

The effect of sucking habits, cohort, sex, intercanine arch widths, and breast or bottle feeding on posterior crossbite in Norwegian and Swedish 3-year-old children

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The upper and lower intercanine arch widths and the prevalence of posterior crossbite were registered for 445 3-year-old children with and without a continuing or previous dummy-sucking or finger-sucking habit in different areas in Sweden and Norway. Sami children from northern Norway also took part in the study, as well as 15 medieval skulls with intact deciduous dentitions. Compared with the nonsuckers, an increased prevalence of posterior crossbite was observed for the finger suckers, especially the Swedish girls. Stepwise logistic regression showed that posterior crossbite could be predicted with upper intercanine arch width alone. The finger sucking variable would not improve prediction; neither did other entities such as cohort (residential area), sex, lower intercanine arch width, nor the difference between upper and lower intercanine arch width. High prevalences of posterior crossbite were registered for dummy suckers (pacifiers) especially the Swedish girls (26%). Stepwise logistic regression showed that posterior crossbite in dummy suckers could be predicted with upper and lower intercanine arch width. Stepwise linear regression showed that both arches tended to be narrower in Swedes and girls, and that dummy sucking decreased the upper and increased the lower intercanine arch width. Analyses of covariance revealed that at least 2 years of dummy sucking is necessary to produce a significant effect in the upper jaw and 3 years in the lower jaw. (AM J ORTHOD DENTOFAC ORTHOP 1994;106:161-6.)

An increased prevalence of posterior crossbite in children who wear dummies (pacifiers) compared with those who did not has been reported by several authors.¹⁻⁴ Also finger sucking seems to affect the transverse development of the jaws but to a lesser degree.^{1,5} Variables with possible influence on posterior crossbite have not been subjected to more comprehensive studies. The present study was designed to examine the effect of transverse position of the deciduous canines, children's sucking behavior, and residence in Norway and Sweden on the development of posterior crossbite. Also the child's sex and whether the child was brought up by breast or bottle were analyzed.

MATERIAL AND METHODS

The study group comprised all children with or without a previous dummy-sucking or finger-sucking habit born in

1986 and living mainly in the communities of Falköping (district dental center 1), Mullsjö, and Karlsborg in southwestern Sweden. A few children born in 1987 from the same areas also participated. Children born in 1987 in Lillehammer in the southeastern part of Norway, and Alta, Karasjok, and Kautokeino in northern Norway were also included. The children took part in the dental health inspection of the 3-year-olds during 1989 and 1990. The children in Karasjok and Kautokeino were selected so that at least one of each child's parents spoke the local language, Samish, as the native tongue. About half of these children moved annually with their families while herding reindeer from the valleys to the mountains. A total of 445 3-year-old children took part in the study, 250 children in Norway and 195 children in Sweden. The prevalence of sucking habits in these populations has been described in a previous article.⁶

The examinations were performed by hygienists and specially educated dental nurses. They all belonged to staffs who dealt with the normal dental health inspection of 3-year-old children and had been specially trained by the authors for these examinations. The present, as well as previous, sucking habits were recorded by questioning the parents. The presence of posterior crossbite was also recorded, as well as teeth involved in the crossbite.

The intercanine widths were measured between the cusp tips of the upper and lower arches. When the cusps were abraded, the intercanine widths were measured between the

The study was supported by a grant from The Swedish Research Council.

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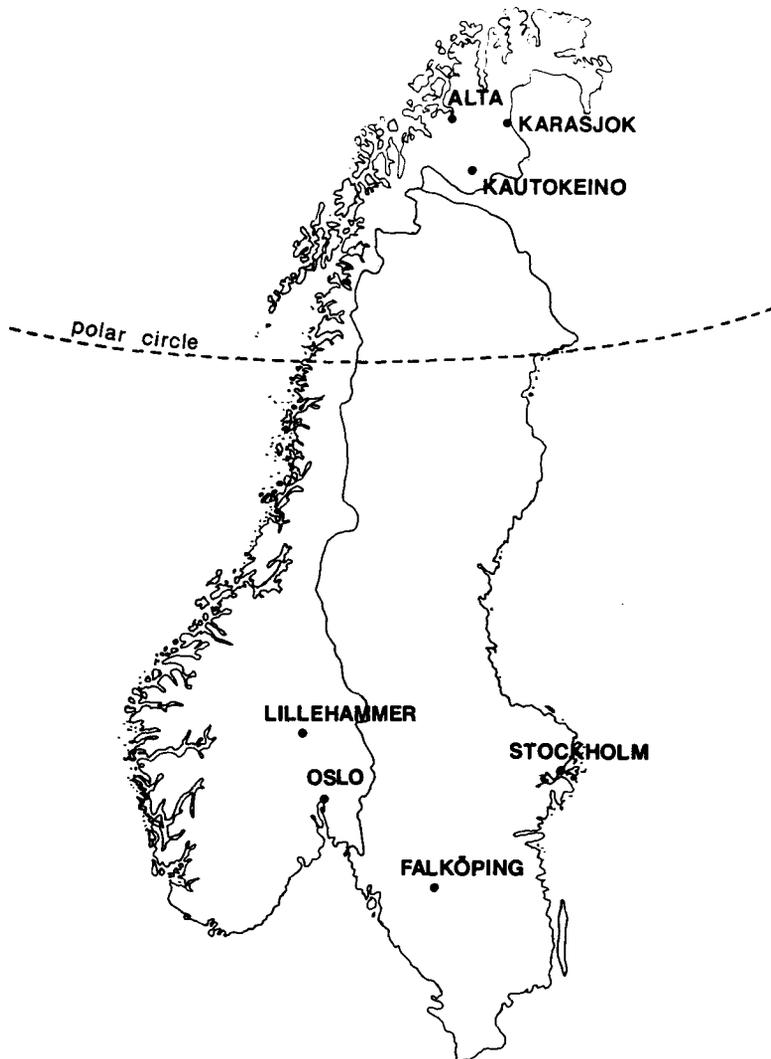


Fig. 1. Map showing areas where the studies were performed in Norway and Sweden.

center of the abraded surfaces. The measurements were recorded to the nearest 0.5 mm. For the Norwegian children, information about breast or bottle feeding was recorded by questioning the parents.

For comparison, intercanine arch widths in 15 medieval skulls from the Schreiner Collections, Anatomical Institute, Medical Faculty, University of Oslo, from a previous study were used.⁷ The skulls had been found in Scandinavia and were mainly from the period 1000 to 1500 AD. All the skulls exhibited intact deciduous dentitions. These children were most likely nonsuckers, as discussed by Larsson and Dahlin.⁸

The reliability of the measurements of the intercanine arch widths was assessed by double readings by the two of the investigators in 15 3-year-old children.

STATISTICAL ANALYSIS

The data for the reliability study were subjected to a paired *t* test. Data from the three Swedish communities were combined and designated "Falköping". Also the data from Karasjok and Kautokeino were combined. Crossbite was analyzed with logistic regression and intercanine arch width with regression and analysis of variance (ANOVA). The probabilities were corrected for multiple comparisons.

A bivariate correlation matrix was produced, and logistic and linear regression was used to describe sucking habits and their dependencies on sex and cohort. The material was then analyzed for finger and non-

Table I. Variables used in the present study

Variable	Type	Logistic regression	Linear regression
Posterior crossbite	Yes/no	Dependent	Not used
Upper intercanine arch width	Interval	Independent	Dependent
Lower intercanine arch width	Interval	Independent	Dependent
Difference between upper and lower intercanine arch width	Interval	Independent	Dependent
Cohort Swedish	Nominal yes/no	Independent	Independent
Sex	Nominal	Independent	Independent
Still finger sucking at 3 years	Yes/no	Independent	Independent
Number of years with dummy sucking	Interval	Independent	Independent

Table II. Percentage of crossbites at age 3 years in girls and boys who were dummy and finger sucking and nonsuckers. The figures within parentheses give the percentage for the girls and boys combined

	Kautokeino/Karasjok n = 56		Alta n = 69		Lillehammer n = 72		Falköping n = 146	
<i>Dummy suckers</i>								
Girls	14	(9)	10	(9)	0	(3)	26	(20)
Boys	0		0		9		15	
<i>Finger suckers</i>								
Girls	14	(11)	0	(0)	9	(7)	14	(13)
Boys	0		0		0		10	
<i>Nonsuckers</i>								
Girls	8	(3)	0	(3)	0	(0)	8	(7)
Boys	0		5		0		6	

suckers combined ($N = 199$) and for dummy and nonsuckers combined ($N = 374$).

Stepwise logistic regression was used with crossbite as the dependent variable. Stepwise linear regression was used with intercanine arch width as the dependent variable. ANOVA with t tests on corrected means were also applied.

Type and usage of variables are shown in Table I. Four Norwegian children with scissor-bites were excluded from some of the analyses, whereas two Norwegian children with dubious cohorts had to be excluded from all analyses. The cohort variable was recorded when needed to combine cohorts within or between Norway and Sweden. The BMDP statistics programs were run on a VAX 6330 mainframe.

RESULTS

No posterior crossbites were recorded for the skulls and very low prevalences for the nonsucking Norwegian children (Table II). A somewhat higher but not significant proportion was found for the Swedish children who were nonsuckers. For the children who continued dummy or finger sucking, higher prevalences were noted (Table II).

Of the posterior crossbites 90% involved canines. The crossbites (64%) were most often on the patients' right side. In the dummy suckers with posterior crossbite, 62 deciduous canines, 38 first deciduous molars, and 36 second deciduous molars were involved. In the finger suckers and nonsuckers with posterior crossbite, 26 deciduous canines, 20 first deciduous molars, and 18 second deciduous molars were involved.

Logistic regression showed that breast feeding or bottle feeding had no influence on development of posterior crossbite in the Norwegian children in any area ($p = 0.84$ and $p = 0.68$, respectively).

Nonsuckers

For both the Norwegian and the Swedish children, neither sex ($p = 0.85$) nor residential area ($p = 0.61$) were of importance for the development of posterior crossbite.

Neither upper nor lower intercanine arch widths were dependent of the gender ($p = 0.23$, $p = 0.25$). However, the Falköping children had significantly smaller upper intercanine arch widths than any of the Norwegian children or the skulls ($p = 0.020$) (Table III). Among the Norwegian children, there were no

Table III. The mean upper and lower intercanine arch widths and the mean difference between the upper and lower intercanine arch width (mm) in the nonsucking children and the skulls

Intercanine arch width	Skulls	Karasjok/Kautokeino	Alta	Lillehammer	Falköping	Significance probabilities*
53-63	29.1	29.6	29.3	28.9	27.1	F/A $p = 0.00$ F/L $p = 0.02$ F/K $p = 0.00$
73-83	<u>21.8</u>	<u>24.3</u>	<u>23.4</u>	<u>24.5</u>	<u>22.1</u>	F/S $p = 0.01$ F/A $p = 0.01$ F/L $p = 0.00$ F/K $p = 0.00$ S/L $p = 0.00$ S/K $p = 0.00$
Difference	7.3	5.4	5.9	4.4	5.0	S/A $p = 0.02$ S/L $p = 0.00$ S/A $p = 0.02$ A/L $p = 0.00$ S/K $p = 0.00$ S/F $p = 0.00$

*S = skulls; K = Karasjok/Kautokeino; A = Alta, L = Lillehammer, F = Falköping. Probabilities are corrected for multiple comparisons.

significant differences. The Falköping children and the skulls had the smallest lower intercanine arch widths ($p = 0.020$). The lower arch widths between the Falköping children and the skulls were not statistically significant ($p = 0.60$).

The differences between the upper and the lower intercanine arch widths are shown in Table III. The skulls had significantly larger differences than any other group ($p = 0.02$). The smallest difference was recorded for the Lillehammer and the Falköping children.

Finger and dummy suckers

Mean upper and lower intercanine arch widths are given in Table IV. From the correlation matrix (Table V), one can only read preliminary bivariate associations.

Logistic regression showed that finger sucking was found more frequently among girls ($p = 0.000$). Linear regression showed that duration of dummy sucking is longer among Swedish children ($p = 0.000$), independent of gender ($p = 0.14$).

Dummy suckers and finger suckers were studied separately together with nonsuckers. In the finger-sucking group, stepwise logistic regression showed that posterior crossbite could be predicted with upper intercanine arch width ($p = 0.008$) alone. The finger-sucking variable would not improve prediction, neither would cohort, sex, lower intercanine arch width, or difference between upper and lower intercanine arch width.

Stepwise linear regression showed that the upper intercanine arch width tended to be narrower in Swedish

children ($p = 0.000$). Finger sucking did not help to predict the upper arch width. On the other hand, finger sucking ($p = 0.01$) and girls ($p = 0.02$), but not cohort diminished the difference between upper and lower intercanine arch width.

When the effect of dummy sucking was analyzed, stepwise logistic regression showed that posterior crossbite could be predicted with upper ($p = 0.000$) and lower ($p = 0.03$) intercanine arch width. No other variables improved the prediction. However, the difference between upper and lower intercanine arch width could be used equally as well as predictor number 2.

Stepwise linear regression revealed that both arches tended to be narrower in Swedes and girls and that dummy sucking decreased the upper and increased the lower intercanine arch width.

Analyses of covariance showed that at least 2 years of dummy sucking is necessary to produce significant effect in the upper jaw and 3 years in the lower jaw.

DISCUSSION

It has been suggested that breast feeding is superior to bottle feeding as far as development of the occlusion is concerned.^{9,10} In the present study, breast or bottle feeding recorded in the Norwegian children had no influence of the development of posterior crossbite. However, it should be kept in mind that the frequency and duration of breast feeding in these populations is extremely low compared with the situation among so-called primitive people (Silow 1988, personal communication).

Table IV. Mean upper and lower intercanine arch width (mm)

Intercanine arch width	Sex	Karasjok/Kautokeino	Alta	Lillehammer	Falköping
Dummy suckers	Girls	27.3	28.1	28.0	25.2
	Boys	29.5	29.1	28.7	26.7
73-83	Girls	24.1	23.4	24.2	22.4
	Boys	24.0	24.4	24.8	23.5
Finger suckers	Girls	29.4	27.3	27.6	25.7
	Boys	30.5	30.4	28.5	29.0
53-63	Girls	25.7	22.3	23.5	22.2
	Boys	22.5	25.0	24.5	22.5

Table V. Pair correlation matrix

		Finger sucking	Swedish	Girl	Dummy sucking	Crossbite	Upper intercanine arch width
Finger sucking	1	1.0000					
Swedish	2	0.3129	1.0000				
Girl	3	0.2445	0.0388	1.0000			
Dummy sucking	4	0.0000	0.2713	0.0749	1.0000		
Crossbite	5	0.0953	0.2040	0.0800	0.1520	1.0000	
Upper intercanine arch width	6	-0.2805	-0.5133	-0.2167	-0.3198	-0.3484	1.0000
Lower intercanine arch width	7	-0.1135	-0.4263	-0.1366	-0.0383	-0.1090	0.6158

The low prevalence of posterior crossbite registered in young nonsuckers is in accordance with the figures given in the literature.¹⁻⁴ However, it should be pointed out that among the Falköping children, 7% exhibited posterior crossbite. This is a notable increase, compared with the 2.6% 4-year-old nonsucking children who had crossbite according to a study 18 years ago from the same area by Larsson.¹ In another Swedish study, none of the nonsuckers had developed a posterior crossbite by the age of four years.² However, the number of posterior crossbites is so low that one can only speculate whether this malocclusion is increasing among Swedish nonsuckers or not.

Finger sucking

The main purpose of this study was to define factors of importance for the development of posterior crossbite, including finger sucking. By using logistic regression analysis, the most influential factor among the finger suckers was found to be the upper intercanine arch width (53 to 63). A reduction in this width was significantly correlated with an increased prevalence of posterior crossbite ($p = 0.008$).

An increased prevalence of posterior crossbite among finger suckers has been reported in a few studies.^{1,5} In this study, the Swedish children showed

a somewhat larger prevalence of posterior crossbite in relation to nonsucking children. This was not so obvious with the Norwegian children. In both countries, it also seems as if girls who are finger suckers are more prone to develop a posterior crossbite than boys. However, it was not possible to improve the prediction of crossbite by the variables finger sucking, sex, or country of origin. It should be noted that the Swedish children had narrower jaws than the Norwegian children, which could be of some importance in this context.

Dummy sucking

Many studies have recorded an increased prevalence of posterior crossbite in young dummy suckers compared with nonsuckers.¹⁻⁴ In this study, very high prevalences were registered for the Swedish children, especially the girls. However, the values for the Norwegian children do not seem to be above normal or are just slightly increased. One can only speculate on the reason for this, but the authors continue to compare Swedish and Norwegian children with respect to sucking intensity and duration, as well as eating and chewing habits.

Seventeen years ago, a study was carried out by Larsson¹ concerning the prevalence of posterior crossbite among 4-year-old Swedish dummy suckers. The

prevalence then registered was 13% compared with 20% in this study.

This high, clearly increased, prevalence of posterior crossbite among Swedish children who use pacifiers, especially girls, is a dental health problem that should be carefully considered.

The logistic regression analysis showed that the most influential factors for the development of a posterior crossbite among those who used pacifiers were the upper and lower intercanine arch width (or the difference between the upper and lower widths). The shorter the distance between 53 to 63, and the smaller the difference between the upper and the lower intercanine arch widths, the higher the risk was to develop a posterior crossbite.

These two most influential factors were themselves, significantly influenced by the duration of the habit in years, whether the child was Swedish, Norwegian, boy, or girl. As with finger suckers, girls who were dummy suckers have greater difficulty stopping the habit than boys,^{1,11} and one can speculate whether they also are more intensive suckers.

The longer the child had the dummy-sucking habit, the stronger the effect on the intercanine arch width. This effect is, of course, in the upper jaw a reduction in width. In the lower jaw, the duration of the dummy-sucking habit is significantly correlated with an expansion of the arch width in the canine area. These findings support a hypothesis previously put forward by Larsson: "The high prevalence of posterior crossbite in young dummy-suckers probably is due to an increased activity of the cheeks combined with a reduced lingual support for the deciduous upper molars and canines as the tongue is forced backward and downward by the teat. Perhaps also the low position of the tongue can widen the lower arch, and in this way contribute to a posterior crossbite in the deciduous dentition".¹¹

The observation that a dummy-sucking habit seems to change the position of the tongue so significantly that this affects the width both of the upper and the lower jaw should be of some interest in the discussion of the cause of malocclusions.

CONCLUSIONS

In nonsuckers, none of the tested variables had any significant influence on the development of posterior crossbite. Factors as inheritance, prenatal development, and mouthbreathing are more likely. However, dummy sucking is of great importance for the development of a posterior crossbite. The probable mechanism is that the sucking activity in the cheeks¹² combined with a reduced palatal support as the tongue takes

as lower position, decreases the upper intercanine arch width. The transversal disharmony among the jaws becomes worse as the low tongue position widens the lower arch in the canine area, resulting in a forced lateral guidance of the mandible to a posterior crossbite. Finger sucking seems to have some effect on the development of posterior crossbite. However, this effect is not clearly demonstrated in this article and is no doubt of less importance than that of dummy sucking.

We express our thanks to Annie Hallberg, Ingela Pettersson, and Elisabeth Johannson, of Falköping; Brita Carina Haetta, Kautokeino; Gudrun Kåven, Karasjok; Grete Bjørkeli, Alta; and Inger Rytterbakken, Lillehammer, for their help with the project, to Donna Pettersen for linguistic help with the manuscript, and to Dr. Marek Røsler for statistical analyses.

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