Fluctuation of treatment need for temporomandibular disorders and age, gender, stress, and diagnostic subgroup

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Associations between fluctuation of treatment need for temporomandibular disorders (TMD) and age, gender, stress, and diagnostic subgrouping were analyzed in a 2-year follow-up of 391 subjects. All the studied factors were significantly associated with the treatment need for TMD at all examinations. The diagnostic subgroup (TMD arthro, TMD myo, TMD comb, or non-classified) at base line was significantly associated with the fluctuation of the treatment need for TMD also during the follow-up, but age, gender, and stress score were not. In the subgroup needing active treatment for TMD at least once during the follow-up ($n = 65$), the stress score did not show statistically significant covariation with the treatment need. The diagnostic subgrouping of these 65 subjects at the second and third examination at 12-month intervals did not show any association with the subgrouping at base line or with any studied variable. Detailed descriptive diagnostics may serve well in treatment planning but do not necessarily help us in understanding the nature of TMD. □ *Diagnostic subgrouping; fluctuation; follow-up study; stress; treatment need*

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Clinical experience of temporomandibular disorders (TMD) shows that signs and symptoms of TMD come and go, and no clear order of events of these disorders has been found. Longitudinal studies have also suggested a fluctuating course of the signs and symptoms of TMD (1–3). The number of longitudinal studies is, however, small (4), and if only two consecutive examinations have been carried out, it is not possible to separate fluctuations and trends from each other (5, 6). Most studies have so far concentrated on young subjects. Wänman (7) has recently published a study in which the subjects were clinically examined three times, at 17, 18, and 19 years of age, and filled in a questionnaire at the age of 28 years. In that study fluctuation of signs and symptoms of TMD was present, but a trend difference between genders was also seen. Women showed a more consistent pattern of symptoms than did men after the third clinical examination. Most women with symptoms at the age of 17–19 years also had symptoms 10 years later, compared with only 60% of men showing symptoms throughout the whole study.

One source of fluctuation is the descriptive nature of the diagnoses of TMD. We cannot distinguish between the presence of the disease itself and the presence of its signs and symptoms; such a separation can easily be made for migraine, for example. If we had a better understanding of the etiology, nature, and subgroups of TMD, we could study separately the fluctuation of the disease itself and its symptoms.

We have earlier published a fluctuation chart showing some but no major fluctuation in the treatment need for TMD in adults in a 2-year follow-up. For the two classification systems applied, about half of the subjects were classified in the same group at every examination, and only about 5% of the subjects showed a major shift during the study. A natural explanation such as received medical, dental, or physical treatment for these major changes existed for practically all subjects (8). In the present study we tried to explain the fluctuation observed earlier by analyzing associations between the fluctuation of the treatment need for TMD and age, gender, stress score, and diagnostic subgroup.

Subjects and methods

Altogether 515 subjects aged 25, 35, 45, 55, or 65 years participated in the first examination for a 2-year follow-up study. A total of 446 subjects participated in all three examinations, but 35 of them were treated during the study years for TMD signs and symptoms and were excluded from the follow-up analyses. All the subjects were clinically examined and interviewed at 12-month intervals in 1992–95 by an experienced specialist in stomatognathic physiology (M. Kuttila), applying generally known and recommended methods (9, 10). The radiographic examination was based on orthopantomograms taken of all subjects. Before the study she went through a calibration program at the University of Turku with another experienced clinician and coauthor (Y. Le Bell). For the treatment need analyses, a new classification was introduced. The subjects were classified into active, passive, or no treatment need for TMD groups. A subject was included a) in the active treatment need group for TMD if the signs and/or symptoms of TMD were severe enough to ask for help regardless of other oral health problems, b) in the passive treatment need group if she/he had some minor signs and symptoms of TMD not calling for

Table 1. Percentage distribution of diagnostic subgroups for temporomandibular disorders (TMD) (joint, muscle, combined, non-classified subjects) at base line, and TMD treatment need classification (no need, passive, active) in three consecutive examinations at 12-month intervals. Subjects classified as 'non-classified' had only mild signs and symptoms of TMD or had a combination of signs and symptoms that could not be located unequivocally in one of the three diagnostic subgroups 'TMD arthro', 'TMD myo', or 'TMD comb'. Total number (*n*) for all three examinations = 391. A statistically significant difference between the diagnostic subgroups at base line was observed in the fluctuation of treatment need for TMD during follow-up ($P = 0.004$, ANOVA)

	Treatment need (%)			
Diagnostic group at base line	No need	Passive	Active	*n*
Examination I				
TMD arthro	47	43	10	114
TMD myo	27	63	10	84
TMD comb	7	81	12	75
Non-classified subjects	83	17	0	118
Examination II				
TMD arthro	43	51	6	114
TMD myo	55	35	10	84
TMD comb	17	63	20	75
Non-classified subjects	77	21	1	118
Examination III				
TMD arthro	46	47	7	114
TMD myo	42	45	13	84
TMD comb	13	68	19	75
Non-classified subjects	71	25	3	118

treatment as such but needed treatment for TMD in association with some other dental treatment to ensure that the other dental problems were adequately treated, and c) in the no treatment need group if the signs and/or symptoms of TMD did not call for treatment in any circumstances. The examination and classification were done in a similar manner every year. The examination and classification principles have been published earlier in detail (11).

Diagnostic subgrouping

On the basis of all the gathered information and in accordance with criteria corresponding to those described by the American Academy of Craniomandibular Disorders (currently: American Academy of Orofacial Pain) (10), the 391 subjects who participated in all three examinations and filled in the stress inventory were classified into four subgroups on the basis of their type of disorder (12, 13). Twenty subjects were lost because they lacked the stress inventory questionnaire. The subjects with mainly myogenetic signs and symptoms were included in the 'TMD myo' group ($n = 84$ at base-line examination), those with mainly arthrogenous signs and symptoms in the 'TMD arthro' group ($n = 114$), subjects with myogenetic and arthrogenous signs and symptoms without any preference in the group 'TMD comb' ($n = 75$), and subjects not fitting into these groups in the group 'non-classified' ($n = 118$). The subjects were classified as mainly myogenetic if they reported pain on palpation of one or more masticatory muscles or indicated pain in the area of one or more of the masticatory muscles during active movements of the jaw. In addition, in this group no clinical or radiographic evidence of organic changes in the TMJs was noted, and no tenderness of TMJ on palpation was reported. The subjects were classified as mainly arthrogenous if they indicated pain of the TMJs, and/or radiographs showed organic changes in the TMJs with no major involvement of masticatory muscles. Subjects with internal derangements were also included in this group. Subjects with signs and symptoms both in muscles and TM joints were classified in the TMD comb group. This classification was repeated every year without any knowledge of the earlier classifications. In addition, the fluctuation of the diagnostic subgrouping in the subgroup consisting of the 65 subjects who were in active treatment need for TMD at least once during the 2-year follow-up was analyzed separately.

Assessment of symptoms of stress

Independently of the classifications described above, physical, behavioral, and psychologic symptoms of stress were assessed using the Symptoms of Stress Inventory (SOS) derived from the Cornell Medical Index by Beaton et al. (14). The subjects were asked to rate the frequency with which they may have, during the preceding month, been bothered by a particular stress symptom, using a 0- to 4-graded scale. A total score of 94 items and 10 subscales—peripheral, cardiopulmonary, neurologic, muscle tension, gastrointestinal, habit patterns, depression, anxiety, anger, and cognitive disorganization—were counted. The internal homogeneity of the SOS in American and Finnish patients and non-patients has been

Table 2. Distribution of the 391 temporomandibular disorder (TMD) subjects in different diagnostic subgroups: TMD arthro, TMD myo, TMD comb, or non-classified, on the basis of gender, at every examination. The criteria for the classification are explained in detail in the text

	Examination I		Examination II		Examination III	
Diagnostic subgroup	Men	Women	Men	Women	Men	Women
TMD arthro	55	59	58	53	53	49
TMD myo	37	47	27	44	22	31
TMD comb	21	54***	26	55***	33	74***
Non-classified	72	46	74	54	77	52
	185	206	185	206	185	206

*** $P < 0.001$.

shown earlier (14, 15). This scoring was also repeated every year independently of the earlier scorings.

Fluctuation of the treatment need for TMD

A fluctuation chart for all the 391 subjects including 3*3*3 = 27 possible combinations was produced as reported earlier (8). Associations between diagnostic subgroup, age, gender, and stress score at base line and fluctuation of the treatment need classification were analyzed applying the chi-square test. A separate analysis was done for the 65 subjects who had been classified into the active treatment need group at least once during the study years. On the basis of the results from this subgroup, the association between treatment need classification and diagnostic subgrouping was analyzed for every year for all 391 subjects and separately for both genders. The association between the fluctuation of the stress score and treatment need grouping during the study years was tested, applying repeated-measures analysis of variance for all the 65 subjects with active treatment need for TMD at least once during the follow-up.

Results

For the whole group (n = 391) all the studied factors—age, gender, stress score, and diagnostic subgroup, when studied separately—were associated with the treatment need for TMD at every examination (P for all factors, <0.001). Subjects aged 35 years had more signs and symptoms than the older ones; women had more signs and symptoms than men; subjects with active treatment need for TMD had higher stress scores than the other groups; and subjects with muscular signs and symptoms were more often in the active or passive treatment need groups than were the subjects with joint signs and symptoms. The diagnostic subgroup at base line was associated with the fluctuation of the treatment need grouping during the follow-up (P = 0.004), but age, gender, and stress score at base line were not. The treatment need distribution of the subjects with TM joint signs and/or symptoms ('TMD arthro') at base line did not change between the examinations. The symptoms and signs of muscular origin ('TMD myo') decreased at the second examination and increased again at the third examination. The changes were smaller in the combined subgroup ('TMD comb') (Table 1). At every examination women belonged significantly more often to the combined subgroup than did men (Table 2).

Of the 65 subjects who were classified in the active treatment need group at least once and who were analyzed separately, only 14 were classified in the same diagnostic subgroup every year. The changes in the remaining 51 subjects occurred randomly between all subgroups, showing 41 different combinations. The fluctuation of the diagnostic grouping was not associated with the fluctuation of the treatment need grouping. Neither a change from the passive or no treatment need group to the active treatment need group nor vice versa was associated with a change from one specific diagnostic subgroup to another (Table 3). After this result we excluded all subjects who did not have a perfect fit with the criteria of the diagnostic subgroups described above. The excluded subjects are marked with an asterisk in Table 3. None of the excluded 10 subjects belonged to the original group of 14 subjects showing no fluctuation in diagnostic subgrouping during the study. The repeated analysis included 55 subjects who were in active treatment need for TMD at least once during the study. Despite this 'purification' of the data, 75% of the remaining subjects still had their diagnostic subgroup changed between the examinations.

No statistically significant covariation between stress score and treatment need during the follow-up was observed in the subgroup of 65 subjects who had been classified into the active treatment need group at least once during the study period.

Discussion

To study associations one needs variation in the study base (16). As reported earlier on the basis of the present material of 411 subjects, there was no major variation in the treatment need classification between the three examinations (8). There was more variation in diagnostic subgroups in the group with active treatment need for TMD (n = 65), but the small size of the subgroups and the

Table 3. The distribution into diagnostic subgroups: TMD myo, TMD arthro, or TMD comb of the 65 subjects classified at least once into the active treatment need for TMD group in three consecutive examinations at 12-month intervals. TMD myo refers to subjects with muscular signs and symptoms, TMD arthro to subjects with TM joint signs and symptoms, and TMD comb to subjects with signs and symptoms both in muscles and TM joints. Subjects with a poor fit in this classification are labeled non-class. The letter *A* refers to TMD treatment need subgroup 'active treatment need for TMD', *P* to subgroup 'passive treatment need', and *N* to 'no treatment need' subgroup. The ten subjects marked with an asterisk (*) in the table were excluded from the analysis after reclassification of diagnostic subgroup, applying very strict criteria to identify as typical and pure cases as possible for the study

Examination				Examination			
1st	2nd	3rd	*n*	1st	2nd	3rd	*n*
A	A	A		Comb	Myo	Comb	2 (1*)
Arthro	Arthro	Arthro	1	Comb	Comb	Comb	1
Myo	Myo	Myo	2	Nonclass	Myo	Comb	1
Comb	Arthro	Comb	2	P	A	P	
Comb	Comb	Comb	2	Arthro	Arthro	Arthro	2
A	A	P		Arthro	Arthro	Comb	1
Arthro	Comb	Comb	1	Myo	Myo	Arthro	1*
Myo	Comb	Myo	1	Myo	Myo	Comb	2 (1*)
Comb	Comb	Comb	2	Comb	Arthro	Arthro	1
A	A	N		Comb	Arthro	Myo	1
Arthro	Myo	Myo	1	Comb	Myo	Comb	1*
A	P	A		Nonclass	Arthro	Comb	1
Myo	Myo	Arthro	1	P	A	N	
Myo	Comb	Comb	2	Comb	Myo	Non-class	1
Comb	Arthro	Comb	1	P	P	A	
A	P	P		Arthro	Arthro	Arthro	1
Arthro	Myo	Myo	1	Arthro	Arthro	Comb	2
Arthro	Myo	Comb	1*	Arthro	Comb	Myo	1
Arthro	Comb	Arthro	1	Arthro	Comb	Comb	1
Arthro	Comb	Comb	4	Myo	Myo	Arthro	1
Myo	Arthro	Comb	1	Myo	Comb	Myo	1
Myo	Comb	Myo	1	Myo	Comb	Comb	1
Comb	Arthro	Arthro	1	Comb	Myo	Comb	1
Comb	Comb	Comb	1	Comb	Comb	Myo	1
A	P	N		Comb	Comb	Comb	2
Arthro	Myo	Myo	1	N	P	A	
P	A	A		Arthro	Arthro	Myo	1*
Arthro	Myo	Arthro	1	Non-class	Myo	Comb	1
Myo	Arthro	Arthro	1	Non-class	Comb	Arthro	1
Myo	Myo	Comb	2**	Non-class	Comb	Myo	1*
Comb	Myo	Myo	2 (1*)				Total

small variation in treatment need weakened the power of the analyses.

Practically all those studying stomatognathic disorders today underscore the fluctuating and ephemeral nature of TMDs. Even though the elimination of the variation in treatment need affected the analysis, we wanted to study in detail the subjects who were in active treatment need for TMD at least once because this group can—with caution—be compared with patients. Several investigators have suggested diagnostic subgroupings to get a more accurate picture of TM disorders (11–13). De Leeuw et al. have shown, in cross-sectional studies (12, 13), that 80% of patient subjects could be classified into the applied subgroups. This figure is close to the percentage of 69% given by Schiffman et al. (17). In their study 19% of the patients belonged to the TMD arthro group, 23% to the myo group, and 27% to the combined group. De Leeuw and colleagues classified 32% of the subjects in the TMD arthro group, 33.5% in the TMD myo group, and 16% in the combined group. Both these figures are in line with ours: 26–29% belonged to the group TMD arthro, 14–22% to the group TMD myo, and 19–27% to the group TMD comb in three consecutive examinations. A basic difference between our study and that of de Leeuw et al. makes close comparisons impossible: our subjects were identified in an epidemiologic study, whereas de Leeuw et al. examined patients who were seeking treatment. The fact that altogether 35 subjects from the original sample were treated for TMD and excluded from the analysis also affected the possibility of comparing our results with those of de Leeuw et al. (12, 13).

The result that the diagnostic subgroup of the 65 subjects with an active treatment need was changed randomly at least once between the examinations at 12-month intervals was a total surprise to us. Before the study we believed that a detailed subgrouping would help us to understand the nature and course of TMD, but this was not the case. A renewed search of the literature showed no analyses on fluctuation of the diagnostic grouping of TMD. The results from all diagnostic classification studies

are based on cross-sectional examinations. This is a natural consequence in patient studies. One cannot force the patients seeking care to wait for a long period to ascertain whether the diagnostic classification is stable. In our study it was typical for the diagnostic subgroup of most of the 65 subjects with an active treatment need to change randomly at least once between the consecutive examinations at 12-month intervals, and only 14 subjects had the same classification at all examinations. The changes showed no association with any studied variable: age, gender, or stress score. This result can mean that the applied criteria for diagnostic classification were not valid, that we were incompetent examiners, or that the same subjects really showed different signs and symptoms of TMD in follow-up examinations at relatively long intervals. After having seen the first results we believed that we had included too many non-typical cases in the diagnostic subgroups and had classified them in different ways at different examinations. Therefore, we tried to exclude all non-typical subjects, to find the possible fluctuation of the 'pure' cases. This checking procedure did not, however, change the general picture. Many 'typical' TMD arthro subjects were later 'typical' TMD myo or TMD comb subjects, and vice versa. An interesting detail was, however, that all the 14 subjects who did not show any changes in diagnostic subgrouping during the study were also included in the reanalysis. Yet, the majority, 75% of the reanalyzed subjects, still showed a change of group. If fluctuation of the diagnostic subgroups is a fact, it raises the question of whether the classification of the TMD patients into diagnostic subgroups really helps us to understand the nature of TM disorders, even though it is of benefit in adequate treatment planning. On the other hand, if there is agreement that signs and symptoms of TMD fluctuate, it is not contradictory to think that the types of signs and symptoms also can fluctuate.

Irreversible treatment modalities have been objected to on the basis of the fluctuating character of the signs and symptoms of TMD and on the basis of the unknown order of the events. As we see it, diagnostic subgroups have been introduced to get a reliable picture for correct treatment and to learn to understand the etiology of TMD in subjects with different signs and symptoms (18). We believe it is highly relevant for the treatment planning to obtain detailed information about the clinical status of the patient, but this information may not be as helpful in trying to understand the nature of TMD. All the diagnoses of TMD are still descriptive. We cannot separate the fluctuation of 'basic' TMD itself from the fluctuation of its signs and symptoms. If it is true that the same subjects show random fluctuation also in the dominance of the signs and symtoms in a follow-up, then it is possible that the variation of the manifestation of TMD does not necessarily indicate differences in the etiology of the basic disorder.

The lack of association between the stress score and the fluctuation of TMD treatment need in our study does not exclude the possibility that increased stress could cause a change from a subclinical stage of the disorder to a stage that the subject no longer can cope with. A contrary explanation is also possible: suffering increases stress. Our study, however, lacked power due to both small variation and small sample size. Another restriction was that our observations were perhaps too crude and cross-sectional by nature: the stress score and clinical status were assessed as quite close to each other, without any hypothesis on the time difference between cause and effect. Therefore, even if larger cross-sectional studies were to suggest a systematic and strong association, the causal order of events would remain unknown. An association between stress and treatment need could, however, easily explain why different treatment modalities can show equal results. Reduction of stress could make it possible for the subject to cope with the symptoms, and elimination of some other part of the sufficient causal complex could prevent the increased stress from leading to somatic signs. The large variation in stress scores in subjects needing active treatment for TMD, however, does not suggest a decisive role for stress in the etiology of TMD. This is in accordance with the findings of de Leeuw et al. (19).

We hope that our study will be repeated, to test whether the fluctuation of the diagnostic grouping is a common phenomenon and not caused a) by the unavoidable exclusion of the subjects treated for TMD, b) by including non-typical subjects, or c) by the use of non-valid and/or unreliable diagnostic criteria. Naturally, we cannot exclude the possibility of developing new subgrouping systems with more predictable results. Our results suggesting random fluctuation in the diagnostic typology for TMD applied here forces us to repeat our earlier conclusion. There is no point in conducting detailed long-term studies until conceptual clarifications about the nature and etiology of TMD are available.

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