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Familial occurrence of signs of temporomandibular disorders in headache children and their mothers

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Abstract

Objective. Earlier studies have provided evidence of genetic inheritance of headache, especially migraine, but no familial occurrence has been found regarding temporomandibular disorders (TMD). In adults, headache and TMD have been found to be associated with each other, but studies on children are few. The aim of the present study was to test the hypothesis that there is no association between signs of TMD in 13-year-old headache children and their mothers. ***Material and methods.*** The study population was a nested case-control study of the population-based Finnish Family Competence Study originally consisting of over 1000 families. A structured questionnaire was sent to the families of 6-year-old children. A clinical examination was performed in 96 children with headache and 96 pairwise controls. At the age of 13 years, 75 of these same 96 children with headache and 79 of 96 headache-free controls participated in pediatric and stomatognathic examinations. Moreover, the mothers ($n=154$) filled in a structured headache questionnaire and participated in the stomatognathic examination. ***Results.*** No association between mother's and child's TMD signs was found. There was a significant association between signs of TMD and both migraine and tension-type headache in children. In mothers, the association was significant only between migraine and TMD signs. ***Conclusions.*** Familial occurrence of signs of TMD cannot be found in headache children and their mothers.

Key Words: *Children, familial occurrence, headache, mothers, temporomandibular disorders*

Introduction

Several studies in adults have shown a strong association between temporomandibular disorders (TMDs) and headache [1–4]. In adults, an association is usually considered to exist between TMD and tension-type headache [5,6], but also migraine patients suffer from TMD [7–9]. Studies in children and adolescents have shown that 11–25% of children and adolescents with TMD report recurrent headache [10–14]. Our previous studies indicated that the association with TMD seemed to be stronger in children with migraine than in children with tension-type headache [15,16].

TMDs can be defined as a cluster of symptoms and signs involving masticatory muscles, the temporomandibular joints and associated structures, or both [17]. TMD includes spontaneous pain in the area of the ear, the temporomandibular joint, or the musculature of mastication, limitations in the range of movement, and clicking and popping noises in the temporomandibular joints during jaw function. Pain is often elicited by mandibular function or palpation of the muscles involved in chewing, and this is the most common reason for patients seeking help. TMD is two to four times as common in women, especially those around 35 years of age, as in men [18,19].

Mothers' headache has been found to be a predictor of headache in preschool children [20]. An increase in the prevalence of children's headache during a 6-year follow-up was observed to be greater for children whose mothers suffered from headache [21]. Migraine studies from the early 1950s revealed

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that there is a strong family history of migraine [22]. Bille [23] followed 73 subjects with pronounced migraine in childhood for 40 years. Of those who had become parents, 52% had at least one child who had developed recurrent headache, usually of migraine-type. Twin studies have shown evidence of genetic inheritance of migraine [24–28]. New molecular studies suggest that there are several genetic markers predisposing to migraine [29,30]. Unlike in headache, studies have shown no evidence of family history [31] or inheritance [32] of TMD. In the study by Raphael and co-workers [31], adult myofascial TMD patients, their demographically matched controls and first-degree relatives (parents, siblings, children) were interviewed by telephone. The results suggested that relatives of TMD patients are at no higher risk of TMD or other musculoskeletal conditions than the relatives of controls. A twin study by Michalowicz and co-workers [32] showed no genetic transmittance of TMD. List et al. [33] found no difference between the answers of 12- to 18-year-old children with or without TMD when asked about pain experience of their parents.

The aim of the present study was to test the hypothesis that there is no association between signs of TMD in 13-year-old headache children and their mothers.

Material and methods

In 1986, stratified random cluster sampling was performed in the province of Turku and Pori, in southwestern Finland. The original study population consisted of 1582 families expecting their first child. Of these families, 1443 (91%) filled in an informed consent form and participated, while 139 refused to participate. The mothers gave birth to 1294 children. There were three stillbirths, eight children died in infancy, and five moved abroad. During the follow-up, a further 146 families dropped out of the study. In 1993, a questionnaire inquiring about headache was sent to the remaining 1132 families with children (average age 6 years). The question about headache was answered by 968 parents on behalf of 968 (86%) of 1132 eligible children. Altogether 144 children had suffered from headache that disturbed their daily activities during the preceding 6 months. All these children and their headache-free controls were invited to the Department of Child Neurology, Turku University Central Hospital to participate in a clinical pediatric and neurological interview and clinical examination by one and the same pediatric trainee (M.A.). Headache type was classified according to the IHS criteria (1988) [34]. The controls were chosen from those children who had never had headache ($n=764$) and were matched for age, sex and domicile.

Of the 144 children, 106 with headache and their 106 matched controls participated in the study. The reasons for refusal to participate were long geographic distance, lack of time of the family, several other hospital visits for the child, family member with long-term disease, and anxiety of the parents that the examination might increase the headache attacks.

The statistical difference between the participants and non-participants was analyzed. The child's long-term disease (excluding headache), such as allergy, asthma, diabetes, constipation, and nocturnal enuresis, was more common among non-participants than among participants. Children with secondary headaches were excluded from subsequent examinations. There therefore remained 96 six-year-old children with primary headache and their 96 headache-free controls in the study (Table I). Seventy-three percent of the mothers of 6-year-old headache children and 46% of the mothers of 6-year-old control children suffered from recurrent headache (data not shown in Table I).

At the age of 13 years, the same children were again invited to an examination by telephone or by mail. Altogether 75 headache children, their 79 headache-free controls from the original groups, and

Table I. Occurrence of different headache types in children at the age of 6 and 13 years, and their mothers

Children 6 years	Headache children ($n=96$)	Control children ($n=96$)
Migraine		
Without aura	34 (35%)	
With aura	10 (10%)	
Not fulfilling all criteria	14 (15%)	
Tension-type		
Episodic	24 (25%)	
Not fulfilling all criteria	14 (15%)	
Children 13 years	**Headache children ($n=75$)**	**Control children ($n=79$)**
No headache	14 (19%)	67 (85%)
Migraine		
Without aura	18 (24%)	1 (1%
With aura	5 (7%)	1 (1%)
Not fulfilling all criteria	11 (15%)	3 (4%)
Tension-type		
Episodic	15 (20%)	7 (9%)
Not fulfilling all criteria	11 (15%)	0 (0%)
Other headaches	(1%)	
Mothers of 13-year-olds:	$n=74$	$n=79$
No headache	5 (7%)	11 (14%)
Migraine		
Without aura	22 (30%)	6 (8%)
With aura	13 (18%)	5 (9%)
Not fulfilling all criteria	13 (18%)	16 (20%)
Tension-type		
Episodic	16 (22%)	27 (34%)
Not fulfilling all criteria	2 (3%)	9 (11%)
Other headaches	3 (4%)	5 (6%)
Missing data	1	

their 154 mothers participated in a stomatognathic examination at the Institute of Dentistry, University of Turku (Table I). Of the 154 children, 71 were girls and 83 boys. Their mean age was 13.0 years (range 12.6–13.6). Reasons for dropping out were living far away, lack of time, child's refusal, recent death of a family member and intractability of the child/family.

From the original headache-free control group at the age 6 years, 12 children had begun to suffer from headache at the age of 13 years. On the other hand, of the original headache children, 14 had become headache-free at the age 13 years. In this study, the headache and headache-free children were divided into the groups according to the headache situation at the age of 13 years.

Interview and clinical examination by the physician

The type of headache was elicited with several questions: age of onset of attacks, triggers of headache, predominant time of headache onset, aural symptoms, location of pain, duration of attacks, characterization of pain, concurrent symptoms, worsening or alleviating factors, medication, etc. Clinical examination by one and the same physician (R.V.) included an interview and a somatic examination. Thereafter, the children's headache type was classified by the same physician in accordance with the International Headache Society (IHS) criteria (1988).

The classification of mothers' headache type was based on the headache questionnaire, which included the same questions as the children's interview, and the same IHS criteria (1988). The questionnaire was given to the mothers at the Institute of Dentistry and analyzed by a physician (M.A.). The clinical stomatognathic examination was performed in both mothers and their children and all the examinations took place between autumn 1999 and spring 2000.

Stomatognathic examination

Stomatognathic examination was performed using a standard protocol [15,35] according to general principles of stomatognathic physiology. The clinical stomatognathic examination (M.-R.L.) included measurements of mandibular movements. The sounds of the temporomandibular joints were examined using a stethoscope. Pain and locking or luxation of the joints on movements were recorded. Temporomandibular joints were palpated laterally and posteriorly, and tenderness of the joint was recorded. The following masticatory muscles were palpated bilaterally: the anterior and posterior portions and the insertion into the coronoid process of the temporal muscle, the deep and superficial portions of the masseter muscle, the posterior portion of the digastric muscle, and the medial and lateral pterygoid muscles. Mild tenderness was present if the subject verbally reported any pain during palpation. Moderate or severe tenderness gave rise to blink reflex or resulted in withdrawal.

Scoring of the clinical signs was done from 0 to 2 for every muscle, depending on the degree of tenderness [15]. Joint tenderness was also graded depending on whether it occurred on one or both sides. One point was given for each joint if any sound was registered. Difficulties in guiding the mandible into the centric relation or pain recorded during this manipulation scored one point. Pain on opening and on jaw movements was also scored. When these points were added together the subject was given a score for the severity of TMD signs. A maximum of 35 points was theoretically possible. During the TMD examination, the examiner was blinded to the headache diagnoses and stomatognathic symptoms of the children or the mothers.

Study approval

The study design was approved by the Joint Ethics Review Committee of the Medical School, University of Turku, and the Turku University Central Hospital.

Statistical methods

The TMD sum score was grouped into three categories before the analysis. The subjects were scored as healthy regarding TMD signs if the sum score was zero, having very mild TMD signs when the score was between 1 and 4, and mild or moderate TMD signs when the score was 5 or more [15]. The analyses of associations between variables and differences between groups were carried out using logistic, multinomial logistic or cumulative logistic regression analysis depending on type of response variable (binary, polytochomous nominal scaled or polytochomous ordinal scaled, respectively). The analyses of the associations between child's/mother's headache and child's/mother's TMD were carried out using cumulative logistic regression analysis. Individual matching (at age 6 years) of the headache children with their controls induced correlations between the observations. When the data consisted of individually matched pairs, they were constructed in such a way that the two subjects in each matched pair are expected to be more like each other than any two randomly selected subjects from different pairs. Intra-class correlation was taken into account by applying the generalized estimation equations (GEE) technique in the estimation [36]. In addition to the p-value of 5% significance level, the results of the analysis were quantified by cumulative odds ratios (COR) and 95% confidence intervals (95% CI). The statistical computations were performed with the SAS System for Windows, release 8.2/2001.

Table II. Association between the occurrence of TMD signs in 13-year-old children and their mothers ($p=0.29$, cumulative logistic regression analysis). Total $n=154$

	TMD signs: Mothers		
	0	1–4	≥5
TMD signs: Children			
0	16	44	7
1–4	14	43	7
≥5	4	12	7

Results

The association between TMD signs of children and their mothers was statistically non-significant, and no familial occurrence of TMD signs in children and their mothers could be demonstrated ($p=0.29$) (Table II). There was a significant association between the occurrence of headache in children and mothers ($p=0.043$) (Table III).

Seventy percent of headache children and 82% of their mothers had TMD signs (Table IV). On the other hand, 45% of the headache-free children had TMD signs and 74% of their mothers had TMD signs. Headache children had significantly more signs of TMD compared to headache-free children ($p=0.0002$). The difference between the two groups of mothers did not reach statistical significance ($p=0.12$). A statistically significant association was found between the child's headache and signs of TMD both in migraine and in the tension-type headache groups (Table V). The headache groups did not differ from each other regarding the association with TMD. In mothers, only the association between migraine and TMD signs reached statistical significance (Table VI). There were 46 (75%) mothers of headache children and 25 (36%) mothers of headache-free children who had suffered from recurrent and disturbing headache during the previous 6 months. The difference between the groups was statistically significant ($p<0.0001$).

Headache children had significantly more TMD signs (pain on jaw movement and muscle pain on palpation) than headache-free children (Table VII). A significant difference was observed in muscle pain on palpation between the groups of mothers. The highest TMD score observed for children was 14 points (score range 0–35) and for mothers 21 points (score range 0–35). Girls had more TMD signs than boys ($p=0.037$, COR = 1.93, 95% CI = 1.06–3.51).

Table III. Association between the type of headache in 13-year-old children and their mothers ($p=0.043$, multinomial logistic regression analysis). Total $n=144$. Missing data $n=10$

	Headache: Mothers		
	Headache-free	Tension-type	Migraine
Headache: Children			
Headache-free	11	32	32
Tension-type	2	13	16
Migraine	3	8	27

Table IV. Comparison of the scoring of TMD signs between 13-year-old headache (HA) and headache-free children ($p=0.0002$), and between their mothers ($p=0.12$) (p-values for difference between the HA and HA-free groups are calculated using cumulative logistic regression analysis)

Children's TMD signs score	HA children 13 years ($n=72$)	HA-free children 13 years ($n=81$)
0	21 (29%)	45 (56%)
1–4	32 (44%)	32 (40%)
≥5	19 (26%)	4 (5%)
Mothers' TMD signs score		
0	13 (18%)	21 (26%)
1–4	46 (64%)	52 (64%)
≥5	13 (18%)	8 (10%)

Discussion

The main result, that no association between children's and mother's TMD signs was observed, is in accordance with earlier studies [31–33]. However, the current results cannot exclude the possibility of a familial predisposition of occurrence of TMD due to a variety of other causative factors. The co-occurrence of causative factors such as occlusion or psychological stress may not be present in children at an early age in the same way as in mothers to form an effective causal complex of TMD. It is therefore possible that the result might be different when the children grow up to an age when TMD signs and symptoms are more common. On the other hand, environmental factors may be more important than genetic factors regarding the occurrence of TMD. Pain experiences and behaviour seem to aggregate in certain families [37]. There is a possibility that the child learns the model of stress and pain coping at home, and thus the behavioural model can be transmitted from one generation to the next [38].

The reason for choosing a headache population for studying familial occurrence of TMD signs was the long follow-up time of these families with a large amount of available information. Among other things, familial occurrence of headache had been

Table V. Comparison of the occurrence of children's TMD signs between different headache groups at the age of 13 years. (Overall p-value for differences between all headache type groups was <0.001, cumulative logistic regression analysis). Total $n=153$, missing data = 1

Child's headache	p	COR	95% CI
Migraine ($n=39$) vs. no headache ($n=81$)	<0.001	4.3	1.8–9.9
Tension-type headache ($n=33$) vs. no headache ($n=81$)	0.004	3.1	1.4–6.8
Migraine ($n=39$) vs. tension-type headache ($n=33$)	0.539	1.4	0.5–3.7

COR = cumulative odds ratio.

Table VI. Comparison of the occurrence of mother's TMD signs between different headache groups. (Overall p-value for differences between all headache groups was 0.092, cumulative logistic regression analysis). Total $n=145$, missing data $=8$

Mother's headache	p	COR	95% CI
Migraine ($n=75$) vs. no headache ($n=16$)	0.025	3.6	1.2–11.0
Tension-type headache ($n=54$) vs. no headache ($n=16$)	0.153	2.2	0.7–6.6
Migraine ($n=75$) vs. tension-type headache ($n=16$)	0.139	1.6	0.8–3.1

COR = cumulative odds ratio.

observed in this study sample [39]. Therefore, it was thought that this sample of headache children and headache-free healthy controls and their mothers could provide information about not only the familial occurrence of headache but also that of TMD. One could expect that headache as a sign of a symptomatic TMD might have a familial occurrence. On the other hand, children who suffer from headache from an early age could represent a group that is very different from a typical TMD patient group with the symptoms starting later in life.

Mothers were chosen for the study as first-degree relatives since earlier studies have shown that both headache and TMD are more common in women than in men [18,19,40]. Already at the age of 6 years, headache children had had more TMD-related signs and symptoms than control children [41]. At this stage, mothers of headache children suffered more from headache than mothers of headache-free control children. Mothers' headache before their pregnancy was a significant predictor of the child's headache at 6 years of age. Only 16 mothers (5 mothers of headache children and 11 mothers of headache-free control children) were headache-free when the children were 13 years of age. One explanation could be the age of the mothers (average 40 years), which falls within the period when women usually suffer most from headache [40], since the inclusion criterion for the study for the mothers was to be the mother of a study child.

In addition to the standard questions for headache classification we asked the mothers the same question as the children at 6 and 13 years of age, i.e. whether they had suffered from recurrent and disturbing headache. Usually, migraine attacks are considered to be more disturbing than non-migrainous headache attacks, and there were more migraine than tension-type headache sufferers among these mothers. Mothers were not interviewed and clinically examined before the diagnosis of headache type. The diagnosis of mothers' headache was based on a questionnaire which included the same questions as the children were asked. In epidemiological headache studies, diagnosis of headache type is usually based on a questionnaire. The same questions are commonly used for both children and adults. Somatic examination may further reveal some organic headache types but for this study the main diagnosis of headache type in children was based on the interview.

The present study suggested that there is an association between TMD signs and both migraine and tension-type headache in children. This is in accordance with our previous studies with another child population where migraine associated with TMD signs [15,16], and with the earlier studies where an association between TMD and overall headache in children has been observed [10–14]. Contrary to the results from most of the earlier studies in adults, and from the study in children by List and co-workers [33], we found the association to be stronger between migraine and TMD signs than between tension-type headache and TMD signs in children. The differences in results may be due to methodology and, at least when compared to the adult studies, to the different and more detailed headache classification applied in our study. In the study by List et al., children were diagnosed with TMD, while in this study signs of TMD were used. The studies have also shown that children's headaches fluctuate and change over time [42], and thus the association between headache type and TMD signs and symptoms may differ from one age to the next.

In mothers, the association was significant between migraine and TMD signs, but not between tension-type headache and TMD, which has been demonstrated in several earlier reports [5,6]. The

Table VII. Comparisons of the occurrence of different kinds of TMD signs between 13-year-old headache (HA) and headache-free children and between their mothers. Statistical significance was observed in pain on opening in mothers ($p=0.04$), in pain on jaw movement in children ($p=0.03$), and in muscle pain on palpation in children ($p=0.0002$). The significant differences are in boldface, all other differences were non-significant (logistic regression analysis)

Variable	HA children ($n=72$)	HA-free children ($n=81$)	Mothers of HA children ($n=72$)	Mothers of HA-free children ($n=80$)
Pain on opening	12 (17%)	8 (9%)	**12 (17%)**	**5 (6%)**
Pain on jaw movement	**16 (22%)**	**7 (9%)**	14 (19%)	11 (14%)
Muscle pain on palpation	**36 (50%)**	**17 (21%)**	28 (39%)	22 (28%)
Pain on palpation of joints	20 (28%)	13 (16%)	14 (19%)	15 (19%)
Joint sounds	15 (21%)	9 (11%)	43 (60%)	46 (57%)
Pain or stiffness on guiding the mandible	–	–	5 (7%)	1 (1%)

reasons why migraine associated with TMD signs in mothers could reflect an overall pain sensitivity in migraine patients [43]. This has also been observed in migraine children in our previous study [16].

From a methodological point of view, there were some differences in the design of this study and the previous studies on familial occurrence of TMD [31–33]. We focused on clinical signs of TMD, while Raphael and co-workers interviewed the subjects by telephone, List and co-workers asked the children whether anybody else in their family had pain, and Michalowicz and co-workers interviewed and clinically examined twin pairs.

In conclusion, no familial occurrence of TMD signs can be found in 13-year-old headache children and their mothers.

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