

# Changes in Subjective Symptoms of Craniomandibular Disorders in Children and Adolescents During a 10-Year Period

*An epidemiologic sample of 293 subjects in three age groups, now 17, 21, and 25 years of age, were followed longitudinally with respect to symptoms of craniomandibular dysfunction during a 10-year period. Reports of one or more such symptoms increased in all three age groups during the 10 years. At the follow-up, 1 in 3 individuals in all three groups had noticed such symptoms occasionally and 10% had them frequently. Reports of oral parafunctions such as bruxing and clenching also increased, while other parafunctions such as nail, lip, cheek, and tongue biting increased from the age of 7 to 11 but then decreased with age. Despite the high incidence of subjective symptoms of craniomandibular disorders, only a few subjects had had any kind of functional treatment performed during the 10-year period, and only 7 had an actual demand for treatment at present.*

J OROFACIAL PAIN 1993;7:76-82

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**D**uring the last 2 decades, numerous cross-sectional epidemiologic investigations concerning the prevalence of craniomandibular disorder (CMD) signs and symptoms have been performed in adults as well as in adolescents and children (for reviews, see DeKanter<sup>1</sup> and Tallents et al<sup>2</sup>). From these investigations, it is obvious that both signs and symptoms of CMD are very common. Some authors have suggested that a need for functional treatment is present in 25% of the population,<sup>3-5</sup> while others have stated that those in need number less than 5%.<sup>1,6,7</sup> In a recent study of a fairly large group of 20-year-old men and women, three examiners agreed that 27% were in need of some kind of functional treatment.<sup>8</sup> In most cases, however, the treatment advocated was simple, not time-consuming, and could be incorporated into routine dental treatment. Only 4% of the subjects were judged to need more extensive treatment.

It is probable that the varying opinions presented on this topic are due to differences in definitions. Lack of reliability and validity in measures of demand and need for treatment are evident in other fields of clinical dentistry as well, eg, prosthodontics.<sup>9</sup>

The many cross-sectional investigations performed have been unable to settle controversies concerning the importance of different possible etiologic factors of CMD or the long-term development of such factors. One way to shed further light on these issues might be through longitudinal epidemiologic investigations. Such investigations are rare, however.<sup>10-13</sup>

The aims of the present investigation were to follow the long-term development of signs and symptoms of CMD, to search for possible aggravating factors, and to estimate the demand and need for treatment, in adolescents and young adults. These aims were accomplished by following a group of children and adolescents, previously examined after 4 and 5 years, respectively, over 10 years. This first report of the 10-year follow-up presents the changes in subjective symptoms in subjects of three different age groups. At the time of the 10-year follow-up examination, the patients were 17, 21, and 25 years of age.

## Materials and Methods

Ten years after the performance of an epidemiologic investigation of CMD signs and symptoms in three groups of children, a questionnaire was sent to all of them. The questionnaire included questions about the presence of symptoms from the masticatory system, including headaches, as well as questions about oral parafunctions. Response totals for the three groups of patients, ages 17, 21, and 25, were 95 of 131; 95 of 136; and 103 of 135, respectively, for a total of 293 (73%) of 402. Of those responding, 158 (56%) were women and 135 (44%) were men. Of the 109 who dropped out, 30 had no known address, while the others did not return the questionnaire, despite two letters of reminder. If those without known address are excluded, the response rate was 79%.

Comparisons were made between the subjects' reports of symptoms 10 years ago and at present. Additional comparisons were made for the oldest age group with the findings from a 5-year follow-up.<sup>11</sup> The two younger age groups were also subjected to an investigation after 4 years,<sup>10</sup> but this included a randomly selected part of the original sample, so that comparisons between that follow-up and the present one are inconclusive. All comparisons of the results between the first and third and second and third examinations relate only to the subjects included in the second and third investigations, respectively. Consequently, the prevalence figures for the first and second investigations differ in some cases from those presented earlier.<sup>11,14</sup>

Wilcoxon's matched-pairs signed rank test was used for analysis of differences between the investigations, while Pitman's nonparametric permutation test was used to test for sex differences.<sup>15</sup> Correlations ( $r_s$ ) between variables were calculated by means of Spearman's rank correlation test.<sup>16</sup>

## Results

### Subjective Symptoms

The prevalences of symptoms and parafunctions reported in the first investigation and 10 years later for the three age groups are presented in Table 1. Temporomandibular joint sounds had increased significantly in all three age groups between the first and third investigation ( $P < .001$ ,  $P < .001$ , and  $P < .01$ , respectively) and were reported by approximately one third of the sample at the 10-year follow-up. Additionally, 1 out of 10 subjects reported that the joint sounds occurred frequently. The change in joint sounds between the first investigation and the 10-year follow-up for the whole group is shown in Fig 1. Reports of jaw fatigue also increased in all three groups during the 10-year period ( $P < .05$ ,  $P < .01$ , and  $P < .01$ ), and in the oldest age group this increase took place between the ages of 20 and 25 years. Difficulties in mouth opening were reported significantly more often only in the group of 21-year-olds ( $P < .05$ ), while no change was noted for the whole group or in the youngest and oldest groups. Jaw pain or fatigue during mastication was the symptom most frequently reported, but it increased only in the youngest group ( $P < .001$ ); this was explained by an increase up to age 11.

At the 10-year follow-up, reports of TMJ sounds, jaw fatigue, difficulty in mouth opening, or any combination of these symptoms, had increased in all three age groups ( $P < .001$ ). Approximately 10% reported that these symptoms occurred frequently and another 33% cited occasional occurrence. A slight increase was also noted for reports of TMJ sounds, jaw fatigue, difficulty in mouth opening, pain or fatigue in the jaws or face during mastication, or any combination of these symptoms, for the whole group ( $P < .01$ ), and this was mostly explained by the increase in the youngest age group. Once again, this increase took place up to age 11.

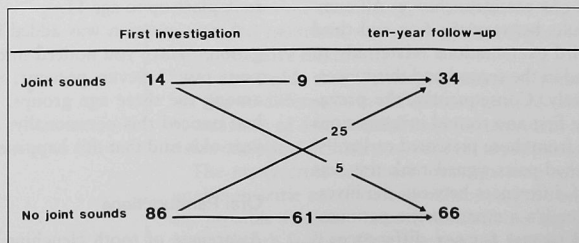
A new question was added in the third investigation: "Have you noticed intermittent locking of your jaw?" Seven percent, evenly distributed among the three age groups, reported that they had noticed this occasionally, and one of the 21-year-olds said that this happened frequently.

### Oral Parafunctions

Awareness of tooth clenching during the waking hours increased in all three age groups ( $P < .001$ ). In the oldest age group, this increase was statisti-

**Table 1** Frequency (in %) of Reported Symptoms and Orofacial Parafunctions in Patients Surveyed at Ages 7, 11, and 15 years and Again 10 Years Later

	7 y	17 y	11 y	21 y	15 y	25 y
1. TMJ sounds						
Frequent	0	7	0	8	2	12
Occasional	6	26	12	27	21	22
2. Jaw fatigue						
Frequent	0	1	0	4	0	2
Occasional	5	14	6	14	5	14
3. Difficulties in mouth opening						
Frequent	0	2	0	3	0	3
Occasional	8	4	6	13	6	6
4. Pain or fatigue in the jaws or face during chewing, for example of chewing gum						
Frequent	3	13	8	12	11	11
Occasional	33	46	61	53	54	56
5. One or more of the symptoms 1-3						
Frequent	0	9	0	11	2	12
Occasional	17	33	20	33	23	34
6. One or more of the symptoms 1-4						
Frequent	3	19	8	17	13	19
Occasional	40	49	63	57	57	58
7. Tooth clenching						
Frequent	3	7	1	10	1	13
Occasional	9	27	10	38	10	32
8. Bruxing						
Frequent	4	6	1	12	1	12
Occasional	15	18	13	16	14	26
9. 7 and/or 8						
Frequent	6	11	1	16	1	15
Occasional	18	29	18	34	16	39
10. Nail, lip, cheek, tongue biting or biting on foreign objects						
Frequent	4	22	27	17	30	16
Occasional	36	47	45	37	48	35
11. 9 and/or 10						
Frequent	19	32	27	28	31	27
Occasional	39	46	48	44	51	49



**Fig 1** Changes in joint sounds (in %) in 276 children and adolescents during a 10-year period.

cally significant both between the ages of 15 and 20 years ( $P < .05$ ) and 20 and 25 years ( $P < .001$ ). Nocturnal bruxing increased in the two older age groups ( $P < .01$  and  $P < .001$ , respectively), while there was no significant change from 7 to 17 years of age.

The presence of either of the two parafunctions increased in all three groups ( $P < .05$ ,  $P < .001$ , and  $P < .001$ , respectively) and at the 10-year follow-up was reported by more than half of the participants in the two oldest age groups.

Reports of other parafunctions increased in the youngest age group up to age 11 ( $P < .01$ ), with no further change to the age of 17. A decrease was reported in the two older age groups ( $P < .01$  and  $P < .001$ , respectively).

### Headache

Reports of occasional headache were very common, and more than 25% of the subjects of each age group had headaches at least once a month at the 10-year follow-up. Reports of frequent headaches (1 or 2 times a week) were fairly rare (Fig 2), and only six individuals complained of daily headaches. The increase of headache was statistically significant only in the youngest age group ( $P < .001$ ), and this increase was recorded from the age of 7 to 11 years. Of those with headache, 9% (evenly distributed between the three groups) judged their headache to be severe, and 8% said that they often took analgesics because of their headaches. In most cases the headache developed during the day; the most common locations were the forehead (35%) and temples (15%). Of those with headaches, 54% had noticed an association with stress.

### Sex Differences

Reports of TMJ sounds ( $P < .001$ ), intermittent locking of the jaw ( $P < .01$ ), jaw fatigue ( $P < .01$ ), difficulties in jaw opening ( $P < .05$ ), and headaches ( $P < .001$ ) were significantly more common in women than in men. The only variable that was reported more frequently by the men was facial trauma, which was measured by the question, "Have you ever had a forceful blow on your chin or to your face?" Affirmative responses were given by 57% of the men and 30% of the women.

### Correlations Between Variables

Subjective symptoms of CMD, including headache, were in most cases significantly correlated to one another, but in most cases the correla-

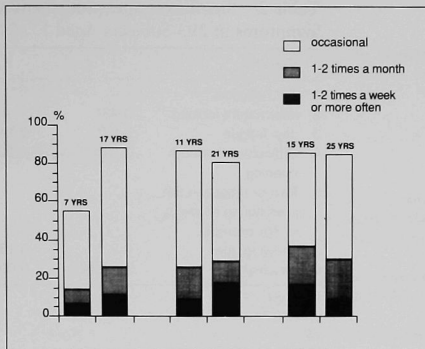


Fig 2 Prevalence (in %) of headache in 293 subjects in three different age groups (7, 11, and 15 years old) followed for a 10-year period.

tions were weak (Table 2). A correlation was also found between awareness of clenching and/or bruxing and the presence of at least one of these symptoms — TMJ sounds, jaw fatigue, difficulty in mouth opening ( $P < .001$ ,  $r_s = .24$ ). The strongest correlations were found between reports of fatigue and bruxing ( $P < .001$ ,  $r_s = .42$ ) and clenching ( $P < .001$ ,  $r_s = .35$ ), respectively.

### Demand for Treatment

Nineteen participants (6.5%), 7 men and 12 women, said that they had had symptoms of CMD that had made them seek treatment. The most common treatment received was occlusal splint therapy, in some cases in combination with occlusal equilibration and/or jaw exercises. Positive treatment results were reported by 64%, while 31% had not noticed any effect and one subject reported impairment by the treatment. When asked if they had any demand for treatment at present, 7 participants (2.4%), all women, said yes.

### Cohort Comparisons

When the group of 17-year-olds was compared with those who were 15 at the first examination, reports of jaw fatigue ( $P < .01$ ), one or more of symptoms 1 to 3 in Table 2 ( $P < .01$ ), and tooth-clenching and/or bruxing ( $P < .001$ ) were significantly more frequent at the 10-year follow-up. In the group of 21-year-olds, jaw fatigue ( $P < .001$ ) and tooth clenching and/or bruxism ( $P < .01$ ) were

**Table 2** Significant Spearman Rank Correlation Coefficients Between Subjective Symptoms in 293 Subjects Aged 17, 21, and 25 Years

Variable	1	2	3	4	5	6
1. TMJ sounds	—					
2. Intermittent locking	0.43*	—				
3. Jaw fatigue	0.27*	0.14†	—			
4. Difficulties in mouth opening	0.19†	0.30*	0.19†	—		
5. Pain or fatigue in the jaws during chewing of, for example, chewing-gum	0.22*	0.16†	0.30*	0.28*	—	
6. Headache	0.09 (NS)	0.00 (NS)	0.22*	0.13‡	0.22*	—

\* $P < .001$ .† $P < .01$ .‡ $P < .05$ .

(NS) Not significant.

reported significantly more frequently than among those examined 5 years previously at the age of 20.

## Discussion

A loss of participants from a research project always creates a risk when results are interpreted, and in longitudinal studies the rate of attrition, of course, tends to increase in the long term. In the present investigation, 27% of the participants were lost. In view of the longitude of the investigation — 10 years between the first and third evaluations — this loss is explicable. It might, however, have influenced the results, which therefore must be interpreted with some caution.

Reports of subjective symptoms from the masticatory system increased in all three age groups during the period under study. They were still occasional in most cases, but approximately 10% in each age group had one or more such symptoms frequently. Many of the subjective symptoms were reported significantly more often by women than by men. At the first examination, no such sex difference was noted. Indeed, in most epidemiologic investigations,<sup>17</sup> no great sex differences have been found. The authors did find, however, as did Wänman et al,<sup>13</sup> more reports of TMJ sounds, intermittent locking, and jaw fatigue among the women. In another epidemiologic study, women in the younger age groups had higher prevalences of reported CMD symptoms.<sup>18</sup>

Headache is a symptom with a possible association with CMD.<sup>19-21</sup> This symptom was frequently reported in the present investigation but in most

cases was occasional. An association between headache and stress was noted by more than half of the headache sufferers; this is an increase compared to the previous investigation. The only change in headache prevalence noted during the 10-year period occurred between the ages of 7 to 11 years. This indicates that the number of subjects complaining of headaches is fairly constant in the population from early ages. However, it was also found that there were great fluctuations during the 10-year period; this symptom tends to appear periodically. As has been found in many previous investigations, women reported headaches much more often than did men.

The correlations found between the different symptoms that were registered clearly illustrate that patients who exhibit one subjective symptom of dysfunction are likely to have other such symptoms. This underlines the fact that CMD patients are often polysymptomatic.

Reports of oral parafunctions such as bruxing and/or clenching were very common. This corroborates earlier findings.<sup>22,23</sup> Subjective reports of oral parafunctions are not reliable, however, because in many cases these are unconscious habits. The prevalence of bruxing and/or clenching increased during the 10-year period, and the same was found in the previous 5-year follow-up. The authors wrote at that time that "it is possible that the participants, as a consequence of the previous examination, have been more focused upon the possible existence of any oral parafunction."<sup>11</sup> This statement is strengthened by the findings in the cohort comparisons. One of the few differences found between comparable age groups was an increase of reports of such parafunctions. There is

no reason to suspect a real difference of these parafunctions at a certain age today compared to 10 years ago.

Even with the factors mentioned taken into account, the finding of a correlation between bruxing and/or clenching and subjective symptoms, especially jaw fatigue, indicates the existence of a causal relationship between such parafunctions and signs of CMD.

Only a few of the participants had a history of earlier functional treatment. Because all participants had attended regular dental examinations annually, this figure might be a rough indication of the accumulated treatment need during the 10-year period. It has already been shown in a population sample of adolescents<sup>8</sup> that the need for CMD treatment in these age groups is low and that the treatment is, on average, not time-consuming.

Investigations have also shown that the demand for treatment in young populations is very low.<sup>7,8</sup> This is in line with the authors' finding that only 2% (all women) sought treatment because of their symptoms.

The use of subjective reports of CMD symptoms in estimating treatment need has been seriously questioned because the sensitivity of the method, ie, the probability of correctly identifying a disease, is poor,<sup>24</sup> and The American Academy of Pediatric Dentistry has also stated that "it should not be assumed that these high prevalence figures represent need for treatment."<sup>25</sup>

The authors agree with this statement entirely, but longitudinal investigations of CMD symptoms might still turn out to be helpful in identifying subjects at risk or investigating long-term development of CMD symptoms. Nevertheless, it is of great importance to correlate the subjective symptoms to clinical findings, and such an investigation is presently in preparation.

## Conclusions

This investigation lends support to the opinion that subjective symptoms of CMD are fairly common in the population and that they increase with age from childhood to young adulthood but are in most cases occasional and mild. This was found both in different age cohorts and longitudinally when individuals were followed during a 10-year period. Accordingly, the demand for treatment is low and high prevalences of occasional CMD symptoms do not equal either need or demand for treatment.

## Acknowledgments

This investigation was supported by grants from the Swedish Dental Association and the American Association of Orthodontists (Grant No. AAO 89019).

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## Resumen

Cambios relacionados a los síntomas subjetivos de los desórdenes craneomandibulares en niños y adolescentes durante un periodo de 10 años

Diez años después de la ejecución de una investigación epidemiológica de los signos y síntomas de desórdenes craneomandibulares en tres grupos de niños (actualmente de 17, 21 y 25 años de edad), se envió un cuestionario a los participantes en donde se les preguntaba acerca de sus síntomas. Se efectuaron comparaciones entre los síntomas reportados 10 años atrás y los efectuados actualmente por las 293 personas que respondieron. En el periodo de los 10 años los reportes de uno o mas síntomas aumentaron en todos los tres grupos, los cuales se caracterizaban por tener diferentes edades. En todos los tres grupos, el 33% de los respondientes dijeron tener síntomas ocasionalmente y 10% informaron que los tenían frecuentemente. Los reportes de parafunciones orales tales como el apretamiento y el crujido de los dientes también aumentaron, mientras que otros hábitos parafuncionales tales como el morderse las uñas, los labios, las mejillas y la lengua; aumentaron desde la edad de los 7 a los 11 años, pero disminuyó luego a medida que la edad aumentaba. A pesar de la alta incidencia de síntomas subjetivos relacionados a los desórdenes craneomandibulares, sólo unos pocos individuos tuvieron algún tipo de tratamiento funcional ejecutado durante los 10 años, y solamente siete (2.4%) solicitaron tratamiento en el presente.

## Zusammenfassung

Veränderungen in subjectiven Symptomen von kranio-mandibularen Störungen in Kindern und Jugendlichen während einer Zeitspanne von 10 Jahren

Zehn Jahre nach der Durchführung einer epidemiologischen Forschung hinsichtlich Anzeichen und Symptomen von kranio-mandibularen Störungen in drei Gruppen von Kindern, die nun 17, 21, und 25 Jahre alt sind, ein Fragebogen über ihre Symptome wurde ihnen nachgesandt. Vergleiche zwischen den symptomatischen Berichten von 293 Erwidrerungen vor 10 Jahren und gegenwärtig sind gemacht worden. Berichte von einem der mehreren Symptomen haben in allen drei Gruppen während der 10 Jahre zugenommen. In allen drei Gruppen, 33% der Subjekte berichteten, dass sie solche Symptome gelegentlich haben und 10% berichteten, dass sie häufige Symptome haben. Berichte von oralen Parafunktionen wie nämlich Zusammenbeißen und Knirschen von Zähnen haben auch zugenommen. Andere Parafunktionen wie das Beißen von Nägeln, Lippen, Wange, und Zunge haben für die Altersgruppen von 7 bis 11 Jahren zugenommen, haben aber mit wachsenden Jahren abgenommen. Trotz des hohen Auftretens von subjectiven Symptomen, nur wenige Subjekte hatten irgendwelche funktionale Behandlung während der 10 Jahre, und nur sieben (2.4%) hatten einen tatsächlichen, gegenwärtigen Bedarf.

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