Maximal mandibular movements in children

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The size of maximal active movements of the mandible were studied in children in two age groups. The younger group consisted of 33 children, aged 1—2 years, in whom mouth opening was recorded using an indirect method. Highly significant differences were found between 3 recordings with the third recording having the largest mean, 38.4 mm.

The older group consisted of 75 boys and 75 girls, aged 6 years. None of them had pain or severe symptoms of dysfunction of the masticatory system. The mean maximal opening was 44.8 mm. The means found for maximal lateral movement to the right and to the left and for maximal protrusion were each about 8 mm. No differences in vertical or horizontal movements were found between the sexes. The mobility of the mandible varied greatly inter-individually, but as the various movements were highly significantly correlated in both boys and girls, the value found for one movement must be evaluated in relation to the sizes of the other movements.

The ranges within which a pair of observations of maximal mandibular movements in a healthy 6-year old child may be expected to fall with 95% probability were calculated and presented graphically. Repeated recordings of maximal opening are recommended for children.

Key-words: Temporomandibular joint syndrome; epidemiology; mandible, jaw.

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Maximal mandibular movements in small children have apparently been studied only by *Nevakari* (1960), *Sheppard & Sheppard* (1965) and *Ingervall* (1970). In the first two investigations that part of the vertical movement referred to as mouth opening (interincisal distance at maximal opening of the mouth), and in the third the entire movement (interincisal distance plus overbite) was recorded using the method previously described and used by the author (*Agerberg*, 1967, 1971, 1974a). In all three investigations the measurements were made upon maximal active opening of the mouth.

Nevakari studied the interincisal distance in 50 boys and 50 girls, aged 6—8 years, with the aid of a series of wooden blocks each of which was 5 mm thicker than the preceding one and found a mean of 46.0 mm. *Sheppard & Sheppard* reported a value of 42.4 mm for 14 children, aged 3—5 years, and of 46.2 mm for 21 children, aged 6—10 years. *Ingervall* found the mean opening capacity in 103 boys and girls, aged 7 years, to be 46.4 mm.

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The maximal vertical mobility, maximal opening, including the vertical overbite, in children thus appear to have been studied in only one investigation. The various maximal movements of the mandible in the horizontal plane recorded with the method previously described and used by the author (*Agerberg*, 1967, 1971) have never before been examined in children below 10 years.

This investigation is one in a series of studies of individuals in various age groups which have been performed in order to obtain a better conception of the sizes of different maximal vertical and horizontal movements of the mandible in children and to demonstrate the possible correlations between these movements. The possible correlations of these mandibular movements with body height and weight were also studied, as in the adult series (*Agerberg*, 1967, 1974a).

Another purpose of the investigation was to obtain normal ranges of movement of the mandible in individuals without functional disorders of the masticatory system of different ages, including children, in order to facilitate the diagnosis of diseases related to function of the masticatory system.

MATERIAL AND METHODS

The investigation was carried out on children in two age groups. The younger group consisted of 33 small children, 19 boys and 14 girls, aged 12 to 25 months (average age 18 months). Most of these children were examined at day-nurseries. All of the children were normally developed and all of them had upper and lower front teeth.

In these young children it was possible to record only that part of maximal opening capacity, which was represented by the distance between the incisal edges of the front teeth.

This was accomplished by having the children open their mouths as wide as they could and bite into half an apple (Fig 1A, B). This was repeated three times for each child. When the children opened the mouth the apple was gently pressed against the front teeth in order to obtain distinct impressions in the apple. The impressions were made first on one side of the apple, then on the other, and finally in the middle. The distance between the impressions in the apple of the edges of the upper and lower central incisors was measured by the author to the nearest millimeter using a sliding caliper (Fig. 2).

The older group of 150 children (75 boys and 75 girls) was studied during a routine examination of the teeth for caries. These children were 5 years and 10 months to 6 years and 3 months old (mean age 6 years and 1 month). According to their parents, the children had not previously suffered any blow against the head or had any symptoms of dysfunction of the masticatory system. Palpation of the masticatory musculature and temporomandibular joints ad modum *Schwartz* (1959) was not described as painful by any of the children. Children who had toothache or abscesses or major malposition of the jaws were not included in the material studied.

The various active maximal movements of the mandible from intercuspal position were performed according to a clinical method for adults previously described by the author (*Agerberg*, 1967, 1971, 1974a), with the child sitting inclined backwards in a dental chair with a firm support for the head. Mouth opening (interincisal distance) was measured with a ruler graduated in millimeters. One end

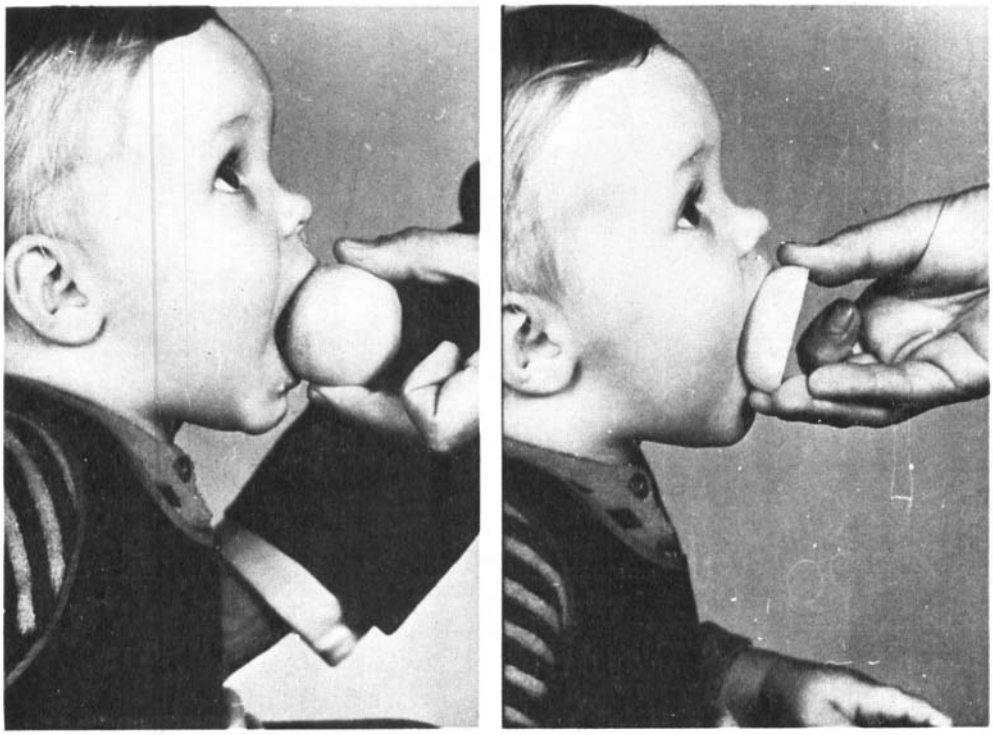


Fig. 1. Indirect recording of mouth opening in an 18-month old child by biting in half an apple at one side (A) and in the middle (B).

of the ruler was placed in the median plane against the incisal edge of one of the lower central incisors and the distance to the incisal edge of the antagonising upper incisor was measured, while the subject held his mouth open as wide as possible. In order to measure the maximal opening, the vertical overbite was also measured using the method of *Lundström* (1948) and added to the value found for mouth opening.

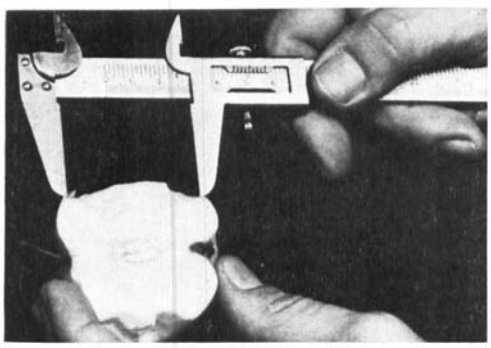


Fig. 2. Measuring of the distance between the impressions in the apple of the upper and lower teeth using a sliding caliper.

For measuring the maximal lateral movements from intercuspal position, vertical marks were made with a black grease pencil in the median plane on the facial surfaces of two opposing central incisors. To facilitate measurement of the distance from intercuspal position to the maximal protruded position, similar vertical marks were made in the right premolar region on an opposing pair of premolars. When the subject subsequently moved the mandible as far as possible to the right, to the left or forward and then closed the jaws in this extreme position the horizontal distance between the marks

was measured. The various movements have been defined previously (*Agerberg*, 1967, 1974a). All the recordings in the older group of children were made to the nearest millimeter with a ruler graduated in millimeters and were performed by the author. Body height and weight were measured to the nearest half cm and half kg, respectively, in the entire younger group and in almost half of the older group (70 children — 35 boys and 35 girls). None of the children examined reported pain or tenderness referable to the masticatory system and none showed any greater deviations or irregularities of the path of movement of the mandible when performing the various maximal movements in the vertical and horizontal planes.

Repeated measurements. In all 33 children in the younger group mouth opening was measured three times by the author using the method previously described.

In 25 of the children in the older group, three consecutive recordings were made of all of the maximal movements of the mandible by the author.

Statistical methods. The mean value of the observations was used as a measure of location of a variable. As measures of variation, the standard deviation and the lowest and the highest values observed (range) were used. The coefficient of correlation was used as a measure of the linear relationship between two variables. Mainly three types of tests were performed in order to discern

a) whether or not a certain variable had significantly different mean values in two groups (boys and girls)
b) whether or not any linear correlation existed between two variables within a group, and
c) whether or not any difference existed between the means of repeated measurements.

In these tests t-distributed test variables were used (*Snedecor & Cochran*, 1968).

Assuming that a pair of variables are two-dimensionally (bivariate), normally distributed, the 95% prediction ellipses were calculated and plotted in a coordinate system. Such a prediction ellipse encloses the area in which a future pair of variable values may be expected to fall with 95% probability, provided that the observation is referable to the same population as that from which the present sample was taken (*Morrison*, 1967).

The following symbols for levels of significance are used:

N.S. $0.05<p$, not significant;
* $0.01<p\leq0.05$, almost significant;
** $0.001<p\leq0.01$, significant;
*** $p<0.001$, highly significant,

where p is the probability of incorrectly rejecting the null hypothesis. The numerical calculations were performed at the computer centre of the University of Umeå (CD 3200).

RESULTS

Younger children

In the younger group, *i.e.* children with an average age of 18 months, the mean of all the three successive recordings of mouth opening was 37.1 mm. For both boys and girls the means were lowest on the first occasion, higher on the second and highest on the third (Table I). The intra-individual differences were found to be between 0 and 7 mm between the different occasions. In all but two of the children, the largest individual values were recorded on the last occasion, for

Table I. *Mean values ($\bar{x}$), standard deviations (S.D.) and range of variation for the three recordings (I, II, III) of mouth opening and the other variables in the 1 1/2-year olds: in 19 boys, 14 girls and all 33 children*

Variable	Boys $\bar{x}$	S.D.	Range	Girls $\bar{x}$	S.D.	Range	All $\bar{x}$	S.D.	Range
Age, months	17.8	4.2	12 —25	19.0	3.2	14 —23	18.3	3.8	12 —25
Mouth opening I mm	36.3	3.2	31 —42	34.7	3.1	30 —43	35.6	3.2	30 —43
» » II mm	37.7	3.4	32 —43	37.1	2.5	33 —43	37.5	3.0	32 —43
» » III mm	38.6	2.9	32 —43	38.1	2.3	35 —44	38.4	2.7	32 —44
Body height, cm	77.0	5.9	71.0—87.0	81.8	2.8	78.0—85.0	79.0	5.3	71.0—83.0
Body weight, kg	11.1	1.4	8.0—13.5	11.7	1.2	9.5—14.0	11.3	1.3	8.0—14.0

which the mean value was 38.4 mm. The increase from one occasion to another was highly significant and was, on the average 2.8 mm, between the first and the third occasion (Table III).

On none of the 3 occasions did mouth opening differ significantly between the boys and the girls. Small numerical differences of at most 0.6 mm were found between the means for the boys and girls on the last two occasions. The inter-individual values for mouth opening varied between 30 and 44 mm. A significant correlation was found between body height and weight. These variables were also correlated with age but not with mouth opening.

Older children

Repeated measurements. In the 25 older children, with an average age of 6 years, the mean value for mouth opening was 44.4 mm for all the three occasions taken together and the mean of the recordings of maximal opening capacity was 45.2 mm. The means increased from the first occasion to the others.

Intra-individual differences ranged between 0 and 4 mm from one occasion to the next. In all but two of the children, the largest individual values were measured on the last occasion, for which the mean was 44.9 mm for mouth opening and 45.7 mm for maximal opening capacity (Table II). The increase between consecutive

Table II. *Mean values ($\bar{x}$) and standard deviations (S.D.) for the three recordings (I, II, III) of the different maximal mandibular movements in 25 6-year old children. Measurements in mm.*

Variable	I. $\bar{x}$	S.D.	II. $\bar{x}$	S.D.	III. $\bar{x}$	S.D.
Mouth opening	43.9	3.7	44.5	4.1	44.9	4.1
Maximal opening	44.7	3.2	45.3	3.6	45.7	3.6
Lateral movement, Right	7.6	0.9	7.8	0.8	7.8	0.8
Lateral movement, Left	7.6	1.0	7.7	0.8	7.8	0.7
Protrusion	7.2	0.7	7.3	1.0	7.3	0.9

Table III. *Mean values of differences and level of significance between three recordings (I, II, III) of the different maximal mandibular movements in 33 1 ½-year old and 25 6-year old children*

	Variable	I—II	I—III	II—III
1 ½-Years	Mouth opening	—1.8***	—2.8***	—0.9***
6-Years	Mouth opening	—0.6*	—1.0**	—0.4**
	Maximal opening	—0.6*	—1.0***	—0.4**
	Lateral movement, Right	—0.2	—0.2	0.0
	Lateral movement, Left	—0.1	—0.2	0.0
	Protrusion	—0.1	—0.1	0.0

occasions was significant and was on the average 1.0 mm between the first and last occasion (Table III).

The means of the various horizontal movements between the three occasions ranged from 7.2 to 7.8 mm. The largest difference of any of the movements between the occasions was, on the average, 0.2 mm. The small mean increases, which occurred only in comparisons with the first of the three recordings were not significant for any of the horizontal movements.

Mobility of the mandible. The mean value found for maximal opening capacity of all the 150 children in the 6-year old group was 44.8 mm (Table IV, Fig. 3). The extreme values for the maximal vertical movements were 33 and 60 mm. The mean vertical overbite for both boys and girls was 0.6 mm with a range of — 6 to 5 mm (Table IV).

The magnitudes of the various mandibular movements in the horizontal plane were very uniform and the mean of each of them was approximately 8 mm (Table IV). The lowest and highest recordings in the horizontal plane were 5 and 13 mm. None of the means of the horizontal movements nor those of the vertical move-

Table IV. *Mean values, standard deviations and range of variation of the maximal mandibular movements recorded in 6-year olds: in 75 boys, 75 girls and all 150 children. Measurements were made of body height and body weight of 35 boys and 35 girls*

Variable	Boys $\bar{x}$	S.D.	Range	Girls $\bar{x}$	S.D.	Range	All $\bar{x}$	S.D.	Range
Mouth opening, mm	43.8	4.1	32— 55	44.5	4.3	34— 56	44.2	4.2	32— 56
Overbite, mm	0.6	1.8	(-4)— 3	0.6	1.7	(-6)— 5	0.6	1.7	(-6)— 5
Maximal opening, mm	44.3	4.1	33— 58	45.2	4.4	36— 60	44.8	4.3	33— 60
Lateral movement, Right, mm	8.4	1.3	6— 13	8.0	1.2	5— 11	8.2	1.3	5— 13
Lateral movement, Left, mm	8.5	1.2	6— 12	8.1	1.2	6— 10	8.3	1.2	6— 12
Protrusion, mm	8.1	1.2	6— 12	7.9	1.1	5— 11	8.0	1.1	5— 12
Body height, cm	114.0	5.1	103—123	112.6	5.3	101—124	113.3	5.3	101—124
Body weight, kg	19.0	5.8	16— 26	19.2	5.0	16— 26	19.1	5.4	16— 26

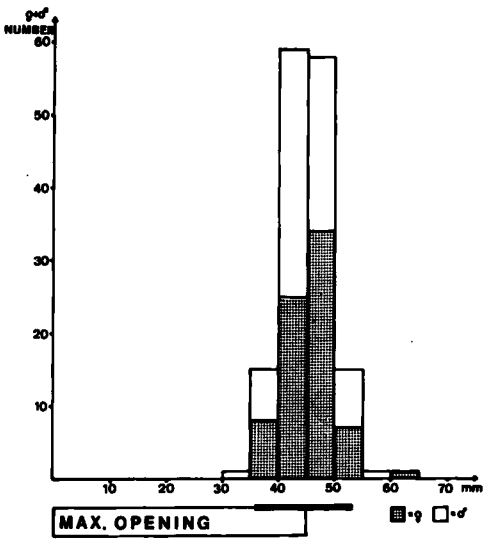


Fig. 3. The distribution of maximal opening in 150 6-year old children (75 boys and 75 girls). The mean value for maximal opening ±2 standard deviations are represented by the horizontal bar and bold line below the figure.

ment differed significantly between the sexes.

Correlation analysis. All the mandibular movements proved to be significantly positively correlated with one another in the 6-year old group as a whole as well as for the boys and the girls separately. The coefficients of correlation were of practically the same magnitude in each sex and in the material as a whole, for which reason only the coefficients for the material as a whole are given (Table V).

Plottings of the correlations between two horizontal movements and maximal opening are given in Figs. 5a, b. The 95% prediction ellipses for maximal horizontal and vertical range of movement were calculated for boys and girls together and are presented in Fig. 6 (See statistical methods).

The vertical overbite was significantly correlated with maximal opening for the material as a whole (r=0.22).

The means and standard deviations found for body height and body weight were similar for each sex (Table IV). The correlations between body height and weight were significant in the material as a whole as well as for boys, but not significant for girls (Table VI). For both sexes together the correlations between body height, and both the horizontal mandibular movements and mouth opening, were almost significant. Body weight was not significantly correlated with any of the mandibular movements.

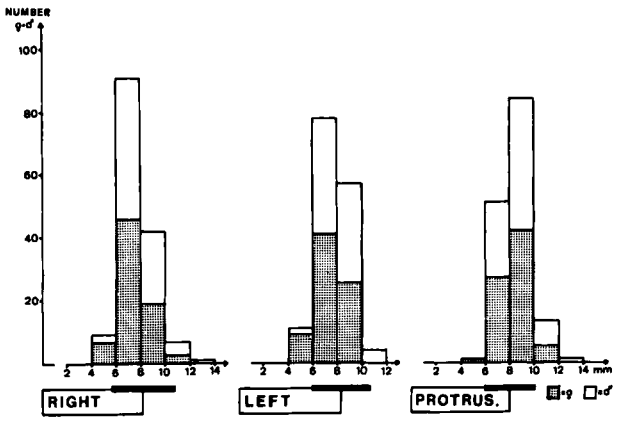
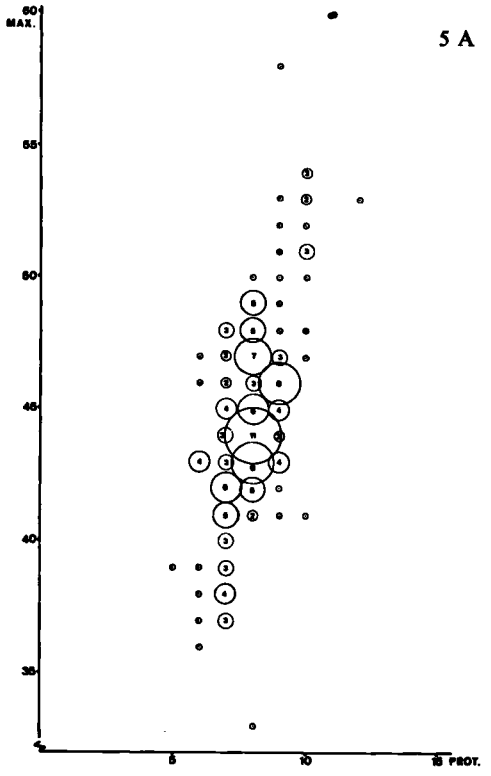


Fig. 4. Distribution of the three maximal horizontal movements in 150 6-year old children (75 boys and 75 girls). The mean values for each movement ±2 standard deviations are represented by the horizontal bar and bold line below the figure.



5 A Fig. 5. A. A plot of the pairs of variable values for maximal opening and protrusion in 150 6-year old children. The area of each circle and the number within it denote the frequency of the pair of observations.

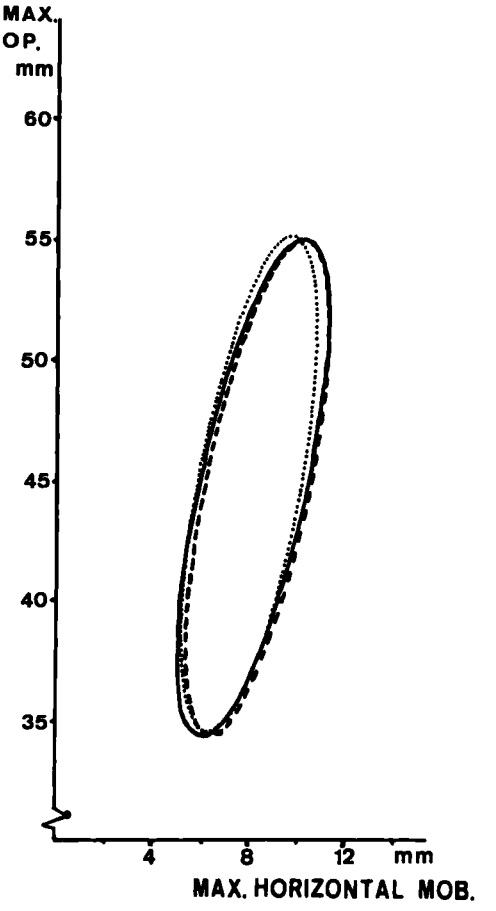
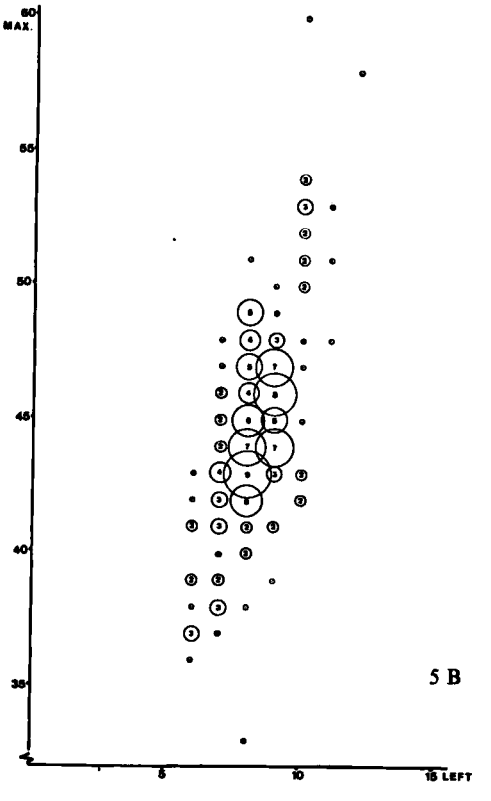


Fig. 6. The 95% prediction ellipses for maximal vertical and horizontal mobility in healthy 6-year old children. A future pair of observations of maximal opening and lateral movement to the right (—), to the left (— — —) and protrusion (. . . . .) will with 95% probability fall within these ellipses.



5 B Fig. 5. B. A plot of the pairs of variable values for maximal opening and lateral movement to the left in 150 6-year old children. The size of each circle and the number within it denote the frequency of the pair of observations.

Table V. *Coefficients of correlation between the different maximal mandibular movements in all the 150 6-year old children*

Variable	Mouth opening	Overbite	Maximal opening	Lateral movement Right	Left
Overbite	—0.19*				
Maximal opening	0.92***	0.22**			
Lateral movement, Right	0.65***	0.08	0.67***		
Lateral movement, Left	0.66***	0.02	0.66***	0.79***	
Protrusion	0.63***	0.00	0.63***	0.76***	0.76***

$r \geq 0.16 = *$ ($p \geq 0.05$); $r \geq 0.21 = **$ ($p < 0.01$); $r \geq 0.27 = ***$ ($p < 0.001$)

DISCUSSION

Recording of mouth opening in small children by measuring the interincisal distance during maximal opening of the mouth using the method described previously by the author (1967, 1971, 1974a) proved difficult because some of the children refused to open the mouth, and it was doubtful if those who did cooperate really opened as wide as they could. To reduce these sources of errors an indirect method was used in which the children bit 3 areas of half of an apple (Figs. 1, 2). Since the vertical overbite was not measured the recordings made were submaximal. No attempt was made to record maximal movement in the horizontal plane because of the difficulties in getting small children to perform such movements.

No investigations are available on maximal or mouth opening in children of such low ages. The mean values found for mouth opening increased from one occasion to the next and the best agreement was found between recordings II and III, with means of 37.5 and 38.4 mm,

Table VI. *Coefficients of correlation between the different maximal mandibular movements and body height and body weight in 6-year olds: in 35 boys, 35 girls and all the 70 children*

Variable		Mouth opening	Overbite	Maximal opening	Lateral movement Right	Left	Protrusion	Body height
Body height								
	boys	0.07	0.05	0.09	0.20	0.12	0.24	
	girls	0.48**	—0.30	0.41*	0.32	0.32	0.26	
	all	0.27*	—0.13	0.22	0.27*	0.25*	0.25*	
Body weight								
	boys	0.18	0.28	0.29	0.32	0.12	0.28	0.56***
	girls	—0.02	0.03	—0.01	—0.03	—0.04	—0.03	0.27
	all	0.08	0.18	0.14	0.14	0.04	0.12	0.42***

Boys, girls: $r \geq 0.35 = *$ ($p \leq 0.05$); $r \geq 0.45 = **$ ($p \leq 0.01$); $r \geq 0.55 = ***$ ($p \leq 0.001$)
All: $r \geq 0.23 = *$ ($p \leq 0.05$); $r \geq 0.30 = **$ ($p \leq 0.01$); $r \geq 0.38 = ***$ ($p \leq 0.001$)

respectively (Table I). Because the first 2 recordings were significantly lower than the third, and an intra-individual increase was as high as 7 mm, one should not be content with only single or even duplicate measurements of mouth opening in children as young as 1—2 years of age (Table III). From a practical clinical point of view, mouth opening must be recorded several times.

In young children no difference between the sexes was demonstrable in the range of movement in the vertical plane and no correlation was found between mouth opening and body height or weight.

The inter-individual differences in mouth opening were also large even in small children and were as much as 13 mm on one occasion. Due to the limited size of the sample and the differences between the values found from one occasion to another, it is difficult to set a lower limit of the normal range of mouth opening for small children. If a deviation of — 2 S.D. from the mean of the three recordings (37.1 mm) be taken as a lower limit for normal variation, the limit would be 31 mm. At this age opening of the mouth should normally not be less than 30 mm.

In the 6-year old children all of the maximal active movements of the mandible were recorded with good reproducibility using the simple clinical methods described previously by the author (*Agerberg* 1967, 1971, 1974a).

Ingervall (1970), who successfully used this recording method on 10-year old children and on adults, measured only the opening capacity in 7-year old children »because the other recordings could not be performed satisfactorily in such young children.» Judging from the results of the three recordings of horizontal movements in the present investigation, however, these movements could be performed both satisfactorily and with good reproducibility in 6-year olds. In none of the comparisons between the 3 recordings were there significant systematic differences (Table III).

The increase in the means found for mandibular movements in the vertical plane from one recording to the next were lower in 6-year old children than in the small children. The largest increases between the first and third recordings in the two age groups were 1.0 and 2.8 mm, respectively (Table III). However, as the increase between the recordings was significant also in the 6-year old children, single recordings are evidently not sufficient in this age group either.

The mean value found for maximal opening for all of the 6-year old children in the investigation was 44.8 mm (Table IV, Fig. 3). This value agrees well with the values, 46.0 and 46.2 mm, given by *Nevakari* (1960) and *Sheppard & Sheppard* (1965), respectively, for the interincisal distance in children, aged 6—10 years, and the value of 46.4 mm given by *Ingervall* (1970) for opening capacity in 7-year old children. The small differences between the means can probably be explained by the slightly higher age of the children in these investigations. That the differences were not larger was probably due to the minimal size of the overbite in children of this age, 0.6 mm, which would cause the means found for maximal opening and mouth opening to be very similar. Owing to the range of variation of vertical overbite, however, it appears desirable to include the entire movement in the analysis of vertical movements of the mandible.

An increase in mouth opening similar to that reported by *Nevakari* (1960) between 6—8-year olds and adults was found for 1½-year old and 6-year old children.

The mean values found for mouth opening in the two age groups studies, 38,4 for 1½-year old children and 44.2 mm for 6-year old children differed highly significantly ($p<0.001$). The mean found by *Sheppard & Sheppard* (1960) in 3- to 5-year old children, 42.4 mm, lies between those calculated for the younger and the older children in the present investigation. The mean values found for maximal opening in both 1½-year old and 6-year old children are thus remarkably large and are only about 17 and 11 mm, respectively, smaller than that found in 20-year old persons (*Agerberg*, 1967, 1971, 1974a).

The difference in vertical movements of the mandible between the sexes in the above mentioned investigation of adults was not demonstrable in the present groups of children. This implies that the maximal opening in 6-year old girls, was, on the average, 85% of that in adults. The corresponding value for the boys was 75%. This difference between the sexes may be explained by the fact that, in the 6-year old children, mouth opening was correlated with other body dimensions and, at 6 years of age the girls are 5% to 8% more advanced in their development toward maximum height and weight. Of the 1½-year old children the mouth opening in the girls was 75% of that of adults. The corresponding value for the boys was 70%. In the 6-year old children mouth opening ranged between 32 and 56 mm and was similar to the ranges in the 3 above-mentioned investigations on children where the values were 35—54, 37—53 and 37—57, respectively. If vertical overbite also be included, the range of variation for maximal opening will be still wider, *i.e.* 33—60 mm. The numerical values of the range and the standard deviation are, however, somewhat smaller for children than for adults, as in Ingervall's study.

The horizontal movements of the mandible, which have never before been studied in children below 10 years, were all of the same magnitude or about 8 mm (Table IV, Fig. 4). These mean values were lower than those in adults by only 1 mm. As in adults, no differences between the sexes could be demonstrated in the horizontal movements in these children. The horizontal ranges of mandibular movements in 6-year old children were 87% of those in 20-year old persons. The ranges of variation of the individual mandibular movements to the right and to the left as well as protrusion were wide, and extreme values of 5—13 mm were recorded. These variations were almost of the same order as those previously found in adults. (*Agerberg* 1974a, d).

In view of the wide range of variation of individual mandibular movements, it is difficult to set normal ranges. If the ranges of vertical and horizontal movements be regarded separately and if a deviation of — 2 S.D. be taken as a lower limit for normal variation, one might regard maximal opening for 6-year old boys and girls to be normal if it is at least 36 mm, and protrusion and lateral movement if they are at least 6 mm. The statistical analysis showed that in healthy children these movements at most rarely fall below these values.

Both in the boys and in the girls highly significant correlations were found between the various maximal horizontal movements (Table V). The correlation coefficients were similar to those in adults and teen-agers (*Agerberg* 1974a and c). The correlations between vertical and horizontal movements were also highly significant in children. Due to these correlations between mandibular movements,

impairment of mobility could be detected with a higher degree of certainty if comparisons are primarily made with the other movements of the mandible.

In order to assess the sizes of mandibular movements and their relations to each other as well as of their distributions within the material, each of the horizontal movements was plotted against maximal opening. As movement to the right and movement to the left gave practically identical results, only 2 of these relationships are shown in Figs. 5a and b. The 95% prediction ellipses were calculated and drawn for the areas within which the values for an observed pair of mandibular movements will fall if the range of mandibular movement in the individual examined is normal. The 95% prediction ellipses for pairs of variables, maximal opening and each of the horizontal movements (lateral movements and protrusion), for all the 6-year old children are presented in Fig. 6. The figure gives a good picture of the position and range of variation of the two variables as well as the correlation between them. With the aid of these ellipses it is easy to form an opinion of the range of movement of the mandible of a given 6-year old child in relation to that in the population by determining the position of the pairs of observations in the coordinate system. If clinical recordings for maximal opening and horizontal movements do not fall within the ellipses, an examination of the masticatory system for pathologic processes is indicated. If we regard the various movements in relation to one another, the lower limits for normal range of movement will be 35 mm for maximal opening and 5 mm for horizontal movements.

The means found for the two constitutional factors, height and weight, show good agreement not only between the sexes in this material but also on comparison with larger series of children in both age groups (*Broman, Dahlberg & Lichtenstein*, 1942; *Karlberg & Perman*, 1959). The highly significant correlation between these two factors in the boys as well as in the material as a whole (Table VI) agrees with the results of previous investigations in children and adults (*Lindegård*, 1953; *Agerberg*, 1967, 1974a). It is remarkable that this correlation was not significant in the girls, but this might be due to their greater constitutional variation.

Analysis of the various movements of the mandible and the constitutional variables in the material as a whole showed almost significant correlations with body height only. That correlations with the vertical movements were found only in the girls may perhaps be explained by constitutional factors. The correlations between body height and mandibular-movements are, however, obviously weak, as they are in adults (*Agerberg*, 1974a).

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