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VARIATIONS IN CRANIOFACIAL GROWTH DEPENDING ON THE TYPE AND DURATION OF LACTATION RECEIVED IN CHILDREN WITH MIXED DENTITION IN PURBA MIDNAPORE, WEST BENGAL: A COMPARATIVE STUDY

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ABSTRACT

Introduction Mother's milk is considered as the most important source of nutrition for newborns as supported by several organizations such as AAP, WHO and so on. As evidenced, the craniofacial growth is influenced by functional stimuli. Different feeding mechanisms thus may affect the craniofacial growth. However few studies are found supporting the fact. **Study and methods** After going through a questionnaire based survey, lateral cephalograms of 153 children of mixed dentition receiving different types of lactation for different time period were compared in terms of Steiners Cephalometric Analysis. Comparison among multiple groups was done using one-way ANOVA test. Tukey HSD (Tukey Honest Significant Differences) was performed for multiple pairwise comparison between the means of groups. Also Kruskal-Wallis rank sum test, a non-parametric alternative to one-way ANOVA was performed when ANOVA assumptions were not met. **Results** After all comparisons, statistically significant differences were observed among exclusively breastfeeding and exclusively bottle-feeding as well as both feeding habit group regarding mostly skeletal and certain dental parameters emphasizing over the fact that exclusively breastfeeding habit caused changes much more near the norm. When comparisons were made within both feeding habit groups based on time duration, some skeletal as well as some dental parameters also showed statistically significant differences favouring positivity towards more time duration in breastfeeding. But no such significant change was observed in terms of soft tissue parameters among different groups. Even no association observed between different feeding habits and non-nutritive sucking habits. **Conclusion** Apart from multiple advantages of breastfeeding both for mother and newborn, breastfeeding for certain time duration also helps in correct orofacial development.

KEYWORDS: breastfeeding, bottle-feeding, non-nutritive sucking habit, orofacial growth.

INTRODUCTION

Breastfeeding is considered the best and safest way of feeding infants because of its positive effects on their physiological and psychological development.[1-3] The unique properties of breast milk make it the best source of nutrients for infants. The policy statement of the AAP Section on Breastfeeding specifies that breast milk is the only source of nutrition a healthy infant requires for about the first six months of life.[4]

Now, Cranio-facial growth and development are affected by functional stimuli such as breathing, swallowing, chewing and sucking.[5] Several authors suggested that breastfeeding, especially if prolonged, protects against malocclusion, stimulating sagittal growth of the mandible and a correct inter-maxillary relationship through the mechanical stimulus of the facial muscles during sucking.[2,6-13]

The roles of nutritive sucking, which includes breastfeeding and bottle feeding, and non-nutritive sucking, which includes pacifier and digit sucking, have been of particular interest to researchers. The sucking mechanism used during bottle feeding differs from that used during breastfeeding.[14-16]

To obtain milk, the infant does not have to suck it from the mother's breast and probably could not do so. Instead, the infant's role is to stimulate the smooth muscle to contract and squirt milk into the mouth. This is done by suckling, consisting of small nibbling movements of the lips, a reflex action in infants. When the milk is squirted into the mouth, it is only necessary for the infant to groove the tongue and allow the milk to flow posteriorly into the pharynx and oesophagus. The tongue, however, must be placed anteriorly in contact with the lower lip, so that milk is in fact deposited on the tongue.

This sequence of events defines an infantile swallow, which is characterized by active contractions of the musculature of the lips, a tongue tip brought forward into contact with the lower lip and little activity of the posterior tongue or pharyngeal musculature. The suckling reflex and the infantile swallow normally disappear during the first year of life.[17]

On the other hand, the bottle-fed child "uses the tongue with piston-like motion in order to compress the artificial teat against the palate." These different sucking mechanisms have the potential to predispose a bottle-fed infant to development of a malocclusion.[14]

Challenges exist in designing an investigation of the influence of sucking behaviours on craniofacial growth; however, the results of studies in which researchers used electromyography suggest that the muscle activity of infants who are breastfed exclusively renders them less likely to develop the dysfunctional muscular patterns that might predispose bottle-fed infants to develop a malocclusion.[15,16]

Many authors believe that breastfeeding and other environmental stimuli influence the growth and development of oral and facial structures through muscular activity.[2,6,9-11]

Others think that strong evidence supports genetics as the main etiological factor in the development of malocclusion and even muscle-activity patterns.[18]

Research shows that children breastfed for less than 6 months had significantly more non-nutritive sucking habits. The association between the short duration of breastfeeding and the development of sucking habits was reported in previous studies and seems to develop in response to frustration and need for contact in these children.[9]

However, there are few scientific evidences supporting that breastfeeding has a positive effect on the growth of the orofacial structures. For this reason, we need to determine, by means of a thorough radiographic and exhaustive study, the dental and/or skeletal changes that occur depending on the type of lactation received.[19]

MATERIALS AND METHODS

▶ SOURCE OF SAMPLE

All the samples have been selected among the patients visiting the Out Patient Department of Pediatrics and Preventive Dentistry of Haldia Institute of Dental Sciences and Research, West Bengal.

▶ SAMPLE SIZE

The present study consists of study sample of 153 subjects which are divided into 3 groups namely 'Exclusively breastfeeding', 'Exclusively bottle-feeding' and 'Having both feeding habit' with 51 sample each. The third group was then further subdivided into 3 subgroups namely 'bottle-feeding with <1 month breastfeeding', 'bottle-feeding with 1-6 months breastfeeding' and 'bottle-feeding with >6 months breastfeeding'.

▶ INCLUSION CRITERIA

Children with age range from 6-11 years old, with an average of 8 years and 7 months old.

▶ EXCLUSION CRITERIA

1. Children with neurological problem.
2. Children having craniofacial developmental anomaly.

▶ METHOD

For this study an informed consent was obtained from the parents of the child patients in their own language. Then a pilot study was done evaluating 10 samples only. Questionnaires were set up asking the data regarding the type of lactation received, their duration, presence of other non-nutritive sucking habit, its nature, frequency and duration in details.

That were asked to the parents of the children, particularly to their mothers as mothers can remember best regarding the type of lactation they provided.

Parallely, Lateral Cephalograms of the children were taken using **Konica Minolta Dry Pro SD-E Digital X-ray film 8*10.**

▶ TESTING AND MEASUREMENTS

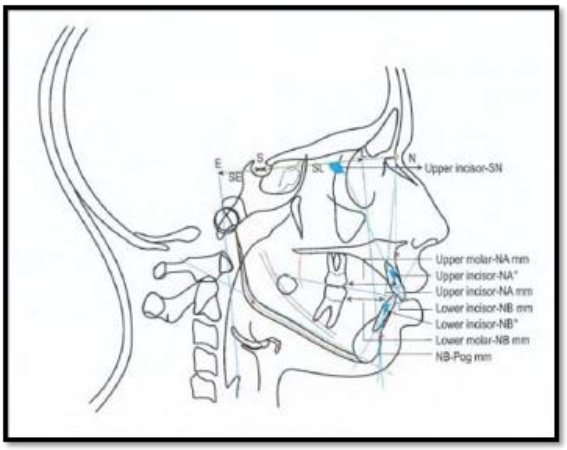
All the skeletal, dental and soft tissue parameters of Steiner Cephalometric Analysis were traced on the Lateral Cephalograms taken and studied to evaluate the variations among different groups.

▶ CEPHALOMETRIC METHOD

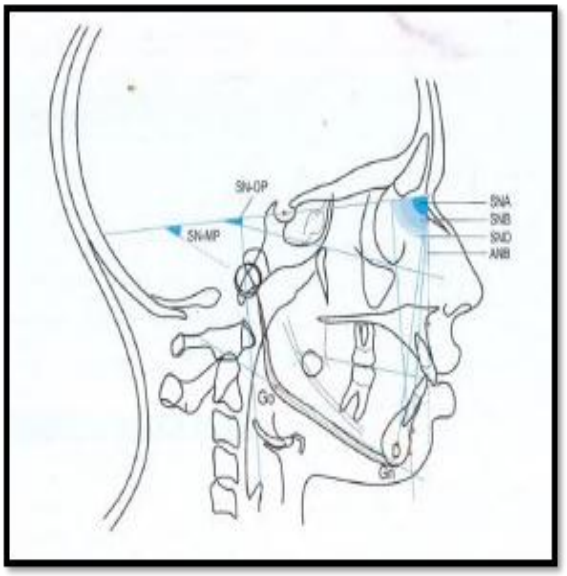
For cephalometric analysis, we checked Steiner's skeletal, dental and aesthetic variables and compared them with Caucasian norms.

▶ CEPHALOMETRIC ERROR

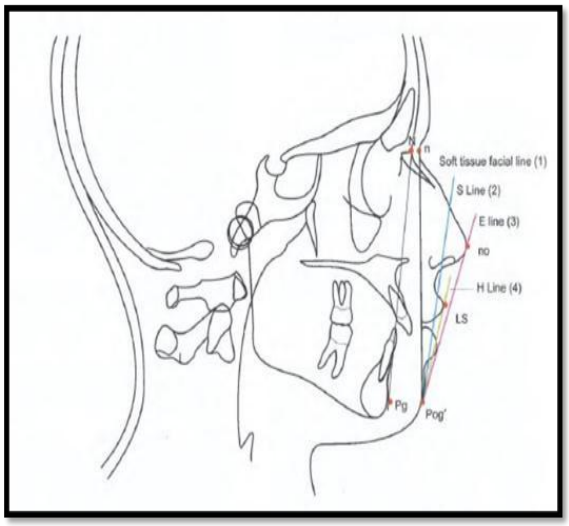
The anatomic points were recorded by one person only. Two cephalometric tracings were obtained from each x-ray and their coincidence was evaluated. The margin of error accepted was of 5%.



Steiner's Dental Parameters



Steiner's Skeletal Parameters



Steiner's S Line

PARAMETERS	CAUCASIAN NORMS
SNA	82°
SNB	80°
ANB	2°
SND	72°
SN-MP	32°
Upper CI to NA(linear)	4 mm
Upper CI to NA(angular)	22°
Lower CI to NB(linear)	4 mm
Lower CI to NB(angular)	25°
Inter-incisal angle	131°
Upper CI to SN	104°
Lower CI to MP	93°
SN-OP	14.5°

▶ STATISTICAL ANALYSIS

- Data analysis was done using R version 4.0.2.
- Comparison among multiple groups was done using One-Way ANOVA test.
- The one-way analysis of variance (ANOVA), also known as one-factor ANOVA, is an extension of independent two-samples t-test for comparing means in a situation where there are more than two groups. In one-way ANOVA, the data is organized into several groups base on one single grouping variable (also called factor variable).

ANOVA test hypotheses

- Null hypothesis: the means of the different groups are the same
- Alternative hypothesis: At least one sample mean is not equal to the others.

Statistically significant codes are demarcated as 0 '' 0.001 '**' 0.01 '*' 0.05***

Multiple pairwise-comparison between the means of groups

- In one-way ANOVA test, a significant p-value indicates that some of the group means are different, but we don't know which pairs of groups are different.
- It's possible to perform multiple pairwise-comparison, to determine if the mean difference between specific pairs of group are statistically significant.

Tukey multiple pairwise-comparisons

As the ANOVA test is significant, we can compute **Tukey HSD** (Tukey Honest Significant Differences, R function: **Tukey HSD**()) for performing multiple pairwise-comparison between the means of groups.

Non-parametric alternative to one-way ANOVA test

A non-parametric alternative to one-way ANOVA is Kruskal-Wallis rank sum test, which can be used when ANOVA assumptions are not met, is also used here.

In this study, first a comparison is made among three groups of 51 samples each, having different feeding habits, regarding the skeletal and dental variables of Steiner's Cephalometric analysis. One way ANOVA analysis is done for comparison of the Means and the results obtained are tabulated as.

RESULTS

Table 1: Comparison of different variables among three groups of different feeding habits.

Parameters	Feeding Habit	N	Mean	SD	Anova
SNA	Exclusively Breastfeeding Habit	51	84.2	2.5	P<2e-16
	Exclusively Bottlefeeding Habit	51	79.5	1.78	
	Both Feeding Habit	51	80.6	2.52	
SNB	Exclusively Breastfeeding Habit	51	81.9	2.61	P=9.67e-15
	Exclusively Bottlefeeding Habit	51	77.2	2.18	
	Both Feeding Habit	51	78.4	3.31	
ANB	Exclusively Breastfeeding Habit	51	2.31	2.46	P=0.986
	Exclusively Bottlefeeding Habit	51	2.24	2.09	
	Both Feeding Habit	51	2.26	2.48	
SND	Exclusively Breastfeeding Habit	51	78.5	3.08	P=3.52e-10
	Exclusively Bottlefeeding Habit	51	74.9	2.18	
	Both Feeding Habit	51	75.3	3.11	
SN-MP	Exclusively Breastfeeding Habit	51	29.8	4.89	P=0.000446
	Exclusively Bottlefeeding Habit	51	33.8	4.31	
	Both Feeding Habit	51	32.9	6.35	
SN-OP	Exclusively Breastfeeding Habit	51	18.4	4.22	P=0.00445
	Exclusively Bottlefeeding Habit	51	21.9	5.79	
	Both Feeding Habit	51	19.6	6.04	
NA to upper CI(linear)	Exclusively Breastfeeding Habit	51	6.15	1.29	P=0.345
	Exclusively Bottlefeeding Habit	51	5.78	1.25	
	Both Feeding Habit	51	6.06	1.37	
NA to upper CI(angular)	Exclusively Breastfeeding Habit	51	25.3	6.77	P=0.312
	Exclusively Bottlefeeding Habit	51	25.8	5.95	
	Both Feeding Habit	51	27.3	7.69	
NB to lower CI(linear)	Exclusively Breastfeeding Habit	51	5.75	1.29	P=0.0226
	Exclusively Bottlefeeding Habit	51	5.23	0.97	
	Both Feeding Habit	51	5.24	0.913	
NB to lower CI(angular)	Exclusively Breastfeeding Habit	51	23.8	7.29	P=0.367
	Exclusively Bottlefeeding Habit	51	23.4	6.34	
	Both Feeding Habit	51	22	5.77	
Interincisal	Exclusively Breastfeeding Habit	51	125	12.3	P=0.272
	Exclusively Bottlefeeding Habit	51	127	8.34	
	Both Feeding Habit	51	128	9.16	
Upper CI to SN	Exclusively Breastfeeding Habit	51	110	7.07	P=0.877
	Exclusively Bottlefeeding Habit	51	110	6.1	
	Both Feeding Habit	51	110	7.56	
Lower CI to MP	Exclusively Breastfeeding Habit	51	94.4	7.4	P=0.049
	Exclusively Bottlefeeding Habit	51	93	4.16	
	Both Feeding Habit	51	91.7	4.44	

[P value 2e-16 implies 2×10^(-16) that means highly significant as demarcated by *** code described above].

Thus from Table 1, it is evident that SNA, SNB, SND, SN-MP, SN-OP, NB to lower CI(linear) and Lower CI to MP are of statistically significant value.

But from the Table 1, it is not specific that actual statistically significant difference exists among which two groups. For that Tukey's test is performed, the result of which is tabulated in Table 2 along with the result obtained in Kruskal-Wallis test, the non-parametric test alternative to One-way ANOVA.

Table 2: Significantly different variables comparing two groups at a time.

Parameters	Comparison between groups	Tukey Contrasts	Kruskal-Wallis
SNA	Bottlefeeding and Both feeding	P=0.0299	P=4.852e-16
	Breastfeeding and Both feeding	P<1e-04	
	Breastfeeding and Bottle feeding	P<1e-04	
SNB	Bottlefeeding and Both feeding	P=0.102	P=1.905e-12
	Breastfeeding and Both feeding	P<1e-04	
	Breastfeeding and Bottle feeding	P<1e-04	
SND	Bottlefeeding and Both feeding	P=0.721	P=7.978e-09
	Breastfeeding and Both feeding	P<1e-05	
	Breastfeeding and Bottle feeding	P<1e-05	
SN-MP	Bottlefeeding and Both feeding	P=0.626844	P=0.0004825
	Breastfeeding and Both feeding	P=0.010616	
	Breastfeeding and Bottle feeding	P=0.000512	
SN -OP	Bottlefeeding and Both feeding	P=0.08358	P=0.005294
	Breastfeeding and Both feeding	P=0.48361	
	Breastfeeding and Bottle feeding	P=0.00346	
NB to lower CI(linear)	Bottlefeeding and Both feeding	P=0.9997	P=0.09203
	Breastfeeding and Both feeding	P=0.0453	
	Breastfeeding and Bottle feeding	P=0.0439	
Lower CI to MP	Bottlefeeding and Both feeding	P=0.4496	P=0.07577
	Breastfeeding and Both feeding	P=0.0376	
	Breastfeeding and Bottle feeding	P=0.4133	

From Table 2, it is quite evident that regarding SNA, SNB and SND, highly significant differences are observed between Exclusively Breastfeeding and Both feeding habit as well as between Exclusively Breastfeeding and Exclusively Bottle-feeding group.

Now, among the Both feeding habit group, how does the duration of Breastfeeding additional to the Bottle-feeding habit affect these parameters are also evaluated and tabulated in Table 3.

The samples are divided into three subdivisions such as Bottle-feeding with < 1month of Breastfeeding, (1-6) months of Breastfeeding and >6 months of Breastfeeding.

Table 3: Comparison within Both-feeding habit group based on duration of Breastfeeding.

Both Feeding Habit					
Parameters	**Duration of breastfeeding**	**N**	**Mean**	**SD**	**Anova**
SNA	Bottlefeeding + <1 month Breastfeeding	18	78.2	1.06	P=7.24e-11
	Bottlefeeding + (1-6) months Breastfeeding	16	80.8	1.57	
	Bottlefeeding + >6 months Breastfeeding	17	83	2	
SNB	Bottlefeeding + <1 month Breastfeeding	18	75.3	2.42	P=1.83e-07
	Bottlefeeding + (1-6) months Breastfeeding	16	80.5	2.48	
	Bottlefeeding + >6 months Breastfeeding	17	79.5	2.45	
ANB	Bottlefeeding + <1 month Breastfeeding	18	2.92	2.07	P=0.000107
	Bottlefeeding + (1-6) months Breastfeeding	16	0.25	2.11	
	Bottlefeeding + >6 months Breastfeeding	17	3.47	2.1	
SND	Bottlefeeding + <1 month Breastfeeding	18	72.9	2.25	P=3.11e-05
	Bottlefeeding + (1-6) months Breastfeeding	16	77	2.82	
	Bottlefeeding + >6 months Breastfeeding	17	76.3	2.61	
SN-MP	Bottlefeeding + <1 month Breastfeeding	18	33.8	6.34	P=0.39
	Bottlefeeding + (1-6) months Breastfeeding	16	31.1	6.1	
	Bottlefeeding + >6 months Breastfeeding	17	33.6	6.61	
SN-OP	Bottlefeeding + <1 month Breastfeeding	18	22.3	6.9	P=0.0112
	Bottlefeeding + (1-6) months Breastfeeding	16	16.2	5.31	
	Bottlefeeding + >6 months Breastfeeding	17	20	4.2	
NA to upper CI(linear)	Bottlefeeding + <1 month Breastfeeding	18	6.25	1.37	P=0.66
	Bottlefeeding + (1-6) months Breastfeeding	16	6.09	1.66	
	Bottlefeeding + >6 months Breastfeeding	17	5.82	1.1	
NA to upper CI(angular)	Bottlefeeding + <1 month Breastfeeding	18	28.4	7.16	P=0.0157
	Bottlefeeding + (1-6) months Breastfeeding	16	30.4	7.09	
	Bottlefeeding + >6 months Breastfeeding	17	23.1	7.35	
NB to lower CI(linear)	Bottlefeeding + <1 month Breastfeeding	18	5.61	1.01	P=0.0783
	Bottlefeeding + (1-6) months Breastfeeding	16	4.94	0.68	
	Bottlefeeding + >6 months Breastfeeding	17	5.12	0.911	
NB to lower CI(angular)	Bottlefeeding + <1 month Breastfeeding	18	22.4	6.1	P=0.955
	Bottlefeeding + (1-6) months Breastfeeding	16	21.9	5.69	
	Bottlefeeding + >6 months Breastfeeding	17	21.9	5.82	
Interincisal	Bottlefeeding + <1 month Breastfeeding	18	127	7.91	P=0.528
	Bottlefeeding + (1-6) months Breastfeeding	16	127	8.31	
	Bottlefeeding + >6 months Breastfeeding	17	130	11.1	
Upper CI to SN	Bottlefeeding + <1 month Breastfeeding	18	111	6.47	P=0.109
	Bottlefeeding + (1-6) months Breastfeeding	16	112	7.15	
	Bottlefeeding + >6 months Breastfeeding	17	107	8.4	
Lower CI to MP	Bottlefeeding + <1 month Breastfeeding	18	92.2	4.19	P=0.28
	Bottlefeeding + (1-6) months Breastfeeding	16	90.2	4.19	
	Bottlefeeding + >6 months Breastfeeding	17	92.4	4.81	

From Table 3, it has been evident that differences in the values of SNA, SNB, ANB, SND, SN-OP and NA to upper CI (angular) are statistically significant among these groups.

Again, from Table 3, we can't draw conclusion regarding specific groups between which statistically significant difference exists. For that, again Tukey's comparison is made and crosschecked using Kruskal-Wallis test. The result of which has been tabulated as.

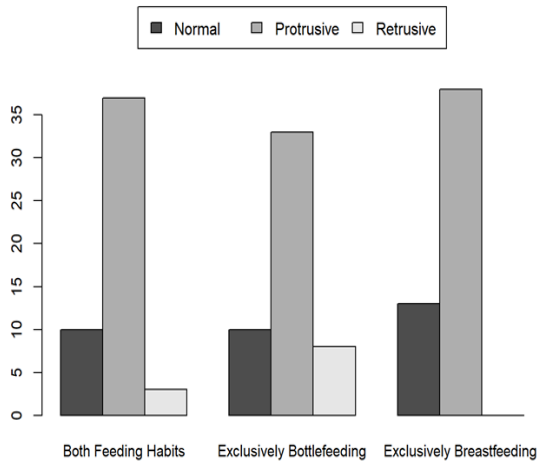
Table 4: Significantly different variables comparing two groups at a time (Within Both feeding habit group; subdivision based on time duration of Breastfeeding).

Parameters	Comparison between groups	Tukey Contrasts	Kruskal-Wallis
SNA	(1-6) months and <1 month	P<1e-04	P=2.6e-08
	>6 months and <1 month	P<1e-04	
	>6 months and (1-6) months	P=0.000538	
SNB	(1-6) months and <1 month	P<1e-04	P=7.86e-06
	>6 months and <1 month	P<1e-04	
	>6 months and (1-6) months	P=0.496	
ANB	(1-6) months and <1 month	P=0.001487	P=0.0003992
	>6 months and <1 month	P=0.714967	
	>6 months and (1-6) months	P=0.000197	
SND	(1-6) months and <1 month	P<1e-04	P=8.84e-05
	>6 months and <1 month	P=0.000675	
	>6 months and (1-6) months	P=0.709796	
SN-OP	(1-6) months and <1 month	P=0.00833	P=0.01489
	>6 months and <1 month	P=0.45941	
	>6 months and (1-6) months	P=0.14486	
NA to upper CI(angular)	(1-6) months and <1 month	P=0.7022	P=0.02263
	>6 months and <1 month	P=0.0879	
	>6 months and (1-6) months	P=0.0155	

Thus, from Table 4, it is evident that the difference in the values for SNA and SNB are of highly significance in group with <1 month Breastfeeding as compared to (1-6) months or >6 months Breastfeeding of which the values are less than the set norm in <1 month Breastfeeding group.

At the same time, for ANB, more significant difference is observed between >6 months and (1-6) months Breastfeeding group among which >6 months group shows more value than set norm.

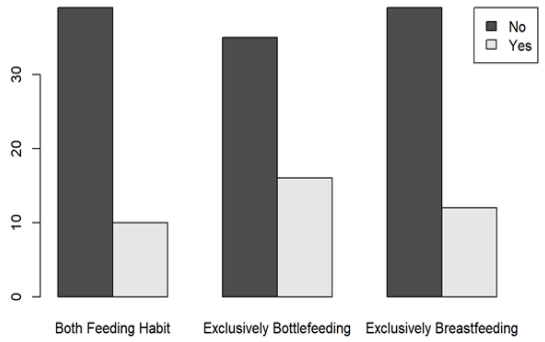
For SND again, highly significant difference is observed between <1 month and (1-6) months or >6 months group showing smaller value than norm in <1 month group. Whereas, SN-OP and NA to upper CI(angular) shows mild significant differences emphasizing lesser value for SN-OP in <1 month group and lesser value for NA to upper CI(angular) in >6 months group.



Graph 1:- Bar diagram representing lip position based on Steiner's 'S' line in three different feeding habits.

The Graph indicates the propensity of protrusive lip in all 3 groups having almost equal distribution.

Lastly, to observe whether the occurrence of other habits get influenced by different feeding habits or not, the answers in 'Yes' or 'No' are plotted and the graph obtained as.



Graph 2: Bar diagram representing relation between presence of other habits and different feeding habits From the graph, it is quite evident that presence of other habits is not influenced by different feeding pattern.

DISCUSSION

After evaluating all the skeletal, dental and soft tissue parameters of Steiner's Cephalometric analysis in three groups having different feeding habit, it has been found that much more normal tendency of craniofacial growth has been observed in exclusively breastfeeding habit as compared to exclusively bottle-feeding or both feeding habit.

If we discuss regarding different parameters, it has been seen that among skeletal parameters, mean values for SNA, SNB and SND angles are lower than the set norm for Caucasian populations in exclusively bottle-feeding group as well as in both feeding group whereas the values are closer to norm in exclusively breastfeeding group. It indicates that, maxillary and mandibular apical bases as well as the centre of the mandibular symphysis are retrognathic in exclusively bottle-feeding and both feeding group than exclusively breastfeeding group.

Now, the question may arise that whether this difference observed is exclusively due to difference in feeding habit or it is just because of the variation in population as it has been well established that Steiner's cephalometric norm was set for Caucasian population.[20]

In some studies on Bangladeshi population, it has been shown that both SNA and SNB angles exhibit a significantly greater value in Bangladeshi subjects than in the Caucasians. It indicates that the maxillary and mandibular apical bases are more prognathic ($P<0.05$) in the Bangladeshi population when compared to the Caucasians.

Similarly, The mean of SND angle is significantly larger in Bangladeshi subjects, indicating that the centre of mandibular symphysis is placed more forward ($P<0.05$) than the Caucasians.[21,22]

From this, it is quite evident that the changes observed in mean values of SNA, SNB and SND among the three groups are not solely due to population variation but may be influenced by different feeding habit.

On the other hand, Mandibular plane angle (SN-MP) shows greater mean value in exlusively bottle-feeding group than the other two groups. It indicates vertical growth pattern and increased lower facial height.

That change is remarkable because, studies on Bangladeshi population have shown that Mandibular plane angle (SN-MP) of Bangladeshi young adults is significantly smaller ($P<0.001$) than that of the Steiner's norm. From this result, it may be a reasonable assumption that Bangladeshi people have a more prominent horizontal growth than the Caucasians.[21]

Therefore, it is a clear indication that exclusive bottle-feeding habit may predispose to vertical growth pattern and increased lower facial height which is quite similar to the result obtained in study by M Sánchez-Molins et al.(2010).[19]

Regarding dental parameters, Occlusal plane angle (SN-OP) shows greater value in exclusively bottle-feeding group as compared to other two groups whereas NB to lower central incisor (linear) and lower central incisor to mandibular plane shows lesser mean value in exclusively bottle-feeding and both feeding group than exclusively breastfeeding group. That findings are again contradictory to results obtained for Bangladeshi population.[21]

It may be due to the fact that different sucking pattern in two different feeding habit can influence the inclination of teeth but at the same time we can't draw any conclusion regarding this as because we are studying on subjects with mixed dentition. Unless and until, full occlusion is established, it will not be evident whether teeth position gets influenced by different sucking pattern or not.

Now, to check the effect of time duration of different feeding habit, the both feeding habit group are subdivided into three groups as bottle-feeding with <1month breastfeeding, (1-6) month breastfeeding and >6 months breastfeeding. When that similar skeletal parameters are checked, it has been found that again SNA, SNB and SND values are lesser in <1 month breastfeeding group than the other two groups which ultimately indicates that smaller duration of breastfeeding may affect the craniofacial development.

Additionally, ANB angle shows significant difference between >6 months breastfeeding and (1-6) month breastfeeding group with >6 months breastfeeding group showing closer value to set norm.

Again, regarding dental parameters, occlusal plane angle (SN-OP) shows lesser value in <1 month breastfeeding group and lesser value for NA to upper central incisor (angular) is observed in >6 months breastfeeding group indicating that lesser proclination of the tooth may be associated with increased time duration of breastfeeding. But as discussed before, we can't draw conclusion regarding dental parameters because of developing occlusion of mixed dentition. On the other hand, soft tissue analysis of three different groups shows almost equal predisposition to protrusive lips with respect to Steiner's S line. That finding is coincident with studies on Bangladeshi population which shows higher tendency of protrusive lips than Caucasian population in general.[21,22]

Therefore, it gives no such indication that change in feeding habit may cause change in soft tissue profile.

Similarly, findings also suggest that development of other non-nutritive sucking habit is not solely dependent on different feeding habit or their time duration. There may be certain other factors which generally initiate different non-nutritive sucking habit but that is beyond the scope of this study.

Nowadays, there are few studies that compare the values of the latero-lateral cephalometry of the cranium of breastfeeding individual and artificial lactation ones. However, some authors have observed there is a greater frequency of malocclusion associated to artificial lactation.

There is always a controversy regarding the association of feeding habit and its duration with the developing malocclusion. As we have seen that Labbok and collaborators[23], in their study conducted on a sample of 15.000 North American children, highlighted that a prolonged breastfeeding (over six months) can prevent orofacial malocclusions, which were 44% less frequent than in the other groups. However, other authors like Legovic and Ostric[24], Luz and collaborators[25] claimed that there were no statistically significant differences between the type of lactation, and the sagittal relationships of molars and incisors or mandibular deficiency. From these results, the authors concluded that there might be many endogenous and exogenous factors able to influence malocclusion, such as oral habits (non-nutritive sucking).

Warren and Bishara[26] also found the same results, after carrying out a study in Iowa, USA. The authors observed that extended breastfed children with non-nutritional suction habits showed arch parameters and occlusal characteristics similar to those of subjects who had received artificial lactation or were breastfed for a short period of time. Therefore, the authors inferred that in the development of malocclusion non-nutritional suction is more important than the type of lactation.

Results obtained in this study finds maximum similarity with the study done by M Sánchez-Molins et al.(2010)[19] except for soft tissue analysis. They found that propensity of lip protrusion might be increased with bottle-feeding habit but in this study it has been observed that propensity of lip protrusion is almost equally distributed among groups with different feeding habits. That may also be possible due to racial variation as claimed in studies on Bangladeshi population.[21,22]

Therefore, though the results differ, still we can't draw any firm conclusion regarding this fact because of its small sample size and lack of other parameters to evaluate the fact.

Also, regarding the variations in dental parameters, we can't firmly establish the fact because the entire study is done on population with mixed dentition. That needs certain longitudinal studies to observe the changes occurring in developing occlusion from mixed to permanent dentition along with other methods of cephalometric analysis to crosscheck.

On the other hand, though some authors[27,28] found positive association of acquiring digital sucking habits with bottle-feeding, in our study we have not observed such association and that finds similarity with results obtained in studies by Klackberg[29], Traisman & Traisman[30] and Porter.[31]

Whether the development of non-nutritive sucking habit gets influenced by other factors such as parenting style, anxiety disorder or anything else that is beyond the scope of this study.

The present study thus gives a positive indication that feeding habit can influence the craniofacial development, particularly that of skeletal bases depending upon the type and duration of feeding practice but can't firmly establish the changes related to dental as well as soft tissue parameters.

It is quite evident from this study that development of other digital habits and malocclusion are not solely dependent upon different feeding practice and their duration, there may be definitely other factors present such as environmental and genetic factors, respiration and functional factors and even some behavioural factors that may influence. Here lies the drawbacks of this study that it fails to correlate such association with different feeding habit in the development of stomatognathic system. It also fails to establish how much the different feeding habit solely affect the craniofacial development. Whether the changes observed in mixed dentition phase

can be self corrected with age, is also beyond the scope of this study.

Not only that, as it is a questionnaire based study, there may be a chance of recall bias also.

For these, further clinical studies are needed to be done in future to obtain an entire concept regarding this matter so that parents can be educated about proper guidelines of feeding practice for sake of the craniofacial development of child with lesser complication.

CONCLUSION

Despite of having certain drawbacks, it can be concluded from the present study that.

- Exclusively breastfeeding habit may predispose to skeletal base positioning much more closer to norm than exclusively bottle-feeding habit or both feeding habit.
- Within both feeding habit, bottle-feeding with >6 months breastfeeding may influence better craniofacial development than bottle-feeding with <1 month breastfeeding or bottle-feeding with (1-6) months breastfeeding.
- Different feeding habit may not cause any changes in soft tissue profile. Racial predilection may play a role behind it.
- Different feeding habit may not be the sole criteria in acquisition of other digit habits. There must be certain other factors to play.

Overall, it can be said that, apart from multiple advantages of breastfeeding both for the newborn and the mother, breastfeeding definitely helps in correct orofacial development such as position of the incisors, vertical or sagittal relationship of the mandible regarding the maxilla or the cranial base.

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