Prevalence of signs and symptoms of craniomandibular disorders and orofacial parafunction in 4–6-year-old African-American and Caucasian children

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SUMMARY **Children, 4–6 years old, 153 Caucasian and 50 African-American, from a pre-school and kindergarten programme in a low income industrial area, who participated in a voluntary oral health examination, were questioned and examined for signs and symptoms of craniomandibular disorders (CMD) and of oral parafunctions. Most of the CMD signs and symptoms were mild. Eight per cent had recurrent (at least 1–2 times per week) TMJ pain, and 5% had recurrent neck pain, African-American children more often than Caucasian children ($P < 0.05$). Seventeen per cent had recurrent headache. Three per cent had recurrent earache. Pain or tiredness in the jaws during chewing was reported by 25% of the children, more often by African-American than by Caucasian children ($P < 0.001$) and more often by girls than by boys ($P < 0.05$). Pain at jaw opening occurred in 10% of the children, more often in the African-American than in the Caucasian group ($P < 0.001$). Thirteen per cent of the children had problems in opening the mouth. Deviation during opening was observed in 17% and reduced opening in 2%. Reduced lateral movements, locking or luxation were not observed in any child. Palpation pain was found in the lateral TMJ area in 16%, in the posterior TMJ area in 25%, in the temporalis and masseter areas in 10%, and pain for all regions was found more often in the African-American than in the Caucasian children ($P < 0.01$). Thirty-four per cent of the African-American, and 15% of the Caucasian children admitted to having ear noises ($P < 0.01$). TMJ sounds, as recorded by auscultation, occurred in 48% of the children, more often in the African-American than in the Caucasian children ($P < 0.001$) and more often in girls than in boys ($P < 0.05$). Bruxism was noted in 31% of the African-American and in 17% of the Caucasian children ($P < 0.05$). Thumb sucking was reported in 56% of the children, more in the girls than in the boys ($P < 0.01$). The habit was still present in 29% of the children. Fifty-five per cent had the parafunction nail biting. The results of this study showed that mild but distinct signs and symptoms of CMD already occur by the age 4–6 with slight differences in distribution observed between the sexes and strong differences noted between the African-American and the Caucasian races.**

Introduction

Craniomandibular disorders (CMD) often have a progressive course (Blackwood, 1963, 1969; Ash, 1986). They represent a general health problem (Kirveskari, 1991) and may, especially if diagnosed too late, progress into a state with irreversible destruction of the intracapsular TMJ elements (Farrar & McCarty, 1983). It is important, in planning therapeutic and prophylactic procedures, to have knowledge about the natural progress of CMD. Little is known however, about the severity of early stages and the influence of gender and racial factors in young age groups. There is also a need for more information about the occurrence in low age groups of oral parafunctions, which may be aetiological factors in CMD (Wechsler, 1931; Olkinuora, 1969; Lindqvist, 1971; Ayer, 1979; Nilner & Lassing, 1981; Ramfjord & Ash, 1983; Rugh & Lemke, 1984; Westling, 1988; Kleinrock *et al.*, 1990). The prevalence of CMD signs and symptoms and of parafunctions have been

subject to many studies in adult populations and in children (Helkimo, 1979; Egermark-Eriksson, Carlsson & Ingervall, 1981; Egermark-Eriksson, 1982a,b; Nilner & Kopp, 1983; Kirveskari, Alanen & Jämsä, 1986; Könönen *et al.*, 1987; Kleinrock *et al.*, 1990), but relatively few of the subjects were below the age of seven. Thus, there is a need for more information about the prevalence of early stages of CMD and oral parafunctions in pre-school children. The aim of the present study was to record the prevalence of CMD signs and symptoms and of oral parafunctions in 4–6-year-old African-American and Caucasian children, and to test the hypothesis that the distribution of CMD signs and symptoms and of oral parafunctions is dependent upon gender and race.

Subjects

Examinations were performed on 203 children, aged 5·06 ± 0·634 (s.d.), from a pre-school and kindergarten, 20 miles west of Detroit, Michigan, U.S.A. The children presented at the school for annual voluntary oral health examination. The results reported here are from those who were in the age range 4–6 years and were either Caucasian or African-American (Table 1). Only those children with a signed consent form could be examined. The sex distribution was 56% boys and 44% girls, about the same as in the entire school in which there were 559 children enrolled with 57% boys and 43% girls.

Methods

The examination and recordings were made by three experienced faculty members and one specially trained dental student. Occlusion was also examined but will be reported separately. Palpation and auscultation recordings were made on all children by the same examiner. Signs, symptoms, and oral parafunctions, generally considered to be associated with CMD (Magnusson & Carlsson, 1978; Nilner & Lassing, 1981; Egermark-Eriksson, 1982a; Ash, 1986; Wänman, 1987; Rothenberg, 1991), were recorded. Intra-oral muscle palpations were not performed for practical reasons since examination and recordings were made in limited school facilities.

Table 1. *Age and sex distribution*

		Age	
	n	Mean	s.d.
Caucasian	153	5·08	0·638
boys	88	5·03	0·651
girls	65	5·15	0·618
African-American	50	4·98	0·622
boys	25	5·12	0·666
girls	25	4·84	0·554
All boys	113	5·05	0·652
All girls	90	5·07	0·614
Total	203	5·06	0·634

s.d. = standard deviation.

Examination

Interview

The children were interviewed concerning acute pain, jaw movement impairment, TM joint sounds, parafunctions, and pain history. Some of the children answered that they did not know the answers to some of the questions. The following questions were presented and carefully explained to each child:

Acute pain: 'Do you have any pain or tiredness in the jaws during chewing such things as gum?'

Acute mandibular dysfunction: 'Do you have any problems in opening your mouth?'

'When you open your mouth, do you have any noises by your ears?'

Oral parafunctions:

Bruxism: 'Are you aware of or has anyone told you that you grind your teeth?'

Nail biting: 'Do or did you bite your fingernails?'

Thumb sucking: 'Do or did you suck your thumb or finger?' 'If yes, at what age did you stop'

Pain history. Headache, earache, neck pain and jaw-joint pain frequencies were recorded as never, seldom (at least 1–2 times per year), or often = recurrent (at least 1–2 times per week). Care was taken when questioning to determine if pain was derived from pulpitis, sensitive tooth areas, or periodontal tissues.

Palpation

The TM joints were palpated laterally and posteriorly, during mandibular rest and during jaw movements. Soreness and tenderness were recorded on a three-graded scale: 0 = no pain; 1 = slight soreness on left and/or right side; 2 = distinct pain and/or palpebral reflex on left and/or right side. The temporalis and

masseter muscle areas were palpated extra-orally and tenderness was recorded using the same scale. Very few (three) had more than grade 1 at palpation and those with grade 1 or 2 were therefore pooled for the statistical analysis.

Examination of jaw movements

Range of active opening and lateral jaw movements were classified as normal or reduced. Agerberg (1974) examined 150 6-year-old children and found the group mean to be 44·9 mm with a range of 32 mm–56 mm. Opening ability was labelled as reduced if it was 35 mm or less and/or the child said that he/she could not open as much as he/she used to. Maximal lateral movement was to be considered reduced if it was less than about 8 mm and confirmed by the child to be less than it used to. Deviations of jaw opening and closing movements in the coronal plane were noted if it was more than 2 mm. The children were asked if they felt pain in the temporal, TM joint or masseter areas at jaw opening. The children were examined for acute symptoms of locking or luxation.

Auscultation of joint sounds

TMJ sounds were recorded using a regular stethoscope without electronic amplifier. The sounds were classified according to location (left or right joint), type (clicking, crepitation), and timing (during opening only, during closing only, or reciprocal). Recordings from left and right TMJ were pooled at the analysis. Popping sounds, occurring when the condyles moved past the articular eminence, were not counted. All auscultation examinations were performed by one investigator.

Statistical analysis

Differences between observed and expected frequencies were tested using the Pearson chi-square statistic and complemented with Fisher's exact test when expected values were small (less than 5). Missing values were not included when calculating the descriptive percentages.

Results

Complete results are presented in Tables 2–6, some of which are repeated here.

Pain history (Table 2)

Headache was the most common recurrent (at least 1–2 times/week) pain symptom (16·7%) followed by TMJ pain (8·4%, neck pain (4·9%) and earache (2·5%).

Table 2. Pain history

	All children $n = 203$	Caucasian 153	African-American 50	Boys 113	Girls 90
TMJ pain					
Never	82·8%	86·9%	70·0%	81·4%	84·4%
Seldom	8·9%	5·9%	18·0%	8·8%	8·9%
Often	8·4%	7·2%	12·0%*	9·7%	6·7%
Headache					
Never	46·8%	49·7%	38·0%	47·8%	45·6%
Seldom	36·5%	33·3%	46·0%	28·3%	46·7%
Often	16·7%	17·0%	16·0%	23·9%	7·8%**
Earache					
Never	71·3%	75·2%	59·2%	74·3%	67·4%
Seldom	26·2%	22·2%	38·8%	23·9%	29·2%
Often	2·5%	2·6%	2·0%	1·8%	3·4%
Neck pain					
Never	79·8%	83·7%	68·0%	80·5%	78·9%
Seldom	15·3%	13·1%	22·0%	14·2%	16·7%
Often	4·9%	3·3%	10·0%*	5·3%	4·4%

Seldom = At least 1–2 times per year. Often (recurrent) = at least 1–2 times per week. There was one missing value regarding earache for African-American girls. It was not included when calculating the descriptive percentages. *$P < 0.05$; ** = $P < 0.01$.

Table 3. Pain at jaw function and palpation

	All children $n = 203$	Caucasian 153	African-American 50	Boys 113	Girls 90
Pain at jaw function					
Chewing pain	25·4% (2)	17·2% (2)	50·0%***	19·8% (2)	32·2%*
Pain at jaw opening	10·3%	5·9%	24·0%***	12·4%	7·8%
Pain at palpation					
Lateral TMJ	16·3%	12·4%	28·0%**	13·3%	20·0%
Posterior TMJ	24·6%	19·6%	40·0%**	22·1%	27·8%
Masseter muscle area	10·8%	7·2%	22·0%**	9·7%	12·2%
Temporalis muscle area	10·3%	7·2%	20·0%**	10·6%	10·0%

Missing values are, if >0, given within parentheses after the percentage values. They were not included when calculating the descriptive percentages. * = $P < 0.05$; ** = $P < 0.01$; *** = $P < 0.001$.

Table 4. Jaw movement dysfunction

	All children $n = 203$	Caucasian 153	African-American 50	Boys 113	Girls 90
Problems in jaw opening	12·9% (1)	11·8% (1)	16·0%	11·6% (1)	14·4%
Deviation at jaw opening	17·2%	15·0%	24·0%	18·6%	15·6%
Reduced jaw opening degree	2·0%	1·3%	4·0%	2·7%	1·1%

Missing values are, if >0, given within parentheses after the percentage values. They were not included when calculating the descriptive percentages.

Table 5. TMJ sounds

	All children $n = 203$	Caucasian 153	African-American 50	Boys 113	Girls 90
Earnoise	19·6% (4)	14·8% (4)	34·0%**	16·2% (2)	23·9% (2)
Auscultation	47·8%	41·2%	68·0%***	40·7%	56·7%*

Earnoise, as reported by the children, and TMJ sounds as recorded by auscultation. Missing values are, if >0, given within parentheses after the percentage values. *They were not included when calculating the descriptive percentages.* * = $P < 0.05$; ** = $P < 0.01$; *** = $P < 0.001$.

Table 6. Prevalence of oral parafunctions

	All children $n = 203$	Caucasian 153	African-American 50	Boys 113	Girls 90
Bruxism	20·0% (3)	16·6% (2)	30·6%* (1)	20·0% (3)	20·0%
Nail biting	55·2%	53·6%	60·0%	54·0%	56·7%
Thumb/finger sucking	55·9% (1)	53·3% (1)	64·0%	46·9%	67·4%** (1)

Missing values are, if >0, given within parentheses after the percentage values. They were not included when calculating the descriptive percentages. * = $P < 0.05$; ** = $P < 0.01$.

Only 46·8% said they had never experienced headaches and 82·8% had never experienced TMJ pain. Most of the children had never experienced earache (71·3%) or neck pain (79·8%). African-American children had *more TMJ pain and neck pain than the Caucasian children* ($P < 0.05$). More boys (23·9%) than girls (7·8%) had recurrent headaches ($P < 0.01$).

Pain (acute) at jaw function and palpation (Table 3)

Pain or tiredness in the jaws during chewing was reported by 25·4% of the children. More African-American than Caucasian children had pain or tiredness at chewing ($P < 0.001$), pain at jaw opening ($P < 0.001$), pain at palpation of the lateral ($P < 0.01$) and posterior ($P < 0.01$) TMJ areas, or pain at palpation of the masseter ($P < 0.01$) or temporalis ($P < 0.01$) areas. Chewing pain was more common in girls than in boys ($P < 0.05$).

Jaw movement dysfunction (Table 4)

Some of the children (12·9%) reported that they had problems in opening the mouth. Reduced opening degree was, however, rare and observed only in 2·0%. Deviations during opening were observed in 17·2% of the children. No observations were made of reduced lateral movements.

Joint sounds (Table 5)

Ear noises were reported by 19·6% of the children and more often ($P < 0.01$) by the African-American (34·0%) than by the Caucasian children (14·8%). Also, more African-American children had joint sounds at auscultation ($P < 0.001$). Girls had joint sounds detectable by auscultation more often than boys ($P < 0.05$). Clicking occurred in 21·4% of the children, mostly during opening, and crepitation was heard in 30·6% of the children. It was often difficult to decide if the sound should be characterized as clicking or crepitation.

Parafunctions (Table 6)

Twenty per cent were aware of or had been told that they grind their teeth. Fifty-five per cent bite, or had been biting their nails. The corresponding figure for thumb/finger sucking was 55·9%. Twenty-nine per cent of the children had continued the habit of thumb sucking. The age of discontinuing the habit, $5{\cdot}0 \pm 0{\cdot}67$ (s.d.) for those 40 children who remembered was close to the mean age for the whole group ($5{\cdot}1 \pm 0{\cdot}63$). The prevalence of bruxism was higher in the African-American than in the Caucasian children ($P < 0.05$). More girls than boys had a history of thumb/finger sucking ($P < 0.01$).

Discussion

Mild forms of signs and symptoms of craniomandibular disorders (CMD) with only a few sex, but many racial, differences, were found to occur to a high degree, similar to the prevalences reported from studies on the 7-year-old age group (Grosfeld & Czarnecka, 1977; Egermark *et al.*, 1981). Bruxism was more common in African-American children, but only at the 5% level. Most of the children's parents were low-income industrial workers who were severely affected by the current recession. Future studies with larger groups will also consider socio-economic and sociomedical factors. Questions of interest would be, for instance, if economic status and educational level of the parents affect the prevalence and incidence of CMD signs/symptoms in their children.

We found higher prevalence of headache than Sillanpää, Piekkala & Kero (1991), who also examined 5-year-old children. The result regarding the prevalence of recurrent (at least 1–2 times per week) headaches, not being lower in boys than in girls, is contrary to other reports (Nilner & Lassing, 1981; Egermark-Eriksson, 1982b; Nilner & Kopp, 1983). Several studies of adolescents have shown females to have significantly more recurrent headaches than males (for review see Egermark-Eriksson, 1982b). A possible explanation is that the mean age was much lower in this study and that changes in headache pattern, may occur in older age groups, due to hormonal changes.

The prevalence of bruxism was similar to what Reding, Rubright & Zimmerman (1966) and Egermark-Eriksson *et al.* (1981) reported. Prevalence of nail biting was only slightly higher than in most reports concerning young children (for review see Westling, 1988). Most authors, however, found a higher prevalence in boys than in girls of the parafunction fingernail biting while we found the sex distribution to be very similar. One explanation may be that the children in the present study were a few years younger than in most of the other studies and that boys may discard the habit earlier than the girls. A history of thumb sucking was found in 56%, but only 29% still had the habit. Nilner & Lassing (1981) found the prevalence to be 5% in 7–14-year-old children. It is obvious that the prevalence of this habit can be expected to decrease with increased age which can explain the difference.

It was difficult to distinguish between clicking and crepitation. Egermark-Eriksson (1982a) made the same

observation. It was also difficult to tell precisely where, during the open-close cycle, the sounds occurred. It is generally agreed that the reliability is low when comparing results of auscultation between observers (Smith & Markus, 1991). It is, therefore, important that one and the same observer listens to all the children. This may of course be a severe problem in longitudinal studies. Joint sounds cannot be expected to occur with the same intensity and character at repeated movements over time. Attempts to calibrate examiners by having them listen with a stethoscope may, therefore, be less successful because they are not listening to the same sounds. Presently, the best solution to these problems seems to be to analyse simultaneous electronic recordings of TMJ sounds, jaw movements and muscle activity, as a complement to auscultation in future studies (Ekensten, 1952; Watt, 1963, 1980; Widmalm & Hedegård, 1974; Widmalm, Williams & Zheng, 1991).

Large inter-observer variation has to be expected for data recorded by palpation and auscultation. It is important therefore, as shown by Carlsson, Egermark-Eriksson & Magnusson (1980), to avoid change of examiner 'within a variable' and to calibrate the observers if such changes cannot be avoided. However, even if the members within a team can be calibrated, it is hardly possible to do the same between different teams, unless they work close together. The present study found, for instance, sounds and palpation tenderness that occurred at a higher degree in the 5-year-old children than reported by Kirveskari *et al.* (1986). This may reflect real differences between the samples, taken from populations with many possible differences in socio-economic, cultural and other factors, but it may also be due to differences in methodology. Regarding data obtained by palpation and/or auscultation, it is probably more fruitful to compare differences found *within* studies than to compare the exact percentages of prevalence data *between* studies. It may also be more rewarding to compare between studies using data obtained using questionnaires, especially if different research groups agree to use the same wording when formulating the questions.

Multiple comparisons using chi-square testing of categorical variables have the unavoidable effect that 5% of the tests will by chance, and will erroneously show significance with P values less than 0·05; 1% of the tests will by chance have P values less than 0·01, etc. The number of significant differences found in this study were, however, higher than what can be expected due to this type of error.

Most epidemiological studies on non-adults have been on school children. Attendance at pre-school and kindergarten is not mandatory in Michigan. A true representation of the whole 4–6-year-old population is therefore difficult, and expensive, to obtain. This does, however, not affect the most important result in this study, namely that the prevalence of distinct signs and symptoms of CMD is high by the age of five. Nor does it affect the conclusion that regular examinations, screening for signs and symptoms of CMD, and the initiating of prophylactic procedures may be advisable with pre-school children. Because the participation was voluntary, the often significant differences between African-American and Caucasian children can only be taken as indications of racial differences. Future studies on larger groups are therefore desirable in order to describe the natural progress of CMD and should also include the examining of the possible influence of sociomedical and socio-economic factors (Franks, 1964; Helöe, Helöe & Heiberg, 1977).

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