Observations on the Dentition and Face in Clefts of the Alveolar Process

YERUCHAM ZILBERMAN, D.M.D.
Jerusalem, Israel

It has been observed that alveolar ridge clefts disturb the dental morphology in a variable manner (*13*). For example, agenesis, supernumerary teeth, concurrent agenesis and supernumerary teeth, and anomalous morphology of teeth are seen both in individuals with cleft lip and palate and in persons who have cleft lip without involvement of the secondary palate. Bohn (*2*) found significant antimere differences in the size of the maxillary permanent incisors, but most of his data are for cleft lip plus palate subjects as a combined group. Foster and Lavelle (*6*) showed that the teeth of cleft lip and palate subjects were significantly smaller than those of control subjects and that several dimensions of teeth in female cleft lip and palate subjects were larger than those of males.

The irregularities in the alveolar process range from small dimples in association with minor clefts in the lip to actual grooves in the alveolar process, and finally to the extreme of total clefts in the alveolar ridge with displacement of the premaxillary segment toward the noncleft side. Therefore, cleft lip and cleft palate do not represent a single fixed clinical entity subject to generalization of description and simple classification (*12*).

In a widely used classification of clefts, lip clefts (i.e. clefts of the primary palate) are distinguished from isolated clefts of the secondary palate and from clefts that involve both the lip and palate (*10*). Some investigators empirically combined the cleft lip and the cleft lip plus cleft palate groups when examining the size and number of teeth, or the relations of the jaws to the skull (*2, 7, 11*). The purpose of this investigation was to collect data on dental anomalies, the occlusion and the facial skeleton in a group of persons who had clefts confined to the primary palate, i.e. clefts of the lip and alveolar process (CAP). The author hoped to compare this cleft lip and alveolar process (CAP) data to previously published complete cleft and normative data to see which group the CAP more closely resembles.

Materials

Thirty-one subjects (17 male, 14 female) born with clefts anterior to the incisive foramen were available for study. Most were of white origin,

Yerucham Zilberman, D.M.D., is affiliated with the Department of Orthodontics, The Hebrew University-Hadassah School of Dental Medicine, P.O. Box 1172, Jerusalem, ISRAEL.

but the group also included three negro subjects. Males ranged in age from five to 40 years with a mean age of 18 years. The females ranged from 7½ to 43 years of age, with a mean age of 21 years. All subjects had undergone surgery prior to the age of six months for repair of the cleft lip, at the Columbia-Presbyterian Medical Center. No palatal surgery of any kind, or pre-dental orthopedic treatment, was performed in any of these cases. Because this study was done retrospectively, and the degree of cleft in the lip and alveolar process were not noted in the medical charts (*9*), no classification could be done on the severity of the cleft. The median followup period was 18.5 years (*3*). Measurements of the mesiodistal width of each permanent anterior tooth present from canine to canine were obtained from maxillary study models made from alginate impressions. Comparisons were made between antimere teeth located close to the cleft (proximate) and the corresponding teeth of the opposite side (distant). All measurements were done twice with a sliding caliper graduated to 0.1 mm. Occlusal x-rays were used to determine the presence or absence of unerupted teeth in the cleft area. If the dental history of subjects was not clear and it could not be determined whether missing maxillary anterior teeth were congenitally absent or lost because of extraction, the case was deleted from the missing tooth category. Cephalometric roentgenograms were taken using the Cephalometrix unit (Moss x-ray and Medical Equipment Co., Chicago). The following measurements were made from acetate tracings of the headplates:

Cranial base angle (planum of sphenoid and clival intercept) to determine degree of cranial base kyphosis.

SNA angle to appraise anteroposterior position of the maxilla.

The facial convexity angle to assess the degree of the convexity of the bony profile.

NS to mandibular plane (Go Gn) angle to find the relation of the mandibular corpus to the cranial base.

Lower incisor to mandibular plane angle—to determine the amount of inclination of lower incisors as related to the base of the mandible.

These cephalometric measurements were selected because they usually differ significantly in complete cleft palate individuals compared with established normal data.

Findings

The distribution of clefts in the 31 subjects is presented in Table 1. Unilateral clefts occurred in equal numbers in both sexes (13 males, 13 females), but the left side was affected more frequently in males. There were more bilateral clefts seen in males. Mean mesio-distal tooth measurements (Table 2) showed no apparent differences between antimere teeth with one exception. The central incisor teeth of females are smaller on the side approximating the cleft (Figure 1). (Note, the range of error for the total 135 measurements was between −0.3 mm. (1 case) and 0.5

TABLE 1. Distribution of cleft alveolar process according to side affected and sex.

	unilateral clefts		*bilateral clefts*	*no. of subjects*
	right side	*left side*		
Males	3	10	4	17
Females	5	8	1	14
Total	8	18	5	31

mm. (1 case). Forty-five per cent of all measurements showed no measurement error at all. For the entire material the mean error of measurement was 0.08 mm).

In many cases morphological anomalies made it difficult to decide precisely which teeth are present in the cleft area, particularly in cases of duplication. These supernumeraries are customarily termed either "medial fissural teeth" or "distal fissural teeth", and they occur in both the deciduous and permanent dentitions (Table 3). There was one unusual instance in which both medial and distal deciduous fissural teeth were observed in a male individual with unilateral cleft. As summarized in Table 4, distal fissural teeth are more frequent in males while agenesis of teeth is higher in females.

In another unusual case J.P. (Figure 2), the history and physical findings indicated a left CAP, but examinations of the study casts showed that medial and distal fissural teeth were present on *both* sides of the

TABLE 2. Tooth size of maxillary anterior teeth of CAP according to proximity to cleft.

	proximity to cleft	*no. of teeth*	*mean*	*S.D.*	*range*
Males					
Central Incisor	Proximate	8	8.13mm.	0.56	7.4–8.9
	Distant	7	8.60	0.45	7.0–9.2
Canine	Proximate	8	7.90	0.44	7.4–8.6
	Distant	8	7.74	0.33	7.3–8.3
Lateral Incisor	Distant	8	7.10	0.70	6.3–8.3
Medial Fissural	Proximate	2	6.25		5.7–6.8
Distal Fissural	Proximate	5	5.86	0.79	5.5–6.5
Females					
Central Incisor	Proximate	7	7.77	0.82	6.3–8.9
	Distant	9	8.87	0.84	7.6–10.4
Canine	Proximate	7	7.64	0.33	7.2–8.2
	Distant	9	7.73	0.25	7.3–8.1
Lateral Incisor	Distant	8	6.83	0.70	5.5–7.7
Medial Fissural	Proximate	1	5.7		
Distal Fissural	Proximate	1	5.4		

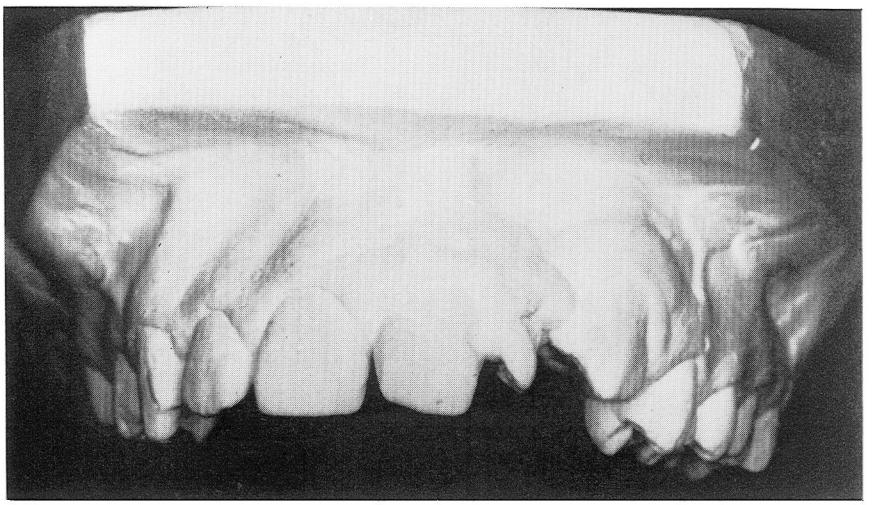

FIGURE 1. Female CAP subject displaying larger maxillary central incisor distant to the cleft.

TABLE 3. Incidence of medial and distal fissural teeth and agenesis in the deciduous and permanent dentitions in CAP.

fissural teeth	*deciduous dentition*		*permanent dentition*	
	unilateral clefts	*bilateral clefts*	*unilateral clefts*	*bilateral clefts*
No. of subjects	3	1	10	3
Males				
Mesial + Distal	1			2
Mesial	1		1	
Distal	1	1	7	1
Agenesis		1	2	3
No. of subjects	1		9*	1
Females				
Medial + Distal				
Medial			1	1
Distal	1		1	
Agenesis			8*	1

* Subject V.M., Right unilateral CAP, Both $\underline{2}\,\underline{2}$ missing.

TABLE 4. Incidence of fissural teeth and agenesis in the permanent dentition, in unilateral CAP.

fissural teeth	*males*	*females*	*total*
Medial	1	1	2
Distal	7	1	8
Agenesis	2	8	10

maxillary jaw. The occlusal x-ray provided evidence of occult alveolar cleft on the right side and this case was therefore included in the bilateral cleft group.

Virtually all of the subjects in this study had Class I dental occlusion. Only two individuals had a Class II malocclusion and none showed a Class III. There were no cases of posterior crossbite.

Measurements taken from the cephalometric roentgenograms without regard for age, sex, or race were compared with similar data found in the literature. Although previous investigators (*7, 11*) reported findings for individuals with cleft lip plus cleft palate (not separating the CAP subjects) cephalometric measurements obtained in this study do not differ substantially from the published results for non-cleft groups (Table 5).

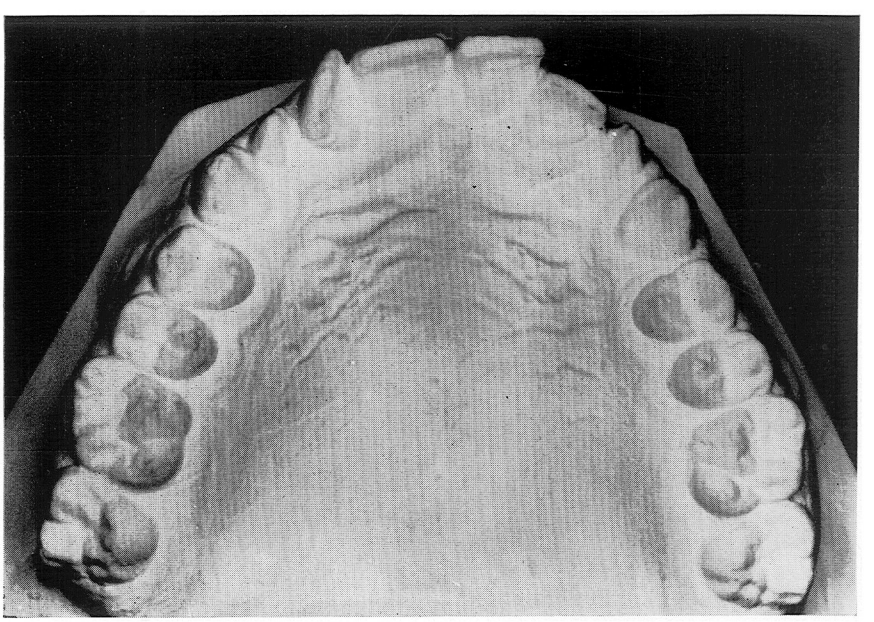

FIGURE 2. Unilateral (left) CAP subject showing the presence of medial and distal fissural teeth.

TABLE 5. Comparison of cephalometric measurements for CAP with measurements for combined forms of clefts, and normal values.

type of measurement	*no. of subjects*	*present study*			*reported means*	
		mean	*S.D.*	*range*	*all clefts*	*normal*
Cranial base angle	21	116.3°	9.7	101–141	106.1*	120.5*
SNA angle	27	82.5°	3.8	76–90	75.48**	82.01**
Facial convexity	27	8.2°	7.8	−10–27	—	0***
NS–GoGn angle	27	32.4°	6.7	21–44	38.31**	31.71**
$\bar{1}$ to GoGn angle	24	92.2°	7.3	83–117	83.19**	91.92**

* After Moss (11).
** After Graber (7).
*** After Downs (4).

Discussion

Bohn (*2*) published a classic work in which he combined the subjects having CAP and cleft lip plus cleft palate for examination of fissural teeth. The present study used only the CAP group. Despite this difference in grouping of subjects, distal fissural teeth were found more frequently in males in both studies. On the other hand, this study showed agenesis of teeth in the cleft area to be more frequent in females than males (Table 4), a finding which is at variance with Bohn's data.

The history of missing teeth in the cleft area was obtained from the subjects themselves. In any case of doubt, the subjects were not included in the missing teeth category. Even so, some information might be misleading because of the high average age of the subjects. This is an inherent problem with any retrospective study where data are collected from a history provided by a patient whose memory may be clouded by the passage of time.

The sex differences in tooth size has been noted, i.e. males having larger teeth than females, except for the central incisor on the non-cleft side (Table 2). Bohn also found a difference between sexes in the mesiodistal widths of the permanent central incisor teeth proximate and distant to the cleft, but of smaller degree than reported here. Differences in tooth size between this study and that of Bohn could also be attributed to tooth size variations in two different populations.

Individuals suffering from a particular deformity, differ from one another in many other respects, such as age, race, sex, etc., thus, because the number of individual cases are usually small, it becomes difficult to compare these statistically with any degree of validity. A large sample of CAP subjects from a uniform population, presenting a small range of variation in the different parameters under study, such as age, race, etc. may yield statistically significant findings. The number of subjects in the

present sample is small and the age range is wide. However, the cases in Moss's (*11*) study ranged from 2 to 47 years of age, and there is no report on the actual distribution according to the sex and the races of his group. Also Graber (*7*) reported on a cleft study in which his sample age ranged from 2 weeks to 77 years.

If we allow for possible variations in cephalometric readings due to age and race differences (our sample included 3 negro subjects), the measurements obtained here are close to those found in the literature for normal (noncleft) subjects (Table 5). The cranial base angle (planum sphenoidale and clival intersection) was found by Moss (*11*) to be 106.1 degrees for subjects presenting all types of clefts, and 120.5 degrees in a non-cleft group.

In the present study, the average measurement obtained for the same angle was 116.3 degrees, which is closer to the non-cleft values given by Moss, considering the wide range of variability (S.D. ± 9.7). Thus, we conclude that cleft of alveolar process patients are cephalometrically more like normal patients than complete cleft palate patients, in regard to the kyphosis of the cranial base.

Closure of the lip was the only surgical intervention in all subjects in this sample. Harvold (*8*) stated that "most orthodontists believe the underdevelopment of the maxilla, as seen in cleft lip and palate cases, is to a large extent due to surgical procedures, especially at a very early age". On the other hand, Foster (*5*) has suggested that agenesis of teeth associated with the cleft malformation may be an important factor in reducing maxillary growth. In cases where the cleft does not extend to the incisive foramen posteriorly, the maxillary complex probably has the potential for normal growth and development. This can be seen from a comparison of the cephalometric data from this study with normal cephalometric data. The mean SNA angle for normal individuals, reported by Graber (*7*), was 82.01 degrees. In the present sample the mean SNA angle was 82.5 degrees being essentially identical with the above report. However, the wide range (76–90 degrees), may indicate that lip-closure surgery may be contributing to the reduction of the SNA angle. The same might apply to the facial convexity angle. It may be added that Graber (*7*), too, found the range for the two above measurements in subjects with different forms of clefts to be extremely wide. In the same study, he found changes in the relation of the mandibular corpus (Go-Gn) to the cranial base (N–S line) in cleft subjects. He described as well the reduction of the incisor-mandibular plane angle for the same group. In the present study however, the values obtained for the above two angles were very close to his reported means for normal (non-cleft) individuals. Aduss (1) published an interesting cephalometric study on complete unilateral cleft lip and palate, where he evaluated the effects of conservative surgical repair of the lip and palate upon the pattern of craniofacial growth. Unfortunately, comparison of our

findings with his were not possible, because of the different methods of analysing the cephalometric x-rays.

The trends obtained in the present study suggest that craniofacial dimensions and relations of subjects with cleft lip and alveolar process only (CAP) are closer to the normal population than to individuals with frank cleft palate. Therefore, when studying all types of clefts, it would be desirable that CAP be grouped with cleft lip individuals only, but not be included in the "cleft-lip and cleft-palate" group. Analysis of a more substantial and uniform sample of CAP subjects will be required in order to show this conclusively.

Summary

The dentition and craniofacial relationships of 31 subjects (17 males, 14 females) born with clefts of the lip and the alveolar process (CAP) were evaluated using dental casts, occlusal and cephalometric x-rays. Unilateral clefts on the left side were more frequent, especially in males. There were an equal number of supernumerary medial fissural teeth in both sexes, but the distal fissural tooth is much more frequent in males. Agenesis of teeth is much higher in females. Furthermore, the size of the maxillary central incisor teeth on the side of the cleft in females is appreciably smaller than its antimere. Cephalometric measurements generally are close to values previously published for non-cleft subjects.

Dental anomalies are highly localized in the area of defect in individuals with CAP. Craniofacial dimensions and relations are closer to the normal population values than to other individuals who have clefts of the lip and palate together. It may be concluded that except for the local deformity in the alveolar process due to the cleft, the facial development of CAP individuals is essentially within the normal range.

Acknowledgments: The author wishes to express his appreciation for the invaluable help in preparing this manuscript provided by Sidney L. Horowitz, Professor of Dentistry and Head, Division of Oro-Facial Development, School of Dental and Oral Surgery, Columbia University.

He would also like to thank Dr. E. Koyoumdjisky-Kaye, Head, Department of Orthodontics, The Hebrew University-Hadassah School of Dental Medicine, Jerusalem, for her helpful criticism of this paper.

References

1. Aduss, H., Cleft lip and palate, *Angle Orthod., 41,* 202–213, 1971.
2. Bohn, A., Dental anomalies in harelip and cleft palate, *Acta Odont. Scand. Vol. 21,* supp. 38, 1963.
3. Crikelair, G. F., Schenck, R. R., and Cosman, B., The fate of the primary palate. To be published.
4. Downs, W. B., Analysis of the dentofacial profile, *Angle Orthod., 26,* 191–212, 1956.
5. Foster, T. D., A survey of the results of cleft palate operation, *Trans. Int. Soc. Plas. Surg.,* p. 36–40, 1959.
6. Foster, T. D., and Lavelle, C. L. B., The size of the dentition in complete cleft lip and palate, *Cleft Palate J., 8,* 177–184, 1971.

7. GRABER, T. M., The congenital cleft palate deformity, *J.A.D.A., 48,* 375–395, 1954.
8. HARVOLD, E., Cleft lip and palate. Morphologic studies of the facial skeleton, *Amer. J. Orthod., 40,* 493–506, 1954.
9. HOROWITZ, S. L., Personal communication, 1972.
10. KERNAHAN, D. A., and STARK, R. B., A new classification for cleft lip and cleft palate, *Plast. reconst. Surg., 22,* 435–441, 1958.
11. MOSS, M. L., Malformations of the skull base associated with cleft palate deformity, *Plast. reconst. Surg., 17,* 226–234, 1956.
12. PRUZANSKY, S., Description, classification and analysis of unoperated clefts of the lip and palate, *Amer. J. Orthod., 39,* 590–611, 1953.
13. PRUZANSKY, S., Factors determining arch form in clefts of the lip and palate, *Amer. J. Orthod., 41,* 827–851, 1955.