

Prevalence of craniomandibular dysfunction in children and adolescents: a review

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Abstract

A review of the literature on the prevalence of craniomandibular dysfunction in children and adolescents is presented. A high prevalence of dysfunction was reported in both selected and nonselected populations. The selected populations referred to samples which were not representative of the entire population. The most common symptom was found to be muscle tenderness followed by those of headaches and temporomandibular joint sounds, and temporomandibular joint tenderness. The criteria used to identify children with signs and symptoms of craniomandibular dysfunction were different in the majority of the studies. Since, however, mild symptoms are present at very young ages, a routine dental examination should include an evaluation of the masticatory system.

Epidemiologic studies of the masticatory system of children and adolescents have shown a high prevalence of functional disturbances. In some of these studies the criteria used to identify individuals with signs and symptoms of craniomandibular dysfunction (CMD) are not well defined. In the majority of the studies with well-defined criteria, the definitions differ from each other.

The purpose of this paper was to review the literature with respect to prevalence of CMD and discuss the methods used to identify individuals with signs and symptoms of the disorder.

Literature Review

Studies published in English are included in this review. Most of the relevant information provided by each study is reported in the tables. Of the studies reviewed, six¹ were conducted in selected populations and seven² in nonselected populations. Two studies (Magnusson et al. 1985; Dibbets et al. 1985) were longitudinal while the others were cross sectional. Nine

studies³ were conducted in whites and one (Ogura et al. 1985) in Orientals, while three⁴ conducted in the United States did not mention any differentiation among races. The study conducted in Orientals showed a lower dysfunction prevalence rate than that found in whites.

The investigations were carried out in seven studies⁵ by two or more examiners, in three⁶ by one, and in the rest of them the number of investigators was not reported. The information was collected in two studies (Williamson 1977; Ogura et al. 1985) by a clinical examination, in five⁷ by a clinical examination and a questionnaire, in four⁸ by a clinical examination and an interview, and in one study (Dibbets et al. 1985) by a clinical examination, radiographic examination, and an interview. In three studies,⁹ the examiners had trained themselves on actual patients prior to the beginning of the investigation.

The overall prevalence of objective symptoms ranged from 9.8 to 74% (Table 1, next page). The frequency of muscle and temporomandibular joint (TMJ) tenderness ranged from 18 to 70% and 5 to 39%, respectively (Table 2, next page). Six studies¹⁰ reported the prevalence of muscle tenderness to be higher than

¹ Bernal and Tsamtsouris 1986; Brandt 1985; Dibbets et al. 1985; Grosfeld and Czarnecka 1977; Wigdorowicz-Makowerowa et al. 1979; Williamson 1977.

² Egermark-Eriksson 1982; Magnusson et al. 1985; Nilner 1983; Nilner and Lassing 1981; Ogura et al. 1985; Wanman and Agerberg 1986a.

³ Egermark-Eriksson 1982; Gazit et al. 1984; Grosfeld and Czarnecka 1977; Magnusson et al. 1985; Nilner 1983; Nilner and Lassing 1981; Wanman and Agerberg 1986a; Wigdorowicz-Makowerowa et al. 1979.

⁴ Bernal and Tsamtsouris 1986; Brandt 1985; Williamson 1977.

⁵ Bernal and Tsamtsouris 1986; Brandt 1985; Gazit et al. 1984; Grosfeld and Czarnecka 1977; Magnusson et al. 1985; Nilner and Lassing 1981; Ogura et al. 1985.

⁶ Egermark-Eriksson 1982; Wanman and Agerberg 1986a; Williamson 1977.

⁷ Bernal and Tsamtsouris 1986; Egermark-Eriksson 1982; Gazit et al. 1984; Magnusson et al. 1985; Wanman and Agerberg 1986a.

⁸ Brandt 1985; Grosfeld and Czarnecka 1977; Nilner 1983; Nilner and Lassing 1981.

⁹ Brandt 1985; Nilner 1983; Nilner and Lassing 1981.

¹⁰ Brandt 1985; Egermark-Eriksson 1982; Gazit et al. 1984; Magnusson et al. 1985; Nilner 1983; Nilner and Lassing 1981; Wanman and Agerberg 1986b.

that of the other clinical signs, while in two (Williamson 1977; Gazit et al. 1984) the frequency of TMJ tenderness was higher than that of muscle tenderness. However, the definitions of the criteria used to identify children with muscle and TMJ tenderness were different in the majority of the studies. Of the investigations using the same definitions of criteria, one (Magnusson et al. 1985) was conducted on the same subjects four years after the first examination and showed an increase in both muscle and TMJ tenderness. The others¹¹ were conducted in different age groups. Therefore, the reported results are not comparable. One study (Bernal and Tsamtouris 1986) conducted in children 3-5 years of age did not report muscle tenderness because of their young age; TMJ tenderness, however, was reported.

With respect to the mandibular movements, seven studies¹² reported the maximal mouth opening while one (Brandt 1985) reported the normal mouth opening. One study (Ogura et al. 1985) reported the limit of mouth opening when the subjects complained of a limitation. The lower limits for the maximal mouth opening and mouth opening were 40 mm and 35 mm, respectively, in the studies conducted in children with transitional and permanent dentitions. These values, however, do not correspond to statistically determined minimal values of the children with transitional dentition and without CMD (Agerberg 1974; Landtwing 1978). In one study (Bernal and Tsamtouris 1986) conducted in children with primary dentition the lower limits of maximal mouth opening were 34 mm. Lateral mandibular movements were measured in three studies,¹³ but the ages of the groups studied were different.

¹¹ Brandt 1985; Nilner 1983; Nilner and Lassing 1981.

¹² Bernal and Tsamtouris 1986; Egermark-Eriksson 1982; Gazit et al. 1984; Magnusson et al. 1985; Nilner 1983; Nilner and Lassing 1981; Wanman and Agerberg 1986a.

¹³ Egermark-Eriksson 1982; Gazit et al. 1984; Wanman and Agerberg 1986.

TABLE 1. Studies on Prevalence of Craniomandibular Dysfunction in Children and Adolescents

Investigator	Sample Size		Age (years)	Dysfunctional Symptoms	
	Males	Females		Subjective	Objective
Grosfeld et al. (1977)	114	135	6-8	—	56%
	117	133	13-15	—	68%
Williamson (1977)	129	175	6-16	—	35%
Wigdorowick et al. (1979)	2100		10-15	—	40% w/bruxism 27% w/o bruxism
Nilner et al. (1981)	222	218	7-14	36%	55%
Nilner (1983)	147	162	15-18	41%	74%
Egermark-Eriksson (1982)		136	7	39%	33%
		131	11	67%	46%
		135	15	74%	61%
Magnusson et al. (1985)		66	11	62%*	66%*
		53	15	66%*	66%*
Brandt (1985)	673	669	6-17	85%	41%
Ogura et al. (1985)	1095	1103	10-18	—	9.8%
Dibbets et al. (1985)	71	94	7-19	19%	21%
				50%**	43%**
Bernal et al. (1986)	79	70	3-5	38%	21.1%
Wanman et al. (1986b)	146	139	17	—	56%
Wanman et al. (1986a)	146	139	17	20%	—
Gazit et al. (1984)	188	181	10-18	—	56.4%

*, ** These values indicate the prevalence of subjective and objective symptoms after the 4- and 10-year follow-up periods, respectively.

Note: Subjective symptoms are those reported by the patients, while objective symptoms are those determined clinically.

TABLE 2. Prevalence of Definitional Symptoms of Craniomandibular Dysfunction in Children and Adolescents

Investigator	TMJ Sounds	TMJ Tenderness	Muscle Tenderness	Reduced Maximal Opening	Headaches
Williamson (1977)	16%	32%	31%	NR	NR
Nilner et al. (1981)	8	39	64	1%	14%
Nilner (1983)	14	34	55	0	16
Egermark-Eriksson (1982)	18	5.5	33	9	23
Magnusson et al. (1985)	20	12	70	8	30
Brandt (1985)	9	7	18	7	21.4
Ogura et al. (1985)	8.6	—	—	0.3	NR
Bernal et al. (1986)	5	5	—	5	1
Wanman et al. (1986)	22	12.7	41	0	12%
Gazit et al. (1984)	35.8%	30.4%	20.3%	1.6%	—

TMJ stands for temporomandibular joint.

NR = not reported.

Note: The sample size and the age group of the above studies are the same as those in Table 1.

The prevalence of TMJ sounds ranged from 5 to 35.8% (Table 2). In six studies¹⁴ TMJ sounds were determined audibly, in one (Bernal and Tsamtouris 1986) by palpation and auscultation while in the others by a stethoscope. One study (Bernal and Tsamtouris 1986) reported the prevalence of TMJ sounds and tenderness to be equal, five¹⁵ showed the prevalence of TMJ sounds to be higher than that of tenderness while the others revealed the opposite trend. The studies which recorded the TMJ sounds audibly did not differentiate between clicking and crepitation sounds.

¹⁴ Brandt 1985; Egermark-Eriksson 1982; Gazit et al. 1984; Magnusson et al. 1985; Wanman and Agerberg 1986a; Williamson 1977.

¹⁵ Brandt 1985; Egermark-Eriksson 1982; Gazit et al. 1984; Magnusson et al. 1985; Wanman and Agerberg 1986b.

The prevalence of subjective symptoms ranged from 19 to 85% (Table 1). The following subjective symptoms were mainly recorded by the investigators: reported TMJ sounds, recurrent headaches, tiredness in jaws, pain during chewing, difficulties in mouth opening, and pain in mouth opening. Recurrent headaches were reported by seven studies.¹⁶ The reported frequency ranged from 1 to 30% (Table 2). The definition of recurrent headaches was different in most of the studies. In those using the same definition,¹⁷ subjects of different ages were included in the sample. One study (Magnusson et al. 1985) conducted on the same subjects four years after the first examination reported an increase of recurrent headaches. The frequency of recurrent headaches was reported to be higher in females than in males.¹⁸ Furthermore, one study (Brandt 1985), which reported the highest prevalence of subjective symptoms, included grinding.

Six studies¹⁹ showed that the prevalence of signs and symptoms increases with age. All the studies, however, reported that the signs and symptoms were generally mild. A statistically significant difference between sexes was found in one study (Brandt 1985) with females having higher frequency of CMD.

The relationships between signs and symptoms were reported in three studies. In one of the studies (Brandt 1985) found associations among the clinical signs as well as between clinical signs and reported symptoms. In a second study (Nilner 1983) reported strong correlation between TMJ tenderness and muscle tenderness, while the third study (Magnusson et al. 1985) reported a statistically significant correlation between subjective symptoms (recurrent headaches were excluded) and clinical dysfunction index.

Discussion

Definitional Symptoms

Most investigators agree that the definitional symptoms of CMD include one or more of the following:

1. Pain and tenderness of the muscles of mastication and TMJs
2. Sounds during condylar movements
3. Limitations of mandibular movements
4. Headaches.

The reviewed investigations, however, differ from each other in the ages of the groups studied, the sample

¹⁶ Bernal and Tsamtsouris 1986; Brandt 1985; Egermark-Eriksson 1982; Magnusson et al. 1985; Nilner 1983; Nilner and Lassing 1981; Wanman and Agerberg 1986a.

¹⁷ Brandt 1985; Nilner 1983; Nilner and Lassing 1981; Wanman and Agerberg 1986a.

¹⁸ Egermark-Eriksson 1982; Magnusson et al. 1985; Nilner 1983; Nilner and Lassing 1981; Wanman and Agerberg 1986a.

¹⁹ Brandt 1985; Egermark-Eriksson 1982; Gazit et al. 1984; Magnusson et al. 1985; Nilner and Lassing 1981; Wigdorowicz-Makowerowa et al. 1979.

size, the composition of the sample, the number of examiners, the definitions of the diagnostic criteria, and consequently the prevalence of the signs and symptoms of CMD.

Clinical Examinations

The results of the clinical examinations are not as precise as the results of the standardized laboratory experiments. Therefore, inter- and intrajudge reliability tests to show the reproducibility of the methods used are necessary. In addition, the definitions of the diagnostic criteria must be standardized to increase the reliability of the reported results. Only four studies,²⁰ however, reported the results of the inter- or intrajudge reliability test while in most of them the definitions of the criteria were different.

Patient Interview

The advantage of the interview method is that it is possible to determine whether a question is misunderstood by the subject (Nilner and Lassing 1981), while the advantage of the questionnaire is that the subject can consider the question calmly or that young children can be helped by their parents (Egermark-Eriksson 1982). In dealing with young children, however, it appears more appropriate to use an interview rather than a questionnaire, because the examiner can help them to understand the questions and any misconception of the parents related to the questions is eliminated.

Sample Selection

All the studies included individuals with a history of dentofacial trauma. However, no statistical tests were carried out to detect any difference between those with and without injury. Subjects with previous orthodontic treatment were excluded in two studies (Williamson 1977, Brandt 1985). Of those which included individuals with orthodontic treatment, two (Nilner and Lassing 1981, Magnusson et al. 1985) reported that there was no difference in the prevalence of the signs and symptoms between those with and without orthodontic treatment, while one study (Egermark-Eriksson 1982) found statistically significant differences with respect to recurrent headaches and TMJ sounds. Dental pathology (pulpitis, pericoronitis) and upper respiratory infection that might provoke signs and symptoms of dysfunction (Bell 1969, Schwartz 1955) were not controlled in any of the reviewed studies. In addition, no differentiation between CMD as a separate entity and other organic diseases that affect the function of the masticatory system has been mentioned. In the studies conducted in the United States,²¹ (next page) race was not taken into consideration. Socioeconomic status was considered in only

²⁰ Brandt 1985; Egermark-Eriksson 1982; Nilner 1983; Nilner and Lassing 1981.

one of the reviewed studies (Nilner and Lassing 1981).

Treatment Needs

The reviewed epidemiologic studies showed high prevalence of the symptoms of CMD in children and adolescents. However, Magnusson et al. (1985), in a four-year longitudinal study, reported that the severity of the symptoms was mild and the need and demand for treatment may be considered small. To date, there are no available data to clarify what proportion of children and adolescents need treatment.

Regarding treatment modalities, Ingerslev (1983) reported that 94% of 366 patients, six to 16 years of age, with functional disturbances of the masticatory system were treated using soft- and hard-bite splints, light grinding of the teeth, and physiotherapy with heat, local anesthesia, and muscle exercises. Since, however, there is not enough evidence in the literature with respect to the efficacy of each treatment type, the guidelines for treatment proposed by the American Dental Association (1982) must be followed.

Conclusions

Based on the reviewed studies, it can be concluded that:

1. The prevalence of CMD is high in selected and non-selected populations. The signs and symptoms, however, are generally mild.
2. The most common symptom is muscle tenderness followed by headaches and TMJ sounds, and TMJ tenderness.
3. Symptoms have been found in all age groups studied.
4. Since mild symptoms of CMD are present at very young ages, a routine dental examination should include an evaluation of the masticatory system to identify and follow up these patients.

Suggestions for Future Research

1. Separate epidemiologic studies should investigate the prevalence of CMD in groups with different characteristics, such as those with a history of dentofacial trauma, different emotional states, malocclusion, oral parafunctions (e.g., grinding, clenching, thumbsucking, nail biting, lip/cheek biting), and impaired physical health. They should also attempt to identify individuals at high risk of developing CMD.
2. Standard definitions of the criteria used to identify children with CMD should be employed.
3. The involvement of each of the etiologic factors as well as their interactions in the development of CMD need to be investigated.

4. Cephalometric studies to test the effect of the TMJ sounds (i.e., clicking, reciprocal clicking, crepitation) on mandibular growth should be conducted.
5. Preventive measures should be developed whenever strong correlations are found between etiologic factors and CMD.
6. Clinical studies are needed to test the efficacy of the existing treatment modalities with respect to etiologic factors and to clarify the proportion of children and adolescents who need treatment.

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²¹ Bernal and Tsamtsouris 1986; Brandt 1985; Williamson 1977.

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The debt

The debt that each of us owes to our profession is one which most of us do not think of too often. We are not reminded of it in nearly as forceful terms as we are of two commonly encountered forms of professional indebtedness — student loans and the Internal Revenue Service.

We are inclined to think of our own struggle to “arrive” in our profession, whether it was toiling against academic odds, overcoming personal financial limits, or culminating a family’s effort to improve the lot of its younger generation. All of these are valid sources of tremendous pride to both the individual and to his or her family. The fact is, however, that each of us owes a special debt to those members of our profession who went before us.

Dental education is undergoing retrenchment. While we go through this period of adjustment in response to market demands, we must be careful not to destroy the foundation of the profession, its educational system.

It was, after all, education which raised dentistry to the status of a profession. It was education and the early leaders of the profession who worked with their hands and their heads and their hearts that lifted dentistry out of the era of the barber surgeon and the itinerant tooth puller working from the back of a wagon.

It was teachers of dentistry who donated their time to a school, or were paid little more than parking money, that kept many schools functioning. The contributions of time, effort, and money by them and by untold practitioners to the precepts of excellence have made it possible for there to be a profession of which we could be proud members.

The next time you are approached by an alumni fund raiser, respond to the debt you owe your education and your profession. The very first portion of the much revered but seldom read Hippocratic Oath states:

To reckon him who taught me this art equally dear to me as my parents. To share my substance
with him and relieve his necessities if required.

It is our debt. Yours and mine.

Dr. Herbert T. Shillingburg, Jr., Editor
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