The Online
ANGLE ORTHODONTIST
An International Journal of Orthodontics and Dentofacial Orthopedics
78th Anniversary 1930-2008

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The Angle Orthodontist: **Vol. 76, No. 3, pp. 441–445.**

Dental Arch Diameters and Relationships to Oral Habits

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ABSTRACT

The objective was to analyze variations in dental arch width in relation to oral habits. Maxillary and mandibular intercanine and intermolar distance were determined in relation to certain oral habits in 1297 children (ages 3 to 6 years). After an oral examination, the parents of each child completed a questionnaire about oral habits, including the use of a dummy or a bottle (or both), finger sucking, mouth breathing, breast- or bottle-feeding, and duration of these habits. Data were subjected to statistical analysis by the chi-square test for qualitative variables and analysis of variance for quantitative variables with homogeneous variances. Statistical significance was $P < .05$. In general, the maxillary arch was larger than the mandibular arch with regard to both the intercanine and the intermolar distances and more significantly so in boys. In relation to age, a significant increase was found only for the mandibular intercanine distance ($P = .001$). When arch width was analyzed in relation to various oral habits, the maxillary intercanine distance was less in children who used a dummy, especially one of a round design ($P = .003$). The maxillary intercanine distance was also less in children who breathed through their mouth ($P = .002$). In most cases, dummy use and mouth breathing were associated with a reduction in the intercanine distance in the maxillary arch. A dummy habit leads to a reduction in maxillary arch width, and mouth breathing causes a reduction in the size of both arches.

KEY WORDS: Dental arch, Oral habits, Prekindergarten.

Accepted: June 2005. Submitted: April 2005

INTRODUCTION Return to TOC

It is widely believed that the deciduous dental arches are the starting point and basis for proper development of the permanent dental arches. In this sense, various oral habits have been suggested to contribute to faulty development of occlusions in the deciduous dentition, and this impaired occlusion can be carried forward to the permanent teeth. Warren et al[1] underlined that the duration of these habits in children should be shortened and suggested that parents be informed about the bad influence of these habits on the development of the dental arches. Kohler and Holst[2] also indicated that finger-sucking habits and dummies can lead to the development of impaired occlusions.

Fukata et al[3] described the bad effects of nonnutritive sucking on the deciduous dentition, and in 1987 Labbok and Hendershot[4] noted that breast-feeding protects against impaired occlusions. The world health authorities, gathering these and other data, advise breast-feeding as a usual habit to prevent alterations of the occlusion in the deciduous dentition.

Similarly, the size of the deciduous dental arches is potentially a crucial factor in determining correct tooth alignment. The space in the jaws created by growth and development allows the permanent molars to erupt correctly. The same space increase will not happen to the incisors, canines, and premolars. Their final position is largely determined by the space available as already defined by deciduous dentition.

Therefore, as part of a much wider epidemiological study of occlusion in the deciduous dentition, dental arch width and its possible variations were analyzed in relation to oral habits. This is the first report about habits and occlusion done in prekindergarten pupils in Seville that includes such a large sample of patients. This work focuses attention on the incidence of nonnutritive sucking habits in our population and the effects of the duration of these habits.

MATERIALS AND METHODS Return to TOC

From 195 schools in Seville that cater to preschool children, three were selected at random from each of the six Municipal Health Districts, one each for high, medium, and low socioeconomic levels.

In total, the sample consisted of 1297 children (719 girls and 578 boys), with a mean age of 4.7 ± 0.7 years.

All the children in the study met the inclusion criteria, which included ages 3 to 6 years inclusive, a student at one of the chosen schools, an examination by two investigators, all the normal number, size, and shape of teeth present, no major tooth destruction or reconstruction, parental completion of a questionnaire about the child's habits (Appendix 1), and no oral or systemic condition that might influence the results.

Three work teams were created for the purposes of conducting the study, each composed of a dentist and an assistant. To ensure consistency of criteria, the proposed process was carried out on patients attending the School of Dentistry before the study began.

Because of the large sample, the dental arches were measured directly in the mouth and did not use study models. Fine-pointed calipers, accurate to within 0.01 mm, were used to intraorally measure the arch widths. The intercanine distance was taken as the distance between the deciduous canine cusp tips or the estimated location if wear facets were present. The intermolar distance was taken as the distance between the mesiobuccal cusp tips of both second deciduous molars. Overjet and overbite were studied, but they are not part of this

study.

All data were analyzed using the chi-square test for qualitative variables and analysis of variance for quantitative variables with homogeneous variances. For nonhomogeneous variances, the nonparametric Kruskal-Wallis test was used. Statistical significance was taken to be $P < .05$.

RESULTS Return to TOC

The results obtained showed that the 1297 children examined had a mean maxillary intercanine distance of 27.48 ± 2.42 mm and a mean maxillary intermolar distance of 40.40 ± 2.96 mm. In the mandibular arch, the mean intercanine and intermolar distances were 22.70 ± 2.02 mm and 35.78 ± 2.61 mm, respectively. For both the maxillary and mandibular arches, the intercanine and intermolar distances were greater in boys than in girls, and these relationships were statistically highly significant (Table 1).

In most cases, the maxillary arch width hardly changed with age, whereas the mandibular arch gradually increased. The statistical significance of this relationship was greater for the mandibular arch, for both the intercanine ($P = .001$) and intermolar ($P = .003$) distances (Table 2).

Of the 1297 children examined, 82% (1063 children) had used or still used a dummy (Table 3a,b), and these children showed a reduction in the width of the maxillary arch. Although the reduction was small and possibly influenced by the big range, it was statistically significant both in the intercanine distance ($P = .003$) and in the intermolar distance ($P = .038$) (Table 3c).

The type of dummy used by 53% (693 children) was a round one, and 29% (370 children) used an orthodontic or flat dummy. When arch width was considered in relation to the type of dummy used, the intercanine and intermolar widths of the maxillary arch were smaller in children who used a round dummy than in those who used a flat or orthodontic dummy. However, this fact was statistically significant only for the intercanine distance ($P = .003$) (Table 4).

With regard to the duration of the habit, a significant difference was present for the maxillary intercanine distance only ($P = .03$).

Of the children examined 12% (152 children) habitually sucked their fingers. No significant differences in dental arch widths were seen between children with and without this habit.

Arch width was reduced in children who breathed through their mouths. However, oral breathing was established by only one question in the interview (Appendix 1) and by the placing of a mirror under the nose. This relationship was statistically significant only for the maxillary intercanine distance ($P = .002$) (Table 5).

No significant relationship was found between arch widths and whether or not, or for how long, children had been breast-fed (Table 6). It was observed that children who had used a bottle had a significant reduction in maxillary intermolar distance (Table 7), and as the duration of the habit increased, there was a nonuniform increase in mandibular intercanine width ($P = .001$).

DISCUSSION Return to TOC

The maxillary and mandibular intercanine diameters are close to those noted by De Nova et al.[5,6] They reported mean maxillary and mandibular intercanine diameters of 27.45 ± 1.95 mm and 22.16 ± 1.78 mm, respectively, for their sample compared with the results of this study, 27.48 ± 2.42 mm and 22.70 ± 2.02 mm. The maxillary and mandibular intermolar diameters (40.05 ± 2.30 mm and 34.49 ± 2.16 mm) are also similar, although the results of this study are somewhat higher (40.40 ± 2.96 mm and 35.78 ± 2.61 mm).

When the sample was divided by sex, de Nova's results are still similar to those found in this study although slightly lower. For boys, de Nova reported maxillary and mandibular intercanine diameters of 27.71 ± 1.86 mm and 22.17 ± 1.67 mm, respectively, whereas the results of this study were 28.01 ± 2.38 mm and 23.00 ± 2.12 mm. Similarly, the maxillary and mandibular intermolar diameter results obtained by de Nova were somewhat lower than those reported in this study: 40.52 ± 2.23 mm and 34.61 ± 2.11 mm, compared with 41.05 ± 2.92 mm and 36.24 ± 2.58 mm. In the girls group, our intercanine diameter results are similar to those reported by de Nova (27.05 ± 2.37 mm and 22.47 ± 1.89 mm compared with 27.15 ± 1.96 mm and 22.16 ± 1.90 mm as found by de Nova), whereas our intermolar diameters are somewhat greater (39.88 ± 2.89 mm and 35.42 ± 2.57 mm) than those reported by de Nova (39.54 ± 2.30 mm and 34.36 ± 2.21 mm).

Maxillary intermolar and intercanine distances are greater than the corresponding mandibular values. Boys have highly statistically significant larger dental arches than girls.

The results of this study are closer to those obtained by Knott[7] and almost the same as those reported by Foster et al,[8] with a maxillary canine distance of 27.85 mm in girls and 27.97 mm in boys, compared with 27.05 mm in girls and 28.01 mm in boys in this study. Maxillary intermolar diameters differ, however. These differences in the various measurements may be due to the different methodology used.

This study is consistent with work by authors such as Woods,[9] Foster et al,[8] Knott,[7] and Beltri et al,[10] in which males have wider arches than females, in contrast to the findings of Lavelle et al.[11]

This study thus confirms other authors' earlier findings, ie, various oral habits encourage the development of impaired occlusion of the deciduous dentition and this is more marked when the habit persists for longer than 3 years.

Similar to Zardetto et al,[12] we believe that dummy use may lead to a reduction in the maxillary intercanine distance, the severity of which may be related to the duration of the habit. According to Larsson[13,14] and Ogaard et al,[15] prolonged dummy use leads to a reduction in the maxillary intercanine distances and an increase in the mandibular intercanine distances because of the low position of the tongue during sucking. This is, of course, a highly significant factor in the development of posterior crossbites.

The reduction in maxillary intercanine width in children with a dummy in this study agrees with Bowden[16] and Larsson,[13,14] whereas the measurements in the mandibular arch were practically unchanged. Warren et al[1,17] associated dummy use and finger sucking with an increased prevalence of anterior open bite and a reduction in overbite. In particular, dummy use is associated with open bite, posterior crossbite, increased mandibular arch width, and increased palatal depth. Finger sucking is associated with open bite, increased overjet, and reduced maxillary arch width.

The results of this study confirm the findings of Warren et al[18] with regard to habit duration. This means that even children with a short-term habit (12 months) have detectable differences in the above parameters. It is from 24 months onward that there is an increased risk of developing posterior crossbite (with an increase in the mandibular intercanine width) and overjet becomes more pronounced. Therefore, similar to Larsson,[14] we advise breaking the habit between the second and third year of life. If necessary, orofacial myofunctional therapy should be used to counteract the adverse effect of such habits.

CONCLUSIONS Return to TOC

- In most cases, the dummy habits lead to a reduction in maxillary arch width, particularly in the region of the canines.

- In children who used a round dummy, maxillary intercanine and intermolar widths were smaller than in children who used a dummy of flat or orthodontic design.
- The finger-sucking habit, with increasing habit duration, was associated with an increase in mandibular intermolar distances.
- Breathing through the mouth appeared to be associated with a reduction in the size of both arches. This was more significant in the maxillary intercanine distance.
- Therefore, to prevent malocclusions in the deciduous dentition, the public should be informed of the harm caused by certain oral habits, the benefits of breast-feeding, and the need to correct bad habits between the second and third year of life.

REFERENCES Return to TOC

1. Warren J, Bishara S, Steinbock K, Yonezu T, Nowak A. Effects of oral habits' duration on dental characteristics in the primary dentition. *J Am Dent Assoc.* 2001; 132:1685–1693. [PubMed Citation]

2. Kohler L, Holst K. Malocclusion and sucking habits of four years old children. *Acta Paediatr Scand.* 1973; 62:373–379.

3. Fukata O, Braham RL, Yokoi K, Kurosu K. Damage to the primary dentition from thumb and finger (digit) sucking. *ASDC J Dent Child.* 1996; 63:403–407.

4. Labbok MH, Hendershot GE. Does breast feeding protect against malocclusion? An analysis of the 1981 Child Health Supplement to National Health Interview Survey. *Am J Prev Med.* 1987; 3:227–232. [PubMed Citation]

5. De Nova MJ, Barbería E, Bartolomé B, Costa F, De Prado de la Torre R. Contribución al estudio de las arcadas dentarias temporales en niños españoles. I. Arcada mandibular. *Odontología pediátrica.* 1995; 4:3111–119.

6. De Nova MJ, Barbería E, Bartolomé B, Mourrelle R, Beltri P, Echaniz R. Contribución al estudio de las arcadas dentarias temporales en niños españoles. II. Arcada maxilar. *Odontología Pediátrica.* 1995; 4:3121–127.

7. Knott VB. Longitudinal study of dental arch widths at four stages of dentition. *Angle Orthod.* 1972; 42:387–394. [PubMed Citation]

8. Foster TD, Hamilton MC, Lavelle CL. Dentition and dental arch dimensions in British children at the age of 2.5–3 years. *Arch Oral Biol.* 1969; 14:1031–1040. [PubMed Citation]

9. Woods GA. Changes in width dimensions between certain teeth and facial points during human growth. *Am J Orthod.* 1950; 36:676–700. [PubMed Citation]

10. Beltri P, Barbería E, Costa F, Mourelle R. Diferencias sexuales en la anchura de las arcadas dentales. *Odontología pediátrica.* 1995; 4:111–14.

11. Lavelle CL, Flinn RM, Foster TD, Hamilton MC. An analysis into age changes of the human dental arch by multivariate technique. *Am J Phys Anthropol.* 1970; 33:403–411.

12. Zardetto C, Rodrigues C, Stefani F. Effects of different pacifiers on the primary dentition and oral myofunctional structures of preschool children. *Pediatr Dent.* 2002; 24:6552–560. [PubMed Citation]

13. Larsson E. Artificial sucking habits: etiology, prevalence and effect on occlusion. *Int J Orofacial Myology.* 1994; 20:10–26. [PubMed Citation]

14. Larsson E. Sucking, chewing, and feeding habits and the development of crossbite: a longitudinal study of girls from birth to 3 years of age. *Angle Orthod.* 2001; 71:2116–119. [PubMed Citation]

15. Ogaard B, Larsson E, Lindsten R. 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. *Am J Orthod Dentofacial Orthop.* 1994; 106:161–166. [PubMed Citation]

16. Bowden BD. The effects of digital and dummy sucking on arch widths, overbite, and overjet: a longitudinal study. *Aust Dent J.* 1996; 11:396–404.

17. Warren J, Bishara S, Steinbock K, Yonezu T, Nowak A. Effects of oral habits' duration on dental characteristics in the primary dentition. *J Am Dent Assoc.* 2001; 132:1685–1693. [PubMed Citation]

18. Warren J, Levy S, Nowak A, Tang S. Nonnutritive sucking behaviors in preschool children: a longitudinal study. *Pediatr Dent.* 2000; 22:3187–191. [PubMed Citation]

APPENDIX 1 Return to TOC

Teaching Unit of Chidrens' Dentistry and Integrated Orthodontics

Interview to be filled in by pupils' parents.

Name and last name of pupil _____

Age _____ Date of birth _____

Father's name _____ job _____

Mother's name _____ job _____

Address _____

_____

Previous dental impaired occlusions in parents

Father: kind of impaired occlusion: _____
corrected _____

Mother: kind of impaired occlusion: _____
corrected _____

Was there any problem during pregnancy or birth?

_____

What kind of illness or surgery has the child had?

_____

Was the child breast-fed? _____
For how long? _____

Did the child use dummy? _____
For how long? _____

What kind of dummy? Round __ Anatomic __ Both __

How long was the child bottle fed? _____

Did the child suck his/her finger? _____
For how long? _____

Does the child sleep with the mouth open? _____
Does the child snore? _____

Please tell how many brothers he/she has and the order he/she has among them. _____

Any other observations? _____

TABLES Return to TOC

TABLE 1. Relationship Between Arch Width and Sex

Measurement	Upper Intercanine	Upper Intermolar	Lower Intercanine	Lower Intermolar
Boys	28.01 ± 2.38	41.05 ± 2.92	23.00 ± 2.12	36.24 ± 2.58
Girls	27.05 ± 2.37	39.88 ± 2.89	22.47 ± 1.89	35.42 ± 2.57
P value	*P* = .000	*P* = .000	*P* = .000	*P* = .000

TABLE 2. Relationship Between Arch Width and Age

Age (y)	Upper Intercanine	Upper Intermolar	Lower Intercanine	Lower Intermolar
Three	27.51 ± 2.14	40.41 ± 2.69	22.87 ± 2.06	35.11 ± 2.35
Four	27.29 ± 2.40	40.11 ± 2.78	22.41 ± 1.88	35.58 ± 2.34
Five	27.52 ± 2.44	40.49 ± 3.10	22.82 ± 1.99	35.93 ± 2.75
Six	27.85 ± 2.44	40.93 ± 2.84	23.06 ± 2.40	36.04 ± 2.76
P value	*P* = .095	*P* = .020	*P* = .001	*P* = .003

TABLE 3a. Relationship Between Arch Width and Dummy Habit

Measurement	Upper Intercanine	Upper Intermolar	Lower Intercanine	Lower Intermolar
Used a dummy	27.38 ± 2.42	40.32 ± 3.03	22.72 ± 2.02	35.84 ± 2.62
Did not use a dummy	27.91 ± 2.37	40.77 ± 2.59	22.63 ± 1.97	35.54 ± 2.53
P value	*P* = .003	*P* = .038	*P* = .528	*P* = .111

TABLE 3b. Relationship Between Dummy Habit and Age

Age (y)	Yes Dummy	No Dummy	Total
Three	15	34	49
Four	83	381	464
Five	114	525	639
Six	22	123	145
Total	234	1063	1297

TABLE 3c. Relationship Between Dummy Habit and Sex

	Boys	Girls	Total
Used dummy	472 (81.87%)	591 (82.2%)	1063 (82.0%)
Never used dummy	106 (18.3%)	128 (17.8%)	234 (18.0%)
Total	578	719	1297

TABLE 4. Relationship Between Arch Width and Dummy Type

Measurement	Upper Intercanine	Upper Intermolar	Lower Intercanine	Lower Intermolar
Othodontic	27.51 ± 2.14	40.41 ± 2.69	22.87 ± 2.06	35.11 ± 2.35
Round	27.29 ± 2.40	40.11 ± 2.78	22.41 ± 1.88	35.58 ± 2.34
No dummy	27.52 ± 2.44	40.49 ± 3.10	22.82 ± 1.99	35.93 ± 2.75
P value	*P* = .003	*P* = .066	*P* = .648	*P* = .519

TABLE 5. Relationship Between Arch Width and Mouth Breathing

Measurement	Upper Intercanine	Upper Intermolar	Lower Intercanine	Lower Intermolar
Mouth breathing	27.08 ± 2.55	40.80 ± 3.89	22.77 ± 2.55	36.53 ± 4.26
Mixed breathing	26.96 ± 2.77	40.21 ± 3.18	22.71 ± 1.95	35.86 ± 2.54
Nasal breathing	27.66 ± 2.27	40.44 ± 2.81	22.70 ± 2.00	35.72 ± 2.49
P value	*P* = .000040	*P* = .660711	*P* = .961073	*P* = .263899

TABLE 6. Relationship Between Arch Width and Breast-feeding

Measurement	Upper Intercanine	Upper Intermolar	Lower Intercanine	Lower Intermolar
Breast-fed	27.45 ± 2.41	40.43 ± 2.83	22.74 ± 2.05	35.83 ± 2.62
Not breast-fed	27.59 ± 2.48	40.28 ± 3.44	22.56 ± 1.84	35.59 ± 2.52
P value	*P* = .577773	*P* = .575966	*P* = .204505	*P* = .185168

TABLE 7. Relationship Between Arch Width and Bottle Use

Measurement	Upper Intercanine	Upper Intermolar	Lower Intercanine	Lower Intermolar
Used a bottle	27.45 ± 2.40	40.34 ± 2.98	22.69 ± 1.99	35.82 ± 2.55
Did not use a bottle	27.75 ± 2.57	40.88 ± 2.68	22.79 ± 2.22	35.52 ± 3.04
P value	*P* = .164128	*P* = .043733	*P* = .624707	*P* = .320622

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