Cranial Base and Cleft Lip and Palate

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Previous studies do not agree on relationships between cleft palate and the cranial base. This study comparing normal and cleft lip-and-palate samples finds no significant difference in cranial base angle, but significantly shorter clivus length in the cleft sample.

KEY WORDS: • CLEFT • CLIVUS • CRANIAL BASE •

During normal embryonic and fetal growth and development, the craniofacial structures undergo considerable change in size and shape. The cranial base alters from a rather straight line to one with a distinct flexure that we call the cranial base angle. This change in angulation is part of a general shift of the foramen magnum axis to a more perpendicular relationship to the trunk, associated with the erect posture of man (KVINNSLAND 1973).

Growth of the craniofacial structures in a child with cleft lip and palate is abnormal, but clefts of the primary palate which involve lip and alveolus only, are usually without the widespread effects associated with more extensive cleft deformities (DAHL 1970).

There are conflicting reports among previous studies of growth in subjects with clefts of the lip and palate. MOSS (1956) reported that all types of cleft lip-and-palate deformity also exhibited an increased flexure of the cranial base. BRADER (1957), using nasion, sella and basion as reference points, reports no significant difference in the cranial base angle in the cleft sample compared to a control group. ROSS (1965) also found no significant difference in cranial base angles between a control group and cleft sample. OSBORNE (1968) reviewed the literature of cranial base angulation in cleft and noncleft patients and concluded that there was no significant difference in cranial base angulation between subjects with cleft lip-and-palate and controls.

In contrast, DAHL (1970) found significant differences in cranial base angle and linear dimensions between subjects with cleft lip-and-palate and a control group.

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— Material and Method —

The cleft sample was composed of standardized lateral cephalometric radiographs of 30 children (17 male, 13 female) chosen at random from the hospital records of patients with combined cleft lip-and-palate deformity. The age range was 11 to 14 years (Mean = 13.0 years).

The control group consisted of 61 patients (31 male, 30 female) sequentially referred for orthodontic treatment for Angle Class I malocclusion and exhibiting normal dental base relationships. Ages ranged from 12 to 13 years (Mean = 12.9) (Table 1).

The cephalometric radiographs traced for orthodontic diagnosis included the landmarks nasion (N), basion (Ba), and sella (S), which were used to delineate the cranial base.

The cranial base angle (N–S–Ba), and the linear dimensions from nasion to sella (N–S), and sella to basion (S–Ba) were recorded.

— Results —

(Tables 2-4)

Cranial base angulation did not differ significantly between the total cleft sample and the control group ($p > 0.05$). However, a significant difference was demonstrated for the clivus length S–Ba, which was smaller in the cleft lip-and-palate group ($p < 0.01$) Table 2.

Table 3 shows the results of a comparison of male controls with males in the cleft lip-and-palate category. The clivus length in the cleft patients was significantly smaller ($p < 0.01$).

Comparing the control group females with the cleft lip-and-palate females (Table 4) demonstrates a significantly greater cranial base angle ($p < 0.01$), and a shorter clivus length S–Ba in the cleft group ($p < 0.05$).

An overall association between the linear dimensions N–S and S–Ba in the total control group and total cleft sample (Fig. 1) demonstrates that differences are apparent.

To illustrate these differences, the control group and cleft sample were ranked separately for each sex by N–S length, each group being divided into subgroups of equal size. The mean measurements for each subgroup were plotted graphically (Figs. 2 and 3).

In both sexes, the cleft group means are nearer the origin, reflecting the smaller dimension for S–Ba reported in the initial findings.

In males (Fig. 2) there is a suggestion that S–Ba length is affected more in the smaller subjects, but this would require more data from a larger sample for confirmation.

Table 1

Study Samples

	N	♂	♀	Age
Control	61	31	30	12 (12.9) 13
Cleft	30	17	13	11 (13.0) 14
Total	91	48	43	

— Discussion —

There appears to be support for the conclusion of Osborne (1968) and the observations of Moss (1956), Brader (1957), and Ross (1965) that the cranial base angle is not significantly different with cleft lip-and-palate. The reduction in clivus length observed in the cleft sample compared with the control supports the conclusions of Dahl (1970) that this dimension is smaller in the cleft lip-and-palate category.

This suggests the possibility that the anomaly of cleft lip-and-palate and changes in the spheno-occipital synchon-

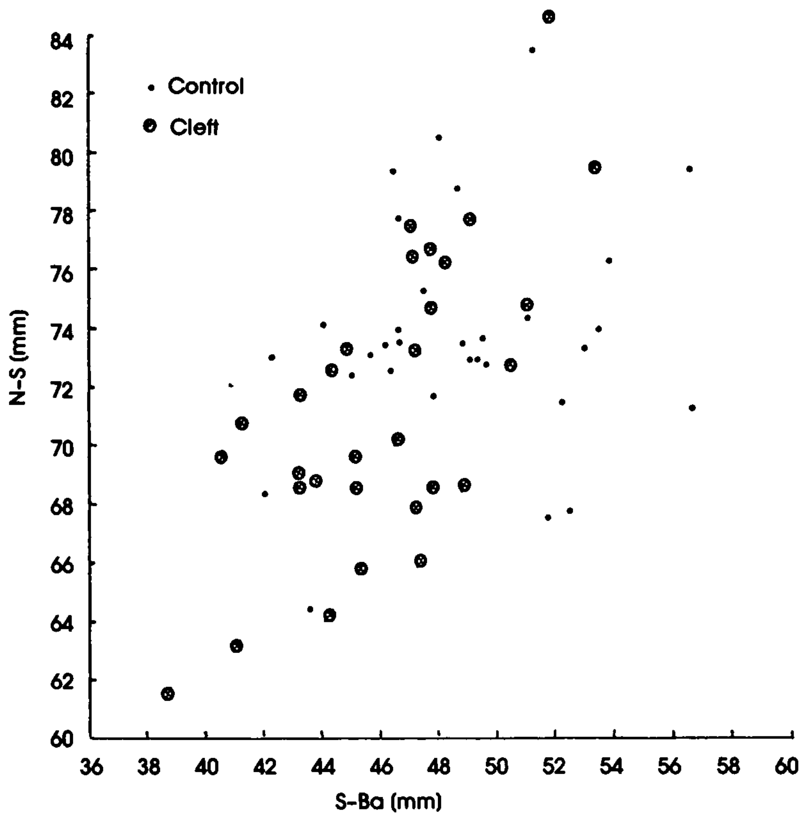

Fig. 1 Association between mean linear dimensions S-Ba and N-S in the total control group and total cleft sample.

Table 2

Data for Cleft lip/palate Subjects and Controls
Both Sexes

		N	Low	Mean	High	S.D.	p
N-S-Ba	Cont	60	121.8	130.6	138.9	3.92	p>0.50
(degrees)	Cleft	30	112.8	131.3	142.7	6.48	(ns)
N-S	Cont	61	64.5	73.3	83.5	3.77	p>0.05
(mm)	Cleft	30	61.7	71.7	84.7	5.12	(ns)
S-Ba	Cont	61	42.0	48.8	56.6	3.54	p<0.01*
(mm)	Cleft	30	38.6	46.1	53.3	3.42	

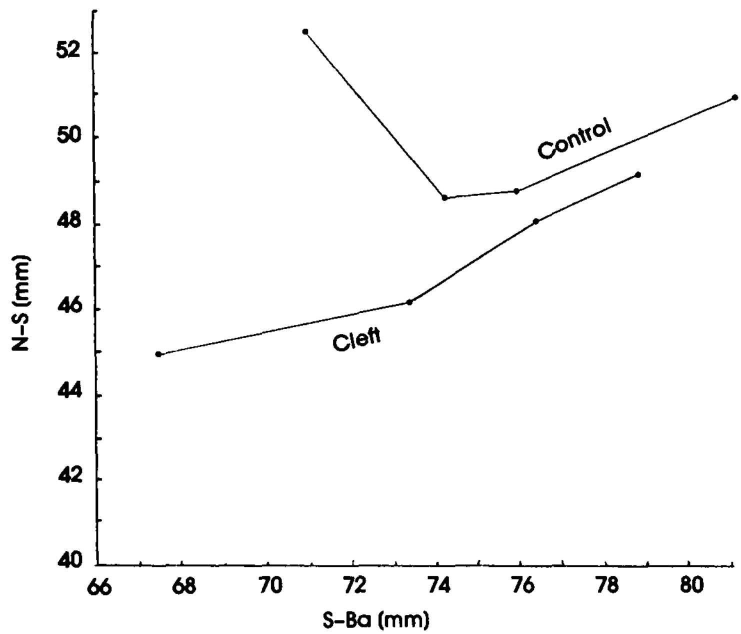

Fig. 2 Association between mean S-Ba and N-S for males in the control group and the cleft sample.

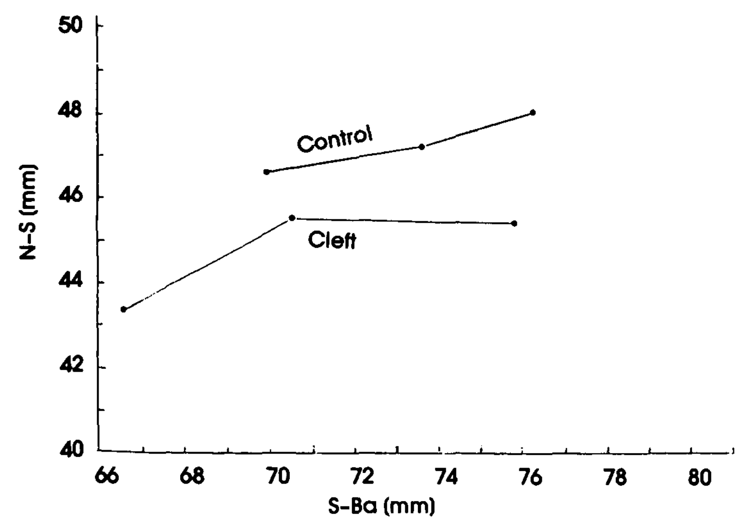

Fig. 3 Association between mean S-Ba and N-S for females in the control group and the cleft sample.

Table 3

Data for Cleft lip / palate Subjects and Controls
Males

		N	Low	Mean	High	S.D.	
N–S–Ba	Cont	31	123.7	131.3	138.9	4.28	P>0.01
(degrees)	Cleft	17	112.8	129.2	135.5	6.67	
N–S	Cont	31	67.6	74.5	83.5	4.00	p>0.01
(mm)	Cleft	17	64.3	73.0	79.6	4.59	
S–Ba	Cont	31	44.0	50.2	56.6	3.41	p<0.01*
(mm)	Cleft	17	43.1	47.1	53.3	2.82	

Table 4

Data for Cleft lip / palate Subjects and Controls
Females

		N	Low	Mean	High	S.D.	
N–S–Ba	Cont	30	123.2	129.9	137.3	3.43	p<0.01*
(degrees)	Cleft	13	127.2	134.1	142.7	5.26	
N–S	Cont	30	64.5	72.3	79.4	3.20	p>0.05
(mm)	Cleft	13	61.7	70.0	84.7	5.43	
S–Ba	Cont	30	43.0	47.3	53.6	3.04	p<0.05*
(mm)	Cleft	13	38.6	44.8	51.9	3.78	

drosis which controls clivus length may be related.

It has been pointed out by Moss (1956) that clefting of the palate is not exclusively a local defect. Dahl (1970) confirmed this, and Pashayan (1983) catalogued the many associated anomalies and deformities.

Children with clefting deformity are also more likely than a control group to have cervical vertebral anomalies. This has been pointed out by Osborne (1968) and Sandham (1987). The primitive embryonic cellular origins of upper cervical vertebrae and the basilar and condylar parts of the occipital bone are similar. Both develop from parachordal cartilage which arises from the cranial end of the notochord and incorporates the fused sclerotomes of the four occipital and upper cervical somites (Bosma 1976).

It has been further postulated that the nasal septum has cellular origins in the sclerotomes of this area (Wilson 1973). In children with the genetic potential for clefting deformity, it would therefore not be unexpected to find anomalies in areas developed from the same or similar paraxial mesoderm.

The failure of fusion of palatal shelves to nasal septum, cranial base deformity, and cervical vertebral anomalies may be more frequently associated with clefts of the lip and palate than is often considered.

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