione muscolare nell'area cervicale nei DTM, particolarmente quando in associazione ad emicrania. Suggeriamo che la stabilometria possa rappresentare un valido strumento nell'approccio posturale al paziente emicranico con DTM.

Parole chiave: DTM, emicrania, stabilometria.

Introduction

Temporomandibular disorders (TMDs) can be described as a whole of clinical syndromes, affecting masticatory muscles, temporomandibular joint, or both (1).
They are often associated with a lot of signs and symptoms relative to craniocervical district, among which headache is the most frequently reported one. TMDs, headache and orofacial pain are also highly predominant in the population and they can led to a worsening of quality of life (5).
An association between the myogenous disorder in TMD and an increase of muscular tension in tension type headache (TTH) has been suggested (11).
On the other side a muscular component has been also found in migraine, particularly during headache attack (20) .
Balance is a complex biological function regulated by sensory inputs through visual, proprioceptive and vestibular systems (13) and influenced by various determinants (4). In this view it has been showed that head and neck position, swallowing, respiration, stress and anxiety, can change human posture and balance (14).
Recently the role of stomatognathic system in the maintenance of balance control and in particular of head and cervical spine posture has been evaluated (16) , supporting a role of trigeminal afferences on proprioception, visual and postural stabilization (4).
The relationship between headache and balance disorders has been also investigated. In fact, occasionally migraine patients complain of dizziness or vertigo (3).
During the last decade, stabilometry had become widely used to value the role of some components of postural system such as TMJ and cervical receptors in balance alterations (13). It has been also used in migraineurs to quantify the vestibulospinal symptoms such as dizziness, vertigo or truncal ataxia (10).
The aim of this study was first to evaluate the stabilometric pattern in a TMD population with migraine respect to healthy control.
The second purpose was to verify if stabilometry can represent a valid tool in clinical diagnosis and quantitative analysis of postural system in TMD and migraine patients.

Materials and methods

The study included three groups: forty patients (35 female and 5 male), referred to our orofacial pain clinic, and 47 patients (38 female and 9 male) recruited in a headache centre constituted the dentist group (DG) and neurological group (NG), respectively. The matched control (CG) consisted in 23 healthy subjects (19 female and 4 male).
Inclusion and exclusion criteria of the three populations are reported in Tables 1 and 2:
Each patient submitted to a stomathognatic and a neurological visit by a team specialist on TMDs and a neurologist expert in primary headache disorders respectively.
In particular a diagnosis of TMD according to international RDC/TMD criteria (6) and a diagnosis of primary headache according to IHS criteria (9) were made to all patients.
They underwent to a stabilometric examination, too.

Examination of the stomatognatic system
Assisted mouth opening were measured as the interincisal distance after the subjects had executed the movement a few times.

Table 1 - Inclusion and exclusion criteria of the DG and NG.

Inclusion Criteria	Exclusion Criteria
- TMD	- Maxillo-facial malformations
- Headache symptom	- Maxillo-facial tumors
- Informed consent	- Maxillo-facial trauma
- Age between 18–55	

Table 2 - Inclusion criteria of healthy group.

Inclusion Criteria
• Informed consent
• Age 18-55
• Negative history of TMD and craniofacial pain
• Negative history of headache

Table 3 - ICHD II. Cephalalgia 2004; 24 (Suppl.1).

Migraine without aura	Tension type headache
A. At least 5 attacks fulfilling criteria B-D	A. Headache occurring on ≥15 d/mo (≥180 d/y) for >3 mo and fulfilling criteria B-D
B. Headache attacks lasting 4-72 h (untreated or unsuccessfully treated)	B. Headache lasts hours or may be continuous
C. Headache has ≥2 of the following characteristics:	C. Headache has ≥2 of the following characteristics:
1. unilateral location	1. bilateral location
2. pulsating quality	2. pressing/tightening (non-pulsating) quality
3. moderate or severe pain intensity	3. mild or moderate intensity
4. aggravation by or causing avoidance of routine physical activity (eg, walking, climbing stairs)	4. not aggravated by routine physical activity
D. During headache ≥1 of the following:	D. Both of the following:
1. nausea and/or vomiting	1. not >1 of photophobia, phonophobia, mild nausea
2. photophobia and phonophobia	2. neither moderate or severe nausea nor vomiting
E. Not attributed to another disorder	E. Not attributed to another disorder

At the same, laterotrusion left and right, and protrusion were registered.
Clicking sounds during mandibular movements (clicking of TMJ) were examined manually and registered as anterior disc displacement with reduction left or right.
The TMJs were palpated both laterally and posteriorly. Pain feeling , not "just pressure", was considered a positive data.
The temporalis, masseter, medial pterygoid and the region of lateral pterygoid muscle were palpated intra- and extra-orally.
Then subjects were divided into 4 groups: MD (muscular disorders) group, DD (disc displacement) group, MD and DD group and artralgia-group, according to RDC/TMD criteria (6).

Neurological visit for headache diagnosis
Primary headache diagnosis was warranted in according to IHS (2004) criteria (9). In Table 3 diagnostic criteria of the two more frequent headache forms observed in outpatient are reported.

Stabilometric examination
A Dr. Foot system (Dr. Foot, Rome, Italy) was used for static stabilometry.
The static force platform was a square and contained three strain gauge force transducers positioned according to an equilateral triangle of 40 cm per side.
A PC computers calculates the information and provides responses as stability graph (center of foot pressure, assumed to be body barycentre, and its swinging during time). The center of foot pressure (CoP) is considered as the real body barycentre, and it is compared to the theoretical barycentre, which occurs when, ideally, the body weight is uniformly distribuited on the feet supporting points.
The examiners taking stabilometric measurements respected all standardized parameters of the "Association Francaise de Posturologie" (2) as in Table 4.
Patients were asked to stand barefoot at a 30° angle with the heels at a distance of 2 cm from each other. They were instructed to stand straight and motionless with arms along the sides of the body during the whole recording period, looking at a point in front of them 90 cm away.

Table 4 - Standardized parameters in according to *"Association Francaise de Posturologie"* criteria.

✓ Support surface large sufficiently

✓ a quiet room, without visual or hearing inputs

✓ Preventive setting

✓ Romberg's position: arms along the sides of the body, barefooted at 30° angle

✓ Eyes at a distance of 90 cm from the point, in order to not disturb convergence's movement

✓ Need of studing all parameters of oscillations to interpret posture analysis more exactly

✓ test lasting 60 s

The recording lasted 51,2 s.
Four different conditions were used during static stabilometry as follows:
- eyes open with mandibular rest position
- eyes closed with mandibular rest position
- eyes closed with 2 cotton rolls between posterior teeth
- eyes closed with hyperextended head

Patients were required to take several steps between the recordings.
Based on the measures of the displacements of the CoP, two variables were considered in static conditions:
- ellipse surface (in mm^2) : it corresponds to the area of the confidence ellipse, which contains 90% of the positions of the CoP sampled.
- Total length of the oscillations (in mm): sum of the distances covered between each position of CoP. This parameter represents the length of the trajectory of the displacement of the CoP.

The measurements were analyzed according to Guidetti's protocol (8) (Table 5, Figure 1).

Table 5 - Significance and normal value of the three indexes of Guidetti's protocol.

INDEX	SIGNIFICANCE	NORMAL VALUE
Romberg's index (21)	It indicates a visual interference on postural control	110-250
Stomathognatic index (7)	It indicates a stomathognatic interference on postural control	< 60 relative to S < 70 relative to L
Cervical index (7)	It indicates a cervical interference on postural control	> 120

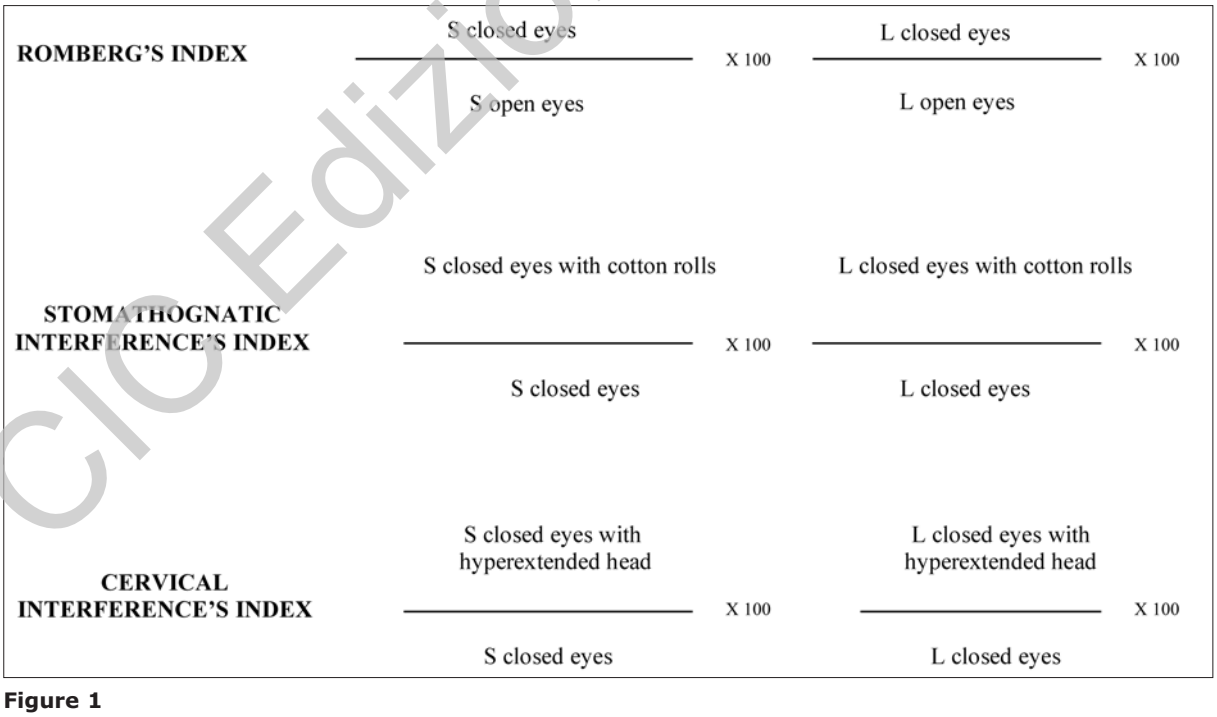

Figure 1
Visual, stomathognatic and cervical interference's indexes of Guidetti's protocol.

Data analysis

Statistical Package for Social Sciences software (SPSS Inc., Chicago, Illinois, USA) was used to analyze data.
A chi-square test was used to assess the equality of groups by gender and age.
ANOVA test was performed to assess the significance of the differences among the three groups in each experimental conditions, while Bonferroni's test was used for intra-group comparisons.
A p value less than 0,05 was considered no statistically significant different.

Results

A total of 40 patients (35 female and 5 male) were recruited in TMJ and Orofacial Pain Clinic, School of Dentistry, and constituted the dentist group (DG).
The second group was formed by 47 patients (38 female and 9 male) (neurological group=NG) referred to headache section of pain medicine center of Policlinico Umberto I, "Sapienza" University of Rome. Twenty-three subjects (19 female and 4 male) constituted the matched control at last.
In regard of TMD, the first group presented masticatory muscle disorders (MMD), associated or not with disk displacement (DD) and artralgia (Table 6).
The second group showed, for TMD diagnosis, findings in Table 7.
Ten patients in the second group showed not TMD.
In regard of headache diagnosis, out of 40 DG patients, 38 (90%) suffered of migraine (M) associated or not with chronic tension-type headache (CTTH) (Table 8).
The second population (NG) presented a diagnosis of migraine entirely (100%) and in 48% migraine was associated with CTTH (Table 9).
In Table 10 TMD and migraine illness duration are reported.
None of the stabilometric parameters showed any significant differences between the groups within any of the experimental conditions with the exception of the *L* parameter which was significantly greater in

Table 6 - Prevalence of TMDs in the first population (DG).

GENDER	MMD	DD	MMD + DD + Artralgia	Tot
Female	20	9	6	35
Male	2	2	1	5
Tot	**22**	**11**	**7**	**40**

Table 7 - Prevalence of TMDs in the second population (NG).

GENDER	MMD	DD	MMD + DD + Artralgia	Tot
Female	18	12	1	31
Male	3	1	2	6
Tot	**21**	**13**	**3**	**37**

Table 8 - Prevalence of primary headaches in the first population (DG).

GENDER	M	CTTH	M+CTTH	Tot
Female	7	2	28	37
Male	3	0	0	3
Tot	**10**	**2**	**28**	**40**

Table 9 - Prevalence of primary headaches in the second population (NG).

GENDER	M	CTTH	M+CTTH	Tot
Female	20	0	18	38
Male	4	0	5	9
Tot	**24**	**0**	**23**	**47**

Table 10 - Historical items of TMD and migraine explored in the study.

Variable	Value
- Migraine illness duration (yrs ± SD)	13,3 ± 10,3
- TMD illness duration (yrs ± SD)	15 ± 10

the DG as compared to the control group under the eyes closed with hyperextended head condition (Table 11):
For the intra-group comparisons, similar results were generally seen for dentist group and neurological group. No statistically significant differences were observed between NG and healthy sample.

Discussion

The identification of temporomandibular disorder is very difficult because of its complex and multifactorial aetiology, in addition to the great multitude of signs and symptoms related to TMJ (15) . The most frequent symptom is headache. In fact, it has been previously demonstrated that TMDs can be associated with migraine with and without aura, tension headache and combinations of these headaches (22). Our findings are in according with these data. In detail, we found that the almost totality of the dentist group presented a diagnosis of migraine associated or not with tension type headache. At the same way, out of 47 patients of the second group (NG), 78% (No= 37) showed a diagnosis of TMD.
A lot of studies suggested a role of TMD in balan-

Table 11 - Static stabilometric parameters among the different experimental conditions in each group.

Measurements	Dentist group (N=40) Mean +-SD	Neurological group (N=47) Mean +-SD	Control group (N=23) Mean +-SD	Significant level
Romberg's index relative to S	116,951 ± 62	98,912 ± 54	138,780 ± 117	0,108
Romberg's index relative to L	118,387 ± 29	134,889 ± 135	119,578 ± 34	0,662
Stomathognatic index relative to S	136,629 ± 100	128,393 ± 78	110,536 ± 60	0,499
Stomathognatic index relative to L	102,422 ± 20	96,017 ± 20	91,631 ± 21	0,114
Cervical index relative to S	175,086 ± 211	144,003 ± 121	94,229 ± 50	0,132
Cervical index relative to L	120,415 ± 32	111,182 ± 24	92,580 ± 17	0,001

ce disorders and more specifically they can modify human posture, particularly of the head and neck (18). In fact, it has been demonstrated that head posture and jaw clenching clearly influence the electromyographic activity in both jaw and cervical muscles, because of a considerable convergence of craniofacial and cervical afferent fibers onto trigeminal brainstem and upper cervical nociceptive neurons (19). The relationship between headache and balance disruptions has long been studied, too. Indeed many authors have identified vertigo, dizziness and instability as prodromes of migraine (17), in according with the hypotesis that migraine is a channelopathic disorder and that channelopathies are often associated with the cerebellar dysfunction. Because of the interconnections of the cerebellum and vestibular system, migraine patients often show vestibular symptoms (10).

Aim of our study was to investigate the balance control in TMD patients with migraine, by using a stabilometric platform. We found an increase of total length under hyperextended head condition in DG comparison with healthy sample, pointing to an increase in the energy required to maintain an orthostatic position. It has been previously suggested that length increase more than surface in patients with disorders of proprioception, because if proprioception is damaged, the body begins to move faster (23). This finding may be due to the neck muscular (proprioceptive) involvement as often observed in TMD (19), particularly when associated with migraine and tension type headache or both headaches (12).

Indeed in our study we not found an increase of stomathognatic parameters, probably due to the elevated illness duration of TMD in both dentist and neurological groups, taking to postural compensations in the cervical district.

Conclusions

Our data suggest that TMD in migraine may be responsible of balance disorder by an involvement of muscular structures of cervical spine.

We support a clinical role of stabilometry for a comprehensive clinical evaluation of TMD migraine patients.

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