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Influence of feeding and non-nutritive sucking methods on the development of the dental arches: longitudinal study of the first 18 months of life

Samir E. Bishara, BDS, DDS, DOrtho, MS Arthur J. Nowak, DMD
Frank J. Kohout, MA, PhD D. Alex Heckert, MA
Mary M. Hogan, BA

Abstract

The purpose of this study is to examine various maxillary and mandibular dental arch parameters in 122 infants over an 18-month period. The subjects were grouped according to their feeding and sucking method as follows: 1. breast fed, 2. breast fed and functional exerciser, 3. functional nipple and exerciser, 4. conventional nipple, 5. conventional nipple and pacifier, and 6. residual group. The choice of the type of feeding, nipple, pacifier or exerciser was left totally to the parents.

Absolute and percentage changes in each dental arch parameter were calculated at each stage of development and the Repeated Measures Analysis of Variances was used for statistical comparisons of the following interactions: sex, i.e., males vs. females; time, i.e., change with growth during the 18-month period; and group, i.e., differences between the various feeding/sucking methods.

Comparisons of the absolute and percentage changes in the maxillary and mandibular arch parameters indicated that no significant differences were present between the different feeding groups at the end of the 18-month period.

Pediatricians, pediatric dentists and orthodontists are interested in infant feeding. Although each specialty might be interested in one aspect of child development, collectively their objective is to ensure that the infant is provided with: (1) good nutrition, (2) optimal physical growth, (3) optimal emotional growth, and (4) optimal dental and facial growth.

The satisfaction that babies and young children derive from nutrient and non-nutrient sucking habits, and the need to duplicate the breast by the use of substitute sucking nipples and pacifiers has been recognized for years. Ravn (1974) reported that sucking objects appear in the literature of the late 15th and early 16th centuries. According to Winter (1980), the first comprehensive account of the sucking bag was given by Struve in 1801 who described it as a small linen bag filled with bread, milk, and sugar and which was used for the nourishment and composing of children.

There are a number of conflicting opinions regarding the effects of the feeding method on the subsequent digital habit that the child practices. Yarrow (1954), Graber (1963), and Najera (1963) are of the opinion that bottle feeding has a significant influence on the child's acquiring digital habits. They generally observed that breast-fed infants have the lowest prevalence of digital habits. On the other hand, Klackenberg (1949, 1971), Traisman and Traisman (1958) and Porter (1964) concluded that the method of feeding had no appreciable influence on the acquisition of digital habits.

Larsson (1985) indicated that in the last 15 years there has been a decrease in the number of children with a finger sucking habit and an increase in the number of dummy suckers. Larsson (1986) in a later review explained that continuous dummy sucking in the primary dentition usually is associated with an anterior open bite and an increased prevalence of posterior crossbite.

Klackenberg (1949) and Popovich and Thompson (1973) believe that the use of a pacifier for non-nutritive sucking decreases the prevalence of the infant's acquiring a digital habit. Popovich and Thompson (1973) concluded that since digital habits increase the prevalence of malocclusion, infants should be encouraged to use a pacifier as a prophylactic measure.

These contradictory opinions regarding the extent to which digit- and dummy-sucking alter the dental occlusion are partly the result of the difficulty

in determining the precise role of any single etiologic factor in the development of malocclusions. Malocclusion and normal occlusion are not always definite and clear-cut entities, particularly in the early stages of dentofacial development. Another contributory factor is the limited number of longitudinal studies describing the changes in the dental arches in infants fed with different methods.

During the last 25 years different types of nipples and pacifiers have been introduced for feeding as well as satisfying the sucking reflex in infants. In general, these nipples and pacifiers are described as being 1 of 2 types: "functional" and "conventional." The major differences between the 2 types is their size and shape in addition to their purported effects on the development of the oral structures. Very little scientific data are presently available to substantiate the desirability of one design over another.

The objective of this study was to examine the changes in the dental arch parameters during the first 18 months in 122 children. The children were grouped according to the types of nipples and pacifiers used into the following 6 groups: 1. breast fed, 2. breast fed and functional exerciser, 3. functional nipple and functional pacifier,[a] 4. conventional nipple and no pacifier, 5. conventional nipple and conventional pacifier,[b] and 6. residual group. This last group included individuals that frequently changed their feeding and sucking habits and hence could not be properly classified in any of the other 5 groups.

Methods and Materials

The Subjects

The infants were recruited from the obstetric and pediatric departments at the University of Iowa Hospitals and Clinics and private pediatric practices in Iowa City, Iowa. The only criteria for selecting the infants for the study were: (a) healthy full-term babies with no apparent congenital anomalies, and (b) availability of the family for evaluation over an 8-year period.

Because longitudinal studies frequently are hampered by the difficulty in retaining the participants for an extended period of time, an attempt was made to recruit parents with a strong commitment to the completion of the program.

The recruiting effort extended over a 2-year period at the end of which 135 infants and their families were enrolled in the project. The combination of monetary rewards, and the knowledge that routine dental examinations would be provided free of charge, produced committed participants. At 24 months, 122 children remained in the study. Of the 122 subjects in the sample, 58 were males and 64 were females.

[a] Nuk Nipple and Exerciser—Reliance Products Corp.
[b] Pūr Orthodontic Nipple and Infa. Gerber—Evenflo Products Co, International Playtex.

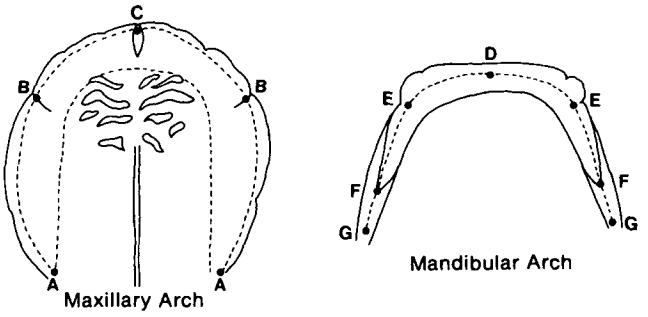

FIG 1. Maxillary and mandibular landmarks.

The choice of the type of feeding, nipple, pacifier, and/or exerciser was left totally to the parents and no attempt was made by the staff to influence their decision. Parents were interviewed prior to the birth of their infant to introduce them to the possible feeding choices and provide them with additional information on commercially available nipples if and when they elected not to breast feed.

Timing of Visits. The infants were examined at various intervals according to the folowing schedule: 1. initial visit—within 6 weeks after birth, and 2. follow-up visits—these were scheduled at 6-month intervals until the primary dentition was complete. Dental arch measurements were evaluated at 6 weeks, 6 months, 12 months, and 18 months.

Records Obtained.

1. A detailed health history that included: feeding habits, feeding times, initiation and frequency of the use of nipples, exercisers, pacifiers, and other digital habits
2. Clinical dental examination
3. Maxillary and mandibular alginate impressions for the fabrication of plaster models. All models were coded and only the person who interviewed the mothers had any knowledge of the infant's feeding and sucking preferences. This approach eliminated the possibility of bias by the evaluators during measurements
4. Facial Kodachrome® records.

Landmarks Used on Study Models. Five maxillary and 7 mandibular landmarks were identified on each set of study casts (Fig 1). The landmarks were defined according to Moorrees (1959) and Sillman (1964) as follows:

Maxillary

A. Postgingival point: the point on the posterior border of the gum pad at the crest of the alveolar ridge

B. Lateral sulcus point: the point at which the lateral sulcus crosses the crest of the alveolar ridge
C. Incisive point: the most anterior point on the incisive papilla in line with the crest of the alveolar ridge

Mandibular

D. Incisive point: the mid-line point on the crest of the alveolar ridge
E. Lateral sulcus point: the point at which the lateral sulcus crosses the crest of the ridge
F. Posterior border of the pad: the point on the posterior margin of the pad where it drops to the posterior ridge
G. Posterior border of the ridge: the point at which the mandibular ridge terminates.

All landmarks were marked by one investigator and verified by another.

Dental Arch Measurements. The following measurements were obtained on each set of study models at each of the 4 stages:

Maxillary

1. Anterior palatal length: perpendicular from point C on the line B-B
2. Anterior arch length: the sum of the right and left C-B measurements
3. Anterior palatal depth: the mid-palatal depth at B-B
4. Anterior arch width (B-B)

Mandibular

5. Mid-line length: perpendicular from D on the line F-F
6. Anterior arch length: the sum of the right and left F-E and E-D measurements
7. Anterior arch width (E-E)
8. Posterior arch width (F-F)

Maxillary-Mandibular

9. Ratio of mandibular anterior width to maxillary anterior width (E-E/B-B).

Measurement Reliability. Double measurements were obtained for each parameter using a dial caliper. Intraexaminer reliability was predetermined at 0.25 mm. A second examiner randomly checked 10% of the measurements obtained. Allowable interexaminer reliability also was predetermined at 0.25 mm. Three per cent of the checked measurements were above this limit, none more than 0.5 mm. For the purpose of this study, it was concluded that this level of accuracy was appropriate.

Placement of Subjects in Different Groups. The choice of the method of feeding as well as the type of nipple and pacifier used was left totally to the parents. During each visit the parents were asked about the feeding method and the type of pacifier used. In order to place the infants in different groups, it was subjectively determined that if during the first year, a particular feeding method was utilized for more than 9 months and a particular pacifier used for more than 6 months, it would be considered as the predominant method. Using these criteria the 122 infants were categorized into 6 groups:

- 17 individuals were breast fed (14.0%); 11 males and 6 females
- 13 individuals were breast fed and had a functional exerciser (10.5%); 5 males and 8 females
- 27 individuals had a functional nipple and functional exerciser (20.0%); 9 males and 16 females
- 29 individuals had a conventional nipple and no pacifier (24%); 16 males and 13 females
- 10 individuals had a conventional nipple and a conventional pacifier (8.0%); 7 males and 3 females
- 28 individuals had multiple feeding and sucking methods (23.5%); 10 males and 18 females; this residual group changed their feeding and/or sucking habits too frequently or for prolonged periods to be properly placed in any of the other 5 groups.

It is important to realize that in all the groups, mothers were occasionally supplementing their major method of feeding with another. As an example mothers who breast fed their infants occasionally supplemented the diet with a bottle or with solid foods at an appropriate age. For practical reasons, this occasional supplemental feeding could neither be accurately quantified nor was it considered to be clinically significant in relation to the major method of feeding. On the other hand, those infants who switched their feeding methods for significant periods were collectively included in the residual group.

Statistical Analysis. Descriptive statistics on the absolute and relative changes in arch parameters for the various feeding-sucking groups were calculated at 6 weeks, 6 months, 12 months, and 18 months.

In addition to comparing the actual measurement of width, length, and arch circumference of the various groups, the percentage change in each dimension was calculated as $(Mx - Mo/Mo) \times 100$ where Mo is the initial measurement and Mx is the measurement at any subsequent time period evaluated. For this study, percentage changes in the parameters are more appropriate than the absolute changes, because of the large variations in the initial size of the arches among the various subjects as well as differences between males and females. Such variation might influence judgment of the group and sex comparisons. As an example, males are likely to have larger absolute changes than females just because they are born with larger dental arches.

Comparisons were made between the sexes and between the 6 groups by plotting both the absolute and relative changes over time using the repeated measures analysis of variance. In addition, the

TABLE 1. Dental Arch Measurements at 6 Weeks of Age

Group	B.F.		B.F. + F.E.		F.N. + F.E.		C.N.		C.N. + C.P.		Residual	
Parameter	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Maxillary arch (mm)												
Ant. pal. length	7.6	1.0	7.8	1.4	7.8	1.1	7.6	1.0	7.8	0.5	8.1	2.2
Ant. arch length	30.3	1.9	30.6	2.2	30.2	2.2	30.1	1.8	30.4	2.2	30.2	2.5
Ant. pal. depth	4.9	0.9	5.3	0.9	5.4	0.9	5.3	1.4	5.8	1.1	5.4	1.1
Ant. arch width	26.1	1.3	26.1	1.2	25.7	1.8	26.0	1.7	26.0	2.3	25.7	1.7
Mandibular arch (mm)												
Mid-line length	15.0	1.0	15.3	1.5	15.1	1.3	15.1	1.3	15.7	1.9	14.3	1.5
Ant. arch length	45.1	2.1	46.0	2.5	45.9	2.9	46.3	3.1	47.9	3.8	44.8	3.0
Ant. arch width	21.7	1.3	22.5	1.5	22.1	1.7	21.9	1.5	23.3	2.8	21.9	1.4
Post. arch width	28.9	1.5	29.1	1.5	29.2	1.6	29.5	1.7	30.5	2.4	29.3	1.5
Maxillary-mandibular (%)												
Man. ant. width / Max. ant. width	82.4	4.1	86.2	4.6	86.1	7.2	85.0	7.2	89.9	6.9	85.4	4.0

$\bar{x}$ = mean, **SD** = standard deviation, **Ant.** = anterior, **Pal.** = palatal, **Max.** = maxillary, **Man.** = mandibular, **B.F.** = breast fed, **F.E.** = functional exerciser, **F.N.** = functional nipple, **C.N.** = conventional nipple, **C.P.** = conventional pacifier, **Residual** = multiple feeding methods and pacifers.

BMDP2V statistical package (Dixon 1983) was used to conduct a repeated measures analysis of variance for each measurement. Recent studies have demonstrated that various adjustments to the univariate F-test will yield similar results as a multivariate analysis, even if the data do not meet the sphericity assumption (O'Brien and Kaiser 1985).

The mean growth profile curve for each parameter was compared among the 6 feeding groups. In the statistical analysis of the growth curves there are two aspects that need to be evaluated: (1) the *shape* of the curves, i.e., the slope which describes growth direction [In this respect, the curves might show a parallel relationship indicating that the growth trends are the same. On the other hand, lack of parallelism indicates different growth trends.], and (2) the *magnitude* of the curves, i.e., the height of the curve which represents the amount of change with time as measured by the intercepts of each curve.

Interaction effects were assessed for significance at the 0.05 level by using the univariate F-tests corrected with the Hyunh-Feldt adjustment. Between subjects effects, which require no adjustment, included the group and sex main effects, in addition to the group by sex interaction effect. Within subjects effects included the time main effect, as well as the time by group, time by sex, and time by sex by group main effects. For example, when the interaction between sex and time (i.e., difference between the two sexes with time) is not significant, this means that the growth curves are parallel. On the other hand a significant difference indicates lack of parallelism, i.e., differences between the two sexes with time.

Although clinical judgment is the appropriate

TABLE 2. Dental Arch Measurements at 6 Months of Age

Group	B.F.		B.F. + F.E.		F.N. + F.E.		C.N.		C.N. + C.P.		Residual	
Parameter	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Maxillary arch (mm)												
Ant. pal. length	8.4	1.0	8.7	1.0	8.8	0.8	8.3	0.9	9.0	1.0	9.0	1.2
Ant. arch length	32.3	1.7	32.6	1.6	32.1	2.1	32.1	1.6	32.7	1.8	32.1	2.2
Ant. pal. depth	5.2	0.9	5.4	0.7	5.8	0.7	5.4	0.9	6.5	1.0	5.7	0.9
Ant. arch width	27.4	1.4	27.4	1.1	26.7	1.9	27.4	1.7	27.2	1.9	26.6	1.7
Mandibular arch (mm)												
Mid-line length	16.1	1.5	16.3	1.2	16.2	1.0	15.9	0.9	16.8	1.4	16.0	1.3
Ant. arch length	47.9	2.7	48.3	2.6	48.4	2.5	48.2	1.9	50.4	2.6	48.0	2.8
Ant. arch width	22.9	1.1	23.3	1.4	23.1	1.4	22.8	1.0	23.8	2.0	23.0	1.5
Post. arch width	30.2	1.2	30.2	1.5	30.4	1.7	30.7	1.3	31.6	2.1	30.1	1.6
Maxillary-mandibular (%)												
Man. ant. width / Max. ant. width	83.6	4.4	85.0	3.9	86.6	4.8	83.7	0.9	87.7	5.0	86.5	3.8

$\bar{x}$ = mean, **SD** = standard deviation, **Ant.** = anterior, **Pal.** = palatal, **Max.** = maxillary, **Man.** = mandibular, **B.F.** = breast fed, **F.E.** = functional exerciser, **F.N.** = functional nipple, **C.N.** = conventional nipple, **C.P.** = conventional pacifier, **Residual** = multiple feeding methods and pacifers.

TABLE 3. Dental Arch Measurements at 12 Months of Age

Group	B.F.		B.F. + F.E.		F.N. + F.E.		C.N.		C.N. + C.P.		Residual	
Parameter	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Maxillary arch (mm)												
Ant. pal. length	8.7	1.1	9.3	0.9	9.5	1.0	8.9	0.9	9.4	0.9	9.5	1.0
Ant. arch length	33.4	1.9	34.2	1.4	33.8	2.2	33.6	1.6	33.9	1.5	33.7	2.2
Ant. pal. depth	5.4	0.9	5.8	0.7	6.1	0.8	5.7	0.7	7.0	0.6	6.2	1.1
Ant. arch width	28.4	1.5	28.6	1.1	27.8	2.0	28.5	1.6	28.1	1.9	27.6	1.8
Mandibular arch (mm)												
Mid-line length	15.8	1.6	16.2	1.6	16.4	1.1	15.8	1.2	16.7	1.4	16.4	1.4
Ant. arch length	48.2	2.8	48.7	3.1	49.2	2.6	48.7	2.1	50.8	2.5	48.3	2.9
Ant. arch width	23.5	1.2	23.9	1.6	23.9	1.2	23.8	1.1	24.6	1.8	23.9	1.5
Post. arch width	31.1	1.2	31.0	1.5	31.4	1.6	31.5	1.2	32.4	2.0	31.2	1.4
Maxillary-mandibular (%)												
Man. ant. width / Max. ant. width	82.9	4.7	83.5	4.8	86.2	4.4	83.8	4.1	87.4	4.3	86.4	4.0

$\bar{x}$ = mean, **SD** = standard deviation, **Ant.** = anterior, **Pal.** = palatal, **Max.** = maxillary, **Man.** = mandibular, **B.F.** = breast fed, **F.E.** = functional exerciser, **F.N.** = functional nipple, **C.N.** = conventional nipple, **C.P.** = conventional pacifier, **Residual** = multiple feeding methods and pacifers.

means for deciding if the sex and group differences are substantively important, the use of significance tests provide a standard, nonarbitrary decision rule for assessing group and sex differences. Fortunately, in this study, clinical judgments and the significance test results corresponded.

Results

Descriptive statistics for the absolute data on the 6 groups of infants with different feeding and sucking methods are presented in Tables 1–4. These tables present dental arch measurements at 6 weeks, 6 months, 12 months, and 18 months, respectively.

The univariate analysis of variance was performed to determine whether differences in the absolute and relative changes in the various arch dimensions are present for the following effects: (1) sex difference between males and females, (2) group differences according to the feeding-sucking method, (3) growth effects with time, and (4) interaction between these 3 effects.

Males vs. Females

Longitudinal comparison of the changes in the absolute values between males and females indicate that males have significantly larger changes than females in both maxillary and mandibular arch widths. On the other hand, comparisons of the relative changes in the dental arch parameters indicated that no significant differences between the two sexes were present (Table 5). As a result, all subsequent comparisons of the percentage changes in the various arch

TABLE 4. Dental Arch Measurements at 18 Months of Age

Group	B.F.		B.F. + F.E.		F.N. + F.E.		C.N.		C.N. + C.P.		Residual	
Parameter	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Maxillary arch (mm)												
Ant. pal. length	8.5	1.3	9.6	1.0	10.0	1.4	9.2	1.2	9.6	0.9	10.1	1.1
Ant. arch length	33.8	2.0	35.3	1.7	35.4	2.5	34.7	1.6	34.9	1.5	35.4	2.3
Ant. pal. depth	5.7	0.8	6.4	1.1	6.7	1.0	6.2	0.8	7.5	0.6	7.1	1.5
Ant. arch width	29.0	1.7	29.6	1.2	29.0	2.0	29.4	1.5	28.9	2.0	28.8	1.9
Mandibular arch (mm)												
Mid-line length	15.1	1.8	16.1	1.6	15.7	1.1	15.0	1.7	15.6	1.3	15.7	1.8
Ant. arch length	47.3	3.4	48.7	3.2	48.4	2.9	47.7	3.3	49.0	2.5	48.6	3.4
Ant. arch width	23.8	1.4	24.2	1.8	24.5	1.6	24.6	1.5	25.3	1.8	24.5	1.6
Post. arch width	31.5	1.7	31.7	1.8	31.9	1.6	32.2	1.4	32.7	2.3	32.0	1.6
Maxillary-mandibular (%)												
Man. ant. width / Max. ant. width	82.1	3.6	81.9	5.9	84.6	4.5	83.7	5.1	87.6	4.3	85.0	4.6

$\bar{x}$ = mean, **SD** = standard deviation, **Ant.** = anterior, **Pal.** = palatal, **Max.** = maxillary, **Man.** = mandibular, **B.F.** = breast fed, **F.E.** = functional exerciser, **F.N.** = functional nipple, **C.N.** = conventional nipple, **C.P.** = conventional pacifier, **Residual** = multiple feeding methods and pacifers.

TABLE 5. Absolute and Per Cent Changes in Maxillary and Mandibular Parameters Between Groups

Parameters	*Interactions*	*S*	*T*	*G*	*S × T*	*G × T*	*T × G × S*
Maxillary arch							
Ant. pal. length:	Absolute	N.S.	N.S.	N.S.	N.S.	N.S.	**
	Per cent	N.S.	**	N.S.	N.S.	N.S.	**
Ant. arch length:	Absolute	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	Per cent	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Ant. pal. depth:	Absolute	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	Per cent	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Ant. arch width:	Absolute	**	N.S.	N.S.	N.S.	N.S.	N.S.
	Per cent	N.S.	**	N.S.	N.S.	N.S.	N.S.
Mandibular arch							
Mid-line length	Absolute	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	Per cent	N.S.	**	N.S.	N.S.	N.S.	N.S.
Ant. arch length:	Absolute	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	Per cent	N.S.	**	N.S.	N.S.	N.S.	N.S.
Ant. arch width:	Absolute	**	N.S.	N.S.	N.S.	N.S.	N.S.
	Per cent	N.S.	**	N.S.	N.S.	N.S.	N.S.
Post. arch width:	Absolute	**	N.S.	N.S.	N.S.	N.S.	N.S.
	Per cent	N.S.	**	N.S.	N.S.	N.S.	N.S.
Maxillary-mandibular							
$\frac{\text{Mandibular width}}{\text{Maxillary width}}\%$	Absolute	**	N.S.	N.S.	N.S.	N.S.	N.S.
	Per cent	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

S = sex effect, T = time effect (growth), G = group effect (feeding/sucking), Ant. = anterior, Pal. = palatal, N.S. = not significant, ** = significant at $P \leq 0.05$.

dimensions will have male and female individuals combined.

Effects of Feeding and Sucking Method

No significant differences were present in either the absolute or percentage comparisons between the 6 groups in any of the maxillary and mandibular arch parameters evaluated (Table 5).

Growth Changes with Time

The results of the analysis of variance indicated that there are significant changes in the various dental arch parameters between 6 weeks, 6 months, 12 months and 18 months. The parameters that did not express significant changes in this time period were: maxillary anterior arch length, palatal depth and the ratio of maxillary to mandibular arch widths (Table 5).

Interaction Between Sex, Feeding-Sucking Method and Growth

No significant changes were present in the comparisons of the absolute and percentage changes for the interactions between sex and growth as well as between feeding groups and growth, in any of the arch parameters compared.

The interaction between growth, sex and the feeding/sucking method indicates that the anterior palatal length expressed the only significant interaction.

Discussion

Male-Female Differences

As stated earlier, there were significant differences between males and females when the absolute changes in the maxillary and mandibular arch widths were compared. On the other hand when the per cent change was compared, no significant differences between males and females were present. Comparisons of the relative changes are therefore more appropriate when evaluating the effects of various feeding and sucking methods.

Differences Between Feeding-Sucking Methods

The comparisons indicated that no significant differences were present between the 6 groups investigated. The absolute curves of the maxillary parameters (Figs 2a–d) indicate that the average difference between any two groups is in the vicinity of 2 mm or less.

When the graphs for the relative or per cent changes were examined (Figs 3a–d) the differences between some of the groups become more accentuated. It is interesting to note that the mean curve for the breast-fed group consistently showed the least amount of relative change in the maxillary anterior arch length and palatal depth with time (Figs 3a–d). The subtle but consistent differences between the breast-fed group and the other 5 groups might be related to the use of nipples and pacifiers, i.e., their

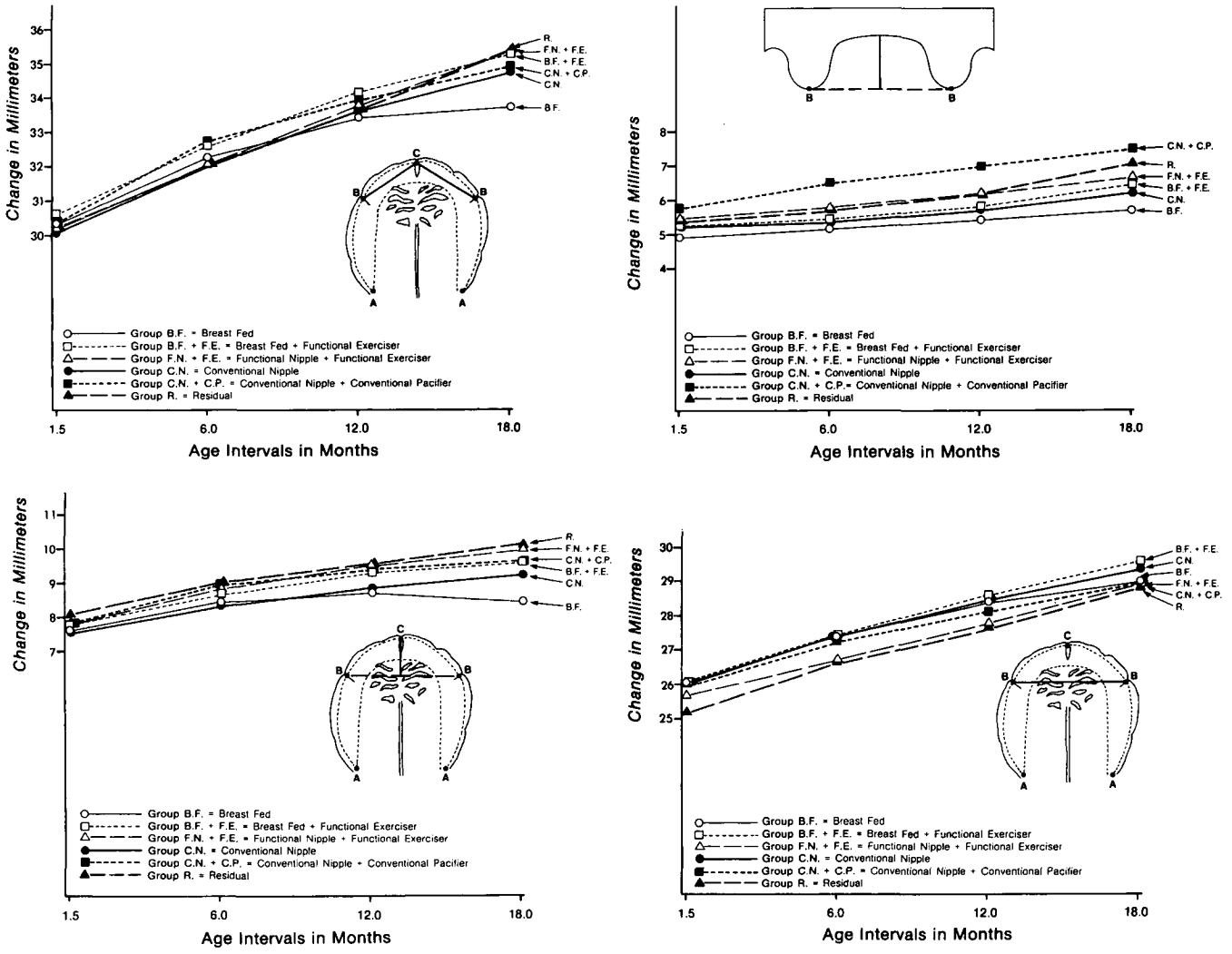

FIG 2. A: Absolute changes in maxillary anterior arch length for the 6 feeding/sucking groups. B: (*upper right*) Absolute changes in maxillary anterior palatal depth for the 6 feeding/sucking groups. C: (*lower left*) Absolute changes in maxillary anterior palatal length for the 6 feeding/sucking groups. D: (*lower right*) Absolute changes in the maxillary anterior arch width for the 6 feeding/sucking groups.

use might cause the anterior part of the palate to be longer and deeper.

The present findings indicate that when all the interactions within a group are considered i.e., sex, the feeding method, non-nutritive sucking and individual variation, the differences between the various groups are not clinically significant. On the other hand, it is possible that persistence of non-nutritive sucking for prolonged periods might introduce significant changes in the dental arches (Larsen 1985, 1986). As indicated from our literature review, there is a difference of opinion regarding the influence of feeding, non-nutritive sucking and digital sucking on dental occlusion.[1] Since the present investigation includes observations during the first 18 months only, these questions can be addressed in the future through a comprehensive evaluation of the various dental arch parameters and occlusal relationships after eruption of the deciduous dentition is completed and in full occlusion.

Summary and Conclusion

The present longitudinal study involved 122 infants between 6 weeks and 18 months of age. Six different feeding and sucking methods were evaluated.

The absolute and relative changes in various maxillary and mandibular arch parameters were compared between males and females as well as between the various feeding/sucking groups. The results indicated that in general, the changes in the various

[1] Yarrow 1954; Graber 1963; Najera 1963; Klackenberg 1949, 1971; Traisman and Traisman 1958; Porter 1964; Larsson 1985, 1986; Popovich and Thompson 1973.

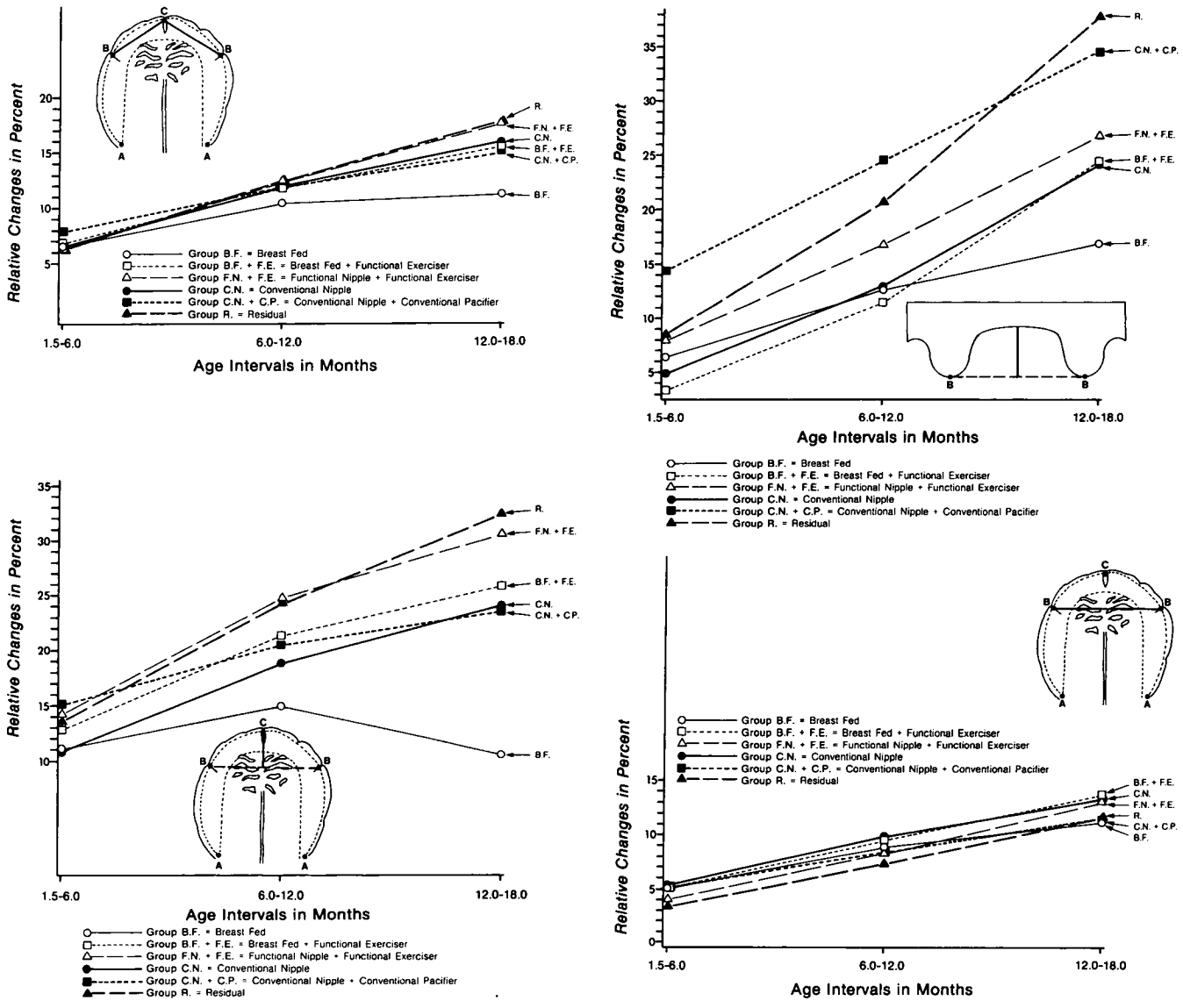

FIG 3. A: Relative changes in maxillary anterior arch length for the 6 feeding/sucking groups. B: (*upper right*) Relative changes in maxillary anterior palatal depth for the 6 feeding/sucking groups. C: (*lower left*) Relative changes in maxillary anterior palatal length for the 6 feeding/sucking groups. D: (*lower right*) Relative changes in the maxillary anterior arch width for the 6 feeding/sucking groups.

arch parameters during the 18-month period were not significantly different between the 6 feeding/sucking groups, namely breast fed, breast fed and functional exerciser, functional nipple and exerciser, conventional nipple, conventional nipple and exerciser, and a residual group (miscellaneous).

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Dr. Bishara is a professor, orthodontics; Dr. Nowak is a professor, pediatric dentistry and pediatrics; Dr. Kohout is a professor, preventive and community dentistry; Mr. Heckert is a research assistant, preventive and community dentistry; and Ms. Hogan is a research assistant, Dows Institute of Dental Research, The University of Iowa College of Dentistry, Iowa City, Iowa. Reprint requests should be sent to Dr. Samir E. Bishara, Department of Orthodontics, College of Dentistry, University of Iowa, Iowa City, IA 52242.

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