# Signs and symptoms of craniomandibular disorders in a series of Finnish children

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The prevalences of subjective symptoms and clinical signs of craniomandibular (CM) disorders, orofacial parafunctions, and occlusal conditions were determined in a series of Finnish children ($n = 166$). All were first interviewed, and then 156 of them were examined clinically. Fifty-two per cent of the children reported at least one subjective symptom, and 75% at least one parafunctional habit. Clinical signs were common but rarely severe in accordance with Helkimo's clinical dysfunction index ($D_i$). Both the number of subjective symptoms ($p < 0.001$) and the number of orofacial parafunctions ($p < 0.05$) correlated with the clinical dysfunction index. □ *Parafunctions; stomatognathic physiology; temporomandibular joint*

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Numerous epidemiologic investigations have shown that signs and symptoms of craniomandibular (CM) disorders are common not only in adults (for a review, see Refs. 1, 2) but also in children (3–7). They even occur in children with primary dentition, although rarely (7, 8). Findings of cross-sectional studies suggest that the prevalence of CM disorders increases with age (3, 5–7, 9, 10). The few studies of the incidence of CM disorders in children have mainly confirmed the findings of cross-sectional studies (11, 12).

It seems that a high increase in clinical signs of CM disorders coincides with occlusal changes in the mixed dentition (7). It has even been suggested that CM disorders are indicators of specific growth patterns (13). Moreover, Carlsson et al. (14) found a highly significant correlation in young Swedish men between great facial height and occlusal disturbances.

Neither cross-sectional studies (3, 5–10) nor the few existing longitudinal studies (11, 12) have shown any predominant factor in the etiology of CM disorders. Thus, additional methods may be needed to provide better information about the development, fluctuation, and importance of the different signs and symptoms of CM disorders.

A longitudinal investigation was therefore undertaken to study, with special reference to craniofacial growth, the incidence of signs and symptoms of CM disorders in a group of Finnish children followed up since birth by the same group of dentists and treated with consistent methods.

The aim of the present study was to obtain data on the prevalence of signs and symptoms of CM disorders as a basis for a follow-up study.

## Subjects and methods

In 1967 a longitudinal investigation on dental development and oral health in children was initiated at the Department of Pedodontics and Orthodontics. Pregnant women expecting their first children were informed about the project at five maternal and child health centers in the city of Helsinki. Altogether 382 infants were brought to the first examination (15). The children in the present study (78 boys and 88 girls) have annually

undergone an examination concerning the development of the teeth, occlusion, and structures related to the teeth (15). At the time of the first stomatognathic examination in 1984 their mean age was 13.6 years (range, 10–16 years).

The children were first interviewed and then examined clinically. The interview, modified after Nilner & Lassing (6), included questions about symptoms of CM disorders, oral parafunctions, and craniofacial pain. For various reasons (lack of time, initiation of orthodontic treatment) 10 of the children (5 boys and 5 girls) could not be examined clinically. Thus, 156 children were subjected to a routine stomatognathic examination to detect signs of CM disorders and to register occlusal conditions (16, 17).

The range of maximal vertical and horizontal movements of the mandible was measured with a ruler to the nearest millimeter. Deviation of the mandible (>2 mm) during opening and closing was also recorded.

Masticatory muscles and the temporomandibular joints (TMJ) were palpated, and tenderness was recorded whenever the palpation gave rise to a palpebral reflex or the child reported tenderness. TMJ sounds, clicking and crepitation, were assessed by using a stethoscope placed at the zygomatic arch. The severity of the clinical signs was estimated by means of the clinical dysfunction index ($D_i$) of Helkimo (18).

Recording of the developmental stage and of morphologic and functional (occlusal interferences) malocclusion was included in the examination of the dentition. The intermaxillary relationship in the permanent dentition was observed at the first molars in the intercuspal position. Mesial and distal relation presupposed a displacement of a half-cusp width or more. Crossbite was recorded in the segment canine to the molars if the buccal cusps of the upper teeth occluded lingually with the buccal cusps of the lower teeth. Scissors-bite was recorded in the segment if the lingual cusps of the upper teeth occluded buccally with the buccal cusps of the lower teeth. Frontal open bite was recorded if the vertical overbite was negative. Deep bite was recorded if the overbite was more than two-thirds of the crown height of the lower incisors. Missing teeth were recorded, and the reason was checked in earlier clinical data.

The occlusal examination also included recordings of unilateral contact in the retruded position (RP) and of the different interferences in accordance with Egermark-Eriksson et al. (3). In addition, laterotrusion interferences (single-tooth contact distal to cuspid during laterotrusion) and protrusion interferences (contact(s) that prevent contact(s) between anterior teeth during protrusion) were recorded. Any maxillary tooth with unilateral contact in RP was verified with a plastic foil (GHM®, Gebr. Hanel-Medizinal, Nürtingen, FRG).

All the clinical examinations were carried out by one dentist (M. Könönen) without knowledge of the results obtained at the interviews by the other members of the team.

### *Statistics*

The significances of differences between sexes and groups were tested by means of the chi-square test and Student's $t$ test. The correlations are given by using Pearson's product moment correlation coefficient. The levels of statistical significance used were $p < 0.001$, $p < 0.01$, $p < 0.05$, and $p > 0.05$ (not significant).

## Results

Fifty-two per cent of the children had at least one subjective symptom of CM disorders (Table 1); 30% had one, 15% had two, and 7% had three or more symptoms. There was no significant difference between the sexes.

Seventy-five per cent of the children were aware of having at least one parafunctional habit (Table 2); 34% had one, 25% had two, and 16% had three or more parafunctions. No significant difference was found between the boys and the girls.

Seventy-eight per cent of the children had permanent dentition, whereas in 22% the dentition was in the second transitional stage. Forty-six per cent of the children had received or were receiving orthodontic treat-

Table 1. Subjective symptoms of craniomandibular disorders. Percentages of affirmative replies at interview, by sex*

| Do you (or did you) have any of the following symptoms? | Currently | | Previously | |
|---|---|---|---|---|
| | Boys ($n$ = 78) | Girls ($n$ = 88) | Boys ($n$ = 78) | Girls ($n$ = 88) |
| Headache (at least once a week) | 12 | 13 | 10 | 8 |
| Pain in the temple region | 10 | 16 | 6 | 7 |
| Any other facial pain | 4 | 2 | 0 | 1 |
| Pain when opening wide | 4 | 8 | 1 | 3 |
| Pain or tiredness when chewing | 21 | 17 | 1 | 6 |
| Restricted opening | 0 | 1 | 0 | 0 |
| Clicking sounds from the TMJ | 13 | 13 | 3 | 5 |

* No significant difference between the sexes.

Table 2. Orofacial parafunctions. Percentages of affirmative replies at interview, by sex*

| Do you have any of the following habits? | Boys ($n$ = 78) | Girls ($n$ = 88) |
|---|---|---|
| Nocturnal grinding | 18 | 10 |
| Diurnal clenching | 6 | 16 |
| Biting on lips or cheek | 23 | 35 |
| Biting on fingernails | 49 | 39 |
| Biting on foreign objects | 35 | 35 |
| Finger-sucking | 4 | 0 |

* No significant difference between the sexes.

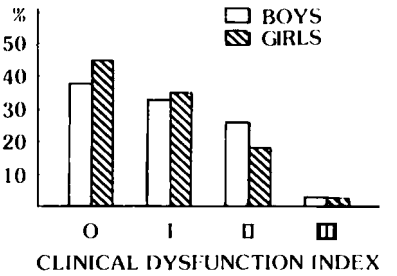


Fig. 1. Percentage distribution of boys ($n$ = 73) and girls ($n$ = 83) in accordance with Helkimo's clinical dysfunction index. No significant difference between the sexes.

ment, 3% of which had only been preventive, such as grinding of the primary dentition.

The intermaxillary relationship recorded was neutral in 82%, distal in 14%, and mesial in 1%. Because of orthodontic treatment it was not recordable in 3%. The percentages of children with crossbite, scissors-bite, open bite, or deep bite were 2, 2, 0, and 9, respectively.

In 11% of the children at least one permanent tooth was missing, and in an additional 17% at least one tooth had been extracted for orthodontic reasons.

Clinical signs of CM disorders were common but were mostly mild according to the $D_i$ (Fig. 1). Two boys (2.6%) and two girls (2.5%) had $D_i$ III. No significant difference in the occurrence of the clinical signs was found either between the right and left sides or between the sexes.

Maximal mandibular movements are presented in Table 3. One girl was clinically diagnosed to have a closed lock of the TMJ, which resulted in a severely restricted opening (25 mm). Lateral deviation of the mandible (>2 mm) during opening and/or closing was seen in 24% of the children.

The magnitude of mandibular displacement from RP to intercuspal position (IP) in three directions is shown in Fig. 2. No significant difference in the measurements of different mandibular movements was found between the sexes.

Mandibular movements were painful on opening in 3%, on laterotrusion to the right in 1% and to the left in 1%, and on protrusion in 1% of the children. None of them reported pain on guided retrusion of the mandible.

Thirty-eight per cent of the children (45%

Table 3. Mean values and standard deviations (SD) in millimeters for maximal vertical and horizontal mandibular movements, by sex*

| | Boys ($n$ = 73) | | Girls ($n$ = 83) | | Total ($n$ = 156) | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| Maximal mouth opening | 56.4 | 7.0 | 54.9 | 6.7 | 55.6 | 6.8 |
| Laterotrusion to the right | 10.7 | 1.6 | 10.3 | 1.5 | 10.5 | 1.5 |
| Laterotrusion to the left | 10.6 | 1.6 | 10.5 | 1.4 | 10.5 | 1.5 |
| Protrusion | 10.9 | 2.0 | 10.6 | 1.7 | 10.7 | 1.8 |
| Retrusion (IP-RP) | 0.5 | 0.7 | 0.4 | 0.6 | 0.4 | 0.6 |

* No significant difference between the sexes.

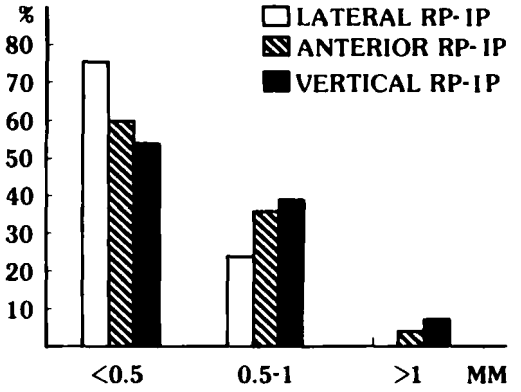


Fig. 2. Magnitude of mandibular lateral, horizontal, and vertical displacement from RP to IP in children ($n$ = 156). Lateral deviations to right and left are pooled.

of the boys and 31% of the girls; $p$ = NS) showed tenderness to palpation of the masticatory muscles, and 17% (20% of the boys and 13% of the girls; $p$ = NS) to palpation of the TMJs. The commonest sites tender to palpation were the lateral pterygoid (28%), insertion of the temporalis (26%), superficial masseter (21%), and anterior temporalis (18%). Deep masseter (6%), medial pterygoid (4%), and posterior temporalis (3%) less frequently showed tenderness to palpation. One boy showed unilateral tenderness to posterior palpation of the TMJ.

TMJ clicking occurred in 12% of the children and equally often in boys and girls (Table 1). Crepitation was noticed in one boy and one girl.

Forty-two per cent of the children (44% of the boys and 41% of the girls) had at least one of the interferences listed in Table 4. Of the unilateral contacts in RP, 31% were on the right and 40% on the left side. In the maxilla they were detected mostly in the first premolars. No significant sex difference was found.

Both the number of subjective symptoms and the number of parafunctions correlated with the $D_i$ ($p < 0.001$ and $p < 0.05$, respectively). The number of subjective symptoms correlated with the mobility index (subunit of $D_i$) ($p < 0.001$).

Table 4. Percentage distribution of occlusal variables, by sex*

| Variable | Boys ($n$ = 73) | Girls ($n$ = 83) | Total ($n$ = 156) |
|---|---|---|---|
| Unilateral contact in RP | 71 | 66 | 69 |
| Interferences | 44 | 41 | 42 |
| Lateral slide (>0.5 mm) RP-IP | 32 | 18 | 24 |
| Mediotrusion side (<3 mm) | 5 | 4 | 4 |
| Mediotrusion side (>3 mm) | 16 | 19 | 18 |
| Laterotrusion side | 3 | 7 | 5 |
| Protrusion | 7 | 1 | 4 |

* No significant difference between the sexes.

## Discussion

The design of this longitudinal investigation, the series of children included, and the demographic background of the children have been discussed earlier (15). As expected, the number of children has decreased considerably during the investigation, resulting in the present group. Moss & Garrett (19) suggested, however, that longitudinal studies of selected groups of subjects, particularly children and adolescents, may be useful in determining the actual incidence rate of signs and symptoms of CM disorders.

The different aspects of the methods used at interview have been discussed previously by Nilner (5). The methods of clinical examination used in the present study are routine, tested procedures in stomatognathic research (16, 17, 20, 21). Since all the children were examined by the same person, it is likely that the comparison of the clinical signs within the group was reliable (20, 21).

The prevalences of single subjective symptoms were in accordance with the studies by Nilner's team (5, 6), which used the same question at interview, except about symptoms when chewing. Our wording of the question included both pain and tiredness, not only pain. Accordingly, the prevalence in the present study was higher than in the above-mentioned previous studies (5, 6). However, it was equal to that of Egermark-Eriksson et al. (3), who used the same wording as we did.

The frequencies of the different orofacial parafunctions in the present study were similar to those in corresponding Swedish studies (3, 5, 6). In general, the prevalence of the clinical signs of CM disorders agreed with those reported for children in Finland and in Sweden (3, 5–7, 22). Furthermore, neither these studies nor the present study showed any difference between the sexes or between 10-year-olds and 15-year-olds.

Maximal vertical and horizontal mandibular movements were close to those reported earlier (5–7, 22). The girl with restricted opening had been operated on for a palatal tonsil, under general anesthesia, 3 weeks earlier. After the operation she found the opening of the mouth painful and restricted. At a clinical examination her condition was diagnosed as a closed lock of the TMJ (maximum opening, 25 mm). After manipulation she was immediately able to open her mouth 43 mm. As emphasized by Wänman & Agerberg (23), the maximal mandibular mobility, especially mouth opening, seems to be one of the most sensitive variables of dysfunction. This was further supported in the present study by the finding that mobility index correlated significantly with the number of subjective symptoms. However, with regard to children the lower limits of normality of the index should be discussed.

The children in the present study had tenderness to palpation of the masticatory muscles and the TMJs more often than did the children studied by Egermark-Eriksson et al. (3) but less often than the children studied by Nilner's team (5, 6). The frequency of muscle tenderness approximated the figures reported by Kirveskari et al. (7) in 10- and 15-year-old children. In agreement with previous findings, lateral pterygoid and insertion of the temporalis were the commonest sites of tenderness to palpation. TMJ clicking was equally common in the boys and in the girls, confirming earlier reports (7, 10, 24). However, in some studies clicking has been found to be commoner in girls than in boys (3, 25).

The definition of mediotrusion side interference in the present study was the same as that used by Egermark-Eriksson et al. (3): contact(s) on mediotrusion which prevented tooth contacts on the laterotrusion side, as inspected by the naked eye. Egermark-Eriksson et al. found these interferences during gliding up to 3 mm from IP in 2% of the 11-year-olds and in 4% of the 15-year-olds. The corresponding frequencies during gliding more than 3 mm from IP were 20% and 18%. These findings agreed closely with ours, as did their findings with regard to other occlusal variables.

The present paper shows that in most of these Finnish children, despite regular and consistent dental care from birth, orofacial parafunctions and signs and symptoms of craniomandibular disorders are common, although rarely severe. The relationship

between signs and symptoms of CM disorders and various other factors such as craniofacial growth, bite force, and occlusal variables will be studied further. The longitudinal development of signs and symptoms of craniomandibular disorders will also be followed up.

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