Craniofacial Morphology in Adults with Bilateral Complete Cleft Lip and Palate

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Cephalometric x-ray studies were carried out on 26 adult males with complete bilateral cleft lip and palate ($BCLP_c$) and 50 non-clefts. The configuration of the neurocranium and cranial base showed no substantial differences. Facial differences were similar to those in unilateral clefts ($UCLP_c$). Protrusion and retroinclination of the premaxilla affected the depth and height of the upper jaw and thus the total height and posterior growth rotation of the face. Thus the depth of the maxillary complex was unchanged, while the depth of the posterior maxilla was reduced, as in $UCLP_c$. The increased length of the face, its posterior growth rotation, the dentoalveolar maxillary retroinclination and the displacement of the maxilla backwards were all more marked in bilateral clefts then in unilateral clefts. Changes of mandibular shape, an enlarged interocular distance, retrusion of the upper jaw and the configuration of the soft tissue profile, including the shorter upper lip were identical in both forms of clefts. However the mandible was more retrognathic and posteriorly rotated in bilateral clefts. The skeletal profile was not flattened, but the palatal plane was retroinclined and the depth of the nose was increased. $BCLP_c$ was associated with a widening of the nasal cavity and a thinner upper lip. The dimensions of the nasopharyngeal skeletal framework were reduced. The retrocheilia was conspicuous. Premaxillary setback resulted in a reduction of the depth of the upper jaw, of the height of the upper face and of the dentoalveolar retroinclination of the maxilla.

This is one of a series of studies of craniofacial deviations in individual types of clefts in adults (Šmahel and Brejcha 1983, Šmahel 1984 a, b). The present report deals with adult males with bilateral complete cleft lip and palate ($BCLP_c$). Our studies are based on X-ray measurements, as well as on cephalometric, somatometric and somatoscopic patterns ascertained in the same series of patients and published elsewhere (Šmahel, 1984c).

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Materials and Methods

A sample of 26 Czech males ranging in age from 20 to 40 years, all with bilateral complete cleft lip and palate and without any other associated malformation or maxillofacial osteotomy were studied. The mean age was 27.7 years and thus matched with the age and age distribution of controls (27.2 years) and of the patients with $UCLP_c$. (28.0 years) (Šmahel and Brejcha, 1983). All patients had been operated on at the Clinic for Plastic Surgery in Prague. The primary procedures were lip repair according to Tennison (in six cases according to Veau), the right side repaired at an

average, of 8.2 months and the left side at 7.3 months (in $UCLP_c$ at 7.6 months by Veau technique). The surgical repair of the cleft palate consisted of pushback and pharyngeal fixation (in four patients it was carried out as a secondary procedure). The mean age at the time of the surgical repair was 5.8 years and thus significantly higher than in $UCLP_c$ (4.7 years, t = 2.53). An enlargement of the vestibulum was performed in twelve individuals (46%). With the exception of three individuals all patients had a secondary surgical repair of the lip and nose, inclusive of a prolongation of the columella nasi in seventeen cases (65%). These data were presented in more detail in the first part of our study (Šmahel, 1984c).

Since premaxillary setback exerted marked effects on some parameters of the upper face, the sample was subdivided into a group of 9 cases with and 17 cases without premaxillary setback prior to palotoplasty. All affected individuals were subjected to varying amounts of orthodontic treatment.

Controls included 50 normal adult males matched in age and selected at random. Their body height and weight were consistent with the norm for the Czech adult male population. They were described in an earlier paper (Šmahel and Brejcha, 1983).

The craniometric points and reference lines used throughout our studies are defined in the companion article on page 142 of this issue. To exclude the effect of the displacement of the premaxilla forwards on maxillary depth we have added point M representing the crossing point of the palatal line and of the perpendicular line descending from the anterior surface of canine neck at the site of its entry into the alveolus.

Because of tooth loss the sample was reduced to 11 for dimensions related to the apex of upper incisors (Is). In two patients the visualization of the apex of lower incisors (Ii) failed during central occlusion (n = 24). Because of the ill defined contours in this region the number of cases was reduced by two also in characteristics Pr-Id, ASL/PL, Ss'_t and Pr_t. The results were analyzed with the F-test and with the t-test.

Results

The results were presented in Tables 1–2 and schematically illustrated in Figures 1 and 2.

CRANIUM: Only the reduced neurocranial height (Ba-Br), increased supraorbital frontal width (Lf-Lf) and reduced Sella-Basion were different from the controls. The increase of frontal width was due to lateral displacement of the orbits.

NASOPHARYNGEAL SKELETON: Height (S-Pl), length (S-Ba) and particularly depth (Pl-Ba) were reduced, related to the backward displacement of the maxilla.

UPPER FACE: Facial width was unchanged (Zy-Zy), but the intraocular distance (Mo-Mo) showed a highly significant increase. The distance between lateral orbital margins was increased only in the upper part (Lo-Lo), and less marked in the middle part (Ek-Ek). This resulted in narrowing of the orbits (Mo-Ek). These findings were consistent with those reported in $UCLP_c$ and were reflected by the interorbital index. There was a marked widening of the nasal cavity (Apt-Apt), but the width of the basal alveolar arch (Em-Em) was unchanged.

The anterior heights of the upper face were increased (N-Ss and N-Pr). Because of marked retroinclination of the dentoalveolar component (ASL/PL) there was also an increase of the distance between the incisal edge of the upper incisors and the anterior nasal spine (Sp-Is). There was a reduction of height dimensions within lateral parts of the upper face (Zm-NSL, Em-HL). The nasal bones were longer (N-Rhi).

The depth of the upper jaw as a whole (Sp-Pl, Ss-Pl) was not reduced, but the depth of the maxilla alone (M-Pl) was significantly smaller. The upper jaw was displaced backwards relative to the cranial base (Ptm-VL, Pl-VL) and in spite of the displacement of the premaxilla forwards (Sp-M) this resulted in a retrusion of the upper face (S-N-Ss, S-N-Sp). The retrusion was accompanied by a corresponding steeper slope of nasal bones (S-N-Rhi) and retrusion of the zygomatic bones (S-N-Zm) and orbits (S-N-Or). There was a marked retroinclination of upper incisors and of the alveolar process (ISL/PL, ASL/PL).

TABLE 1. Bilateral Cleft Lip and Palate: Differences from Non-cleft Controls.

Variable	*Mean*	*S.E.*	*dif.*	*Variable*	*Mean*	*S.E.*	*dif.*
Cranium—Lateral				*Facial height—Lateral*			
N-Op	192.46	1.20	+0.80	N-Rhi	28.77	0.85	$+3.81^{xxx}$
Ba-Br	147.58	1.08	-4.96^{xxx}	N-Sp	58.77	0.75	+1.63
S-P	124.73	0.90	−0.35	N-Ss	62.96	0.93	$+2.56^{x}$
Ba-O	37.88	0.54	+0.36	N-Pr	78.35	1.21^{+}	$+2.91^{x}$
N-Ba	113.08	1.03	+0.76	N-Gn	136.88	1.70	$+6.72^{xx}$
N-S	75.08	0.79	+0.04	Sp-Is	35.45	1.33	$+4.37^{xx}$
S-Ba	47.19	0.65	-2.13^{xx}	Is-PL	32.73	1.08	+1.93
Facial depth-Lateral				Sp-Pr	21.00	0.91^{+}	$+2.40^{x}$
Ss-Pl	52.42	1.24^{++}	+0.02	Pr-PL	19.31	0.93^{+}	+0.97
Sp-Pl	57.15	1.28^{++}	+0.45	Ii-Gn	49.58	0.67	$+3.64^{xxx}$
Sp-K	31.69	1.18^{++}	+0.27	Id-Gn	37.35	0.61	$+2.85^{xxx}$
Sp-M	17.58	1.19^{++}	$+8.80^{xxx}$	Pr-Id	22.75	0.67^{+}	+1.45
M-Pl	39.62	0.72	-8.10^{xxx}	Sp-Pg	74.04	1.29	$+6.38^{xxx}$
Pl-Pmp	−0.54	0.34^{++}	-1.22^{xx}	S-Pgn	136.50	1.57	+0.94
Pl-Ba	42.85	0.85	-5.65^{xxx}	S-Go	85.04	1.12	-3.06^{x}
Pl-VL	7.54	0.77	-6.60^{xxx}	S-Pl	48.58	0.92^{+}	-2.36^{x}
Ptm-VL	10.73	0.43	-2.93^{xxx}	Pl-NSL	47.92	0.84^{+}	−1.02
Mandible-Lateral				Zm-NSL	46.58	0.75	-2.00^{x}
Cd-Go	64.96	0.80	-2.46^{x}	Or-NSL	28.46	0.50	+0.40
Go-VL	20.69	1.19	$+2.99^{x}$				
Ar-tGo	55.19	0.80	-2.65^{x}				
Cd-NSL	17.81	0.58	−1.35				
Pgn-tGo	78.00	1.04	-2.72^{x}				
Pgn-Go	77.00	1.10	−1.96				
Cranial angles				*Upper face angles*			
S-N-F	83.62	0.73	−1.38	PL/NSL	9.77	0.85	+1.75
N-S-Br	82.88	0.76	+0.70	ASL/PL	90.29	2.20^{+}	-17.31^{xxx}
N-S-L	145.42	0.96	+1.34	ISL/PL	70.27	3.19	-21.99^{xxx}
N-S-I	179.42	0.92	−0.04	S-N-Or	49.38	0.85	-5.20^{xxx}
N-S-Ba	134.23	0.79	+2.07	S-N-Zm	48.12	0.61	-5.32^{xxx}
Profile angles				*Mandibular angles*			
S-N-Rhi	108.08	1.07	-7.18^{xxx}	ML/NSL	39.85	1.25	$+9.79^{xxx}$
S-N-Sp	78.85	1.07	-6.37^{xxx}	ML/RL	129.42	1.42	$+7.46^{xxx}$
S-N-Ss	74.38	0.87	-6.30^{xxx}	CL/ML	63.27	1.09	-7.49^{xxx}
S-N-Pr	74.04	0.78	-8.90^{xxx}	RL/NSL	90.23	1.17	+2.07
S-N-Id	74.88	0.80	-5.20^{xxx}	MAL/NSL	63.62	0.95	$+5.42^{xxx}$
S-N-Sm	73.27	0.83	-4.93^{xxx}	PL/ML	30.08	1.08	$+8.04^{xxx}$
S-N-Pg	75.38	0.86	-4.46^{xxx}	IIL/ML	63.74	1.97	-15.82^{xxx}
Ss-N-Sm	1.12	1.05^{+}	−1.36	IIL/NSL	76.42	1.79	$+5.64^{xx}$
Ss-N-Pg	−1.00	1.14^{++}	−1.84	N-S-Cd	134.27	1.34	+3.19
N-Ss-Pg	181.65	2.04^{++}	+3.53	N-S-Pgn	73.42	0.88	$+4.94^{xxx}$
Height-Soft tissue				*Depth-Soft tissue*			
N′-Prn	58.62	0.87	−0.72	Prn-Sn	22.12	0.74^{++}	$+2.12^{x}$
N′-Sn	65.04	0.77	+1.00	Prn-Sp	28.12	1.22^{++}	-4.18^{xx}
N′-Sto	86.69	1.20	−0.09				
N′-Pg′	125.69	1.48	$+5.31^{xx}$	*Profile-Soft tissue*			
Sn-Ls	15.77	0.65	-1.89^{x}	S-N′-Ss′	77.88	0.53^{+*}	-9.20^{xxx}
Sn-Sto	22.08	0.80	-2.26^{x}	S-N′-Sm′	75.81	0.80	-4.11^{xxx}
Thickness-Soft tissue				S-N′-Pg′	77.50	0.89	-4.84^{xxx}
Ss_t'	12.96	0.70^{++}	-1.84^{x}	Ss′-N′-Sm′	2.08	0.49^{+}	-5.08^{xxx}
Pr_t	14.39	0.64^{++}	−0.87	Ss′-N′-Pg′	0.38	0.53	-4.36^{xxx}
Id_t	11.50	0.26	−0.10	N′-Sn-Pg′	177.46	1.34	$+12.82^{xxx}$
Sm_t'	11.31	0.23	-0.95^{xx}	N′-Prn-Pg′	143.04	1.40	$+9.04^{xxx}$

TABLE 1—*Continued*

Variable	*Mean*	*S.E.*	*dif.*	*Variable*	*Mean*	*S.E.*	*dif.*
Pg_t'	*13.62*	*0.45*	*−1.06*				
Cranium-Frontal				*Orbits-Frontal*			
Eu-Eu	162.62	1.57	−0.77	Mo-Mo	30.08	0.58	$+3.18^{xxx}$
Lf-Lf	112.81	0.67	$+3.52^{xxx}$	Lo-Lo	105.50	0.83	$+3.91^{xxx}$
Upper face-Frontal				Ek-Ek	110.85	0.85	+1.20
Zy-Zy	147.46	1.03	+0.28	Mo-Ek dx	40.31	0.30	-1.20^{xx}
Apt-Apt	39.00	0.77	$+4.33^{xxx}$	Mo-Ek sin	40.12	0.30	-1.19^{xx}
Em-Em	69.23	0.87	+0.88	i. interorb.	27.08	0.41	$+2.47^{xxx}$
Em-HL dx	58.85	0.75	-3.72^{xxx}	*Mandible-Frontal*			
Em-HL sin	57.85	0.79	-4.33^{xxx}	Go-Go	111.62	1.54	−0.93
Mmd-HL dx	53.00	0.89	−1.69	Ag-Ag	96.88	0.84	−1.16
Mmd-HL sin	52.84	0.81	−1.71	^{2}dev.Id	−0.19	0.30^{++}	0.09
^{1}dev.Bsptn	+0.15	0.46^{++}	0.02	^{2}dev.Gn	−0.38	0.17	0.20
dev.Intis	0.00	0.50^{++}	0.02				

^{x} $p < 0.05$ ^{xx} $p < 0.01$ ^{xxx} $p < 0.001$

$^{+}$ Significantly higher variance in clefts than in controls

^{1} deviation to the right, ^{2}deviation to the left (in degrees)

* the only characteristic where the variance was significantly smaller in clefts than in controls

TABLE 2. Difference Between Patients With Premaxillary Setback (Set) and Without (Nonset) and controls

Variable	*set*	*nonset*	*Variable*	*set*	*nonset*
Linear measurements			Angular measurements		
N-S	−0.26	+0.20	PL/NSL	+0.20	$+2.57^{x}$
S-Ba^{++}	-4.43^{xxx}	−0.91	ML/NSL	$+8.38^{xxx}$	$+10.53^{xxx}$
N-Rhi	$+2.73^{x}$	$+4.41^{xx}$	ASL/PL^{+}	-11.22^{xx}	-20.35^{xxx}
N-Sp	+0.08	$+2.45^{x}$	S-N-Sp	-9.66^{xxx}	-4.83^{xxx}
N-Ss^{+}	+0.27	$+3.78^{xx}$	S-N-Ss	-7.90^{xxx}	-5.44^{xxx}
N-Pr^{+}	−0.33	$+4.62^{xx}$	Ss-N-Sm	−2.92	−0.54
N-Gn	+3.17	$+8.60^{xxx}$	Ss-N-Pg	−3.73	−0.84
Sp-Pr^{++}	−1.16	$+4.28^{xxx}$	N-Ss-Pg	+6.99	+1.70
Pr-PL	−0.45	+1.72	Soft profile		
Sp-Pg	$+4.78^{xx}$	$+7.22^{xxx}$	N′-Sn^{+}	−1.04	+2.08
S-Go	−4.66	−2.22	N′-Sto	−1.89	+0.87
Zm-NSL	-3.47^{x}	−1.23	N′-Pg′	+3.95	$+6.03^{xx}$
Ss-Pmp^{+}	−2.96	+1.60	Prn-Sp	−1.41	-5.65^{xxx}
Sp-Pmp^{++}	−3.92	+2.77	Ss_t'	−1.14	-2.27^{xx}
Sp-K^{+}	−4.07	+1.75	Pr_t	−0.26	−1.26
Sp-M^{++}	+4.22	$+11.22^{xxx}$	Ss′-N′-Sm′	-5.38^{xxx}	-4.92^{xxx}
M-Pl	-8.17^{xxx}	-8.07^{xxx}	Ss′-N′-Pg′	-4.52^{xxx}	-4.27^{xxx}

$^{+}$ Significant differences between individuals with and without premaxillary setback at $p < 0.05$ ($^{++}$ at $p < 0.01$)

^{x} Significant differences between clefts and controls

Premaxillary setback was followed by significant changes in the upper jaw (Figure 2, Table 2). The height dimensions of the upper face (N-Sp, N-Ss, N-Pr) were increased in the nonsetback patients. The depth of the maxilla (Sp-Pmp, Ss-Pmp) was reduced in the premaxillary setback subgroup, by the displacement of the premaxilla (Sp-M). The depth of the posterior maxilla (M-Pl) was identical in both subgroups. The third significant difference consisted in the retroinclination of the alveolar proc-

TABLE 3. Differences Between Individuals with Bilateral and Unilateral Complete Cleft Lip and Palate For Characteristics which Showed Changes After Premaxillary Setback (Table 2), only Individuals without Setback are Included in the Comparison

Heights		*Depths*		*Angles*		*Angles*	
N-Sp	+5.53^{xxx}	Ss-Pmp	+6.75^{xxx}	N-S-L	−2.80^{x}	PL/NSL	+4.12^{xx}
N-Ss	+6.30^{xxx}	Sp-Pmp	+8.28^{xxx}	N-S-I	−3.17^{x}	ML/NSL	+3.62
N-Pr	+5.97^{xx}	Sp-K	+4.77^{xxx}	N-S-Ba	+3.95^{xx}	MAL/NSL	+2.59^{x}
N-Gn	+6.14^{x}	Sp-M	+8.94^{xxx}	N-S-Cd	+4.15^{x}	ASL/PL	−8.31^{xx}
Sp-Pr	+2.41	M-Pl	−0.60	S-N-Sp	+2.43	ISL/PL	−13.94^{xxx}
Sp-Pg	+1.85	Pmp-VL	−4.43^{xxx}	S-N-Ss	+0.46	N-S-Pgn	+2.36^{x}
Ii-Gn	+2.29^{x}	Go-VL	+3.10	S-N-Pr	−2.55^{x}	Ss-N-Sm	+3.10^{x}
N′-Sn	+3.78^{xx}	Prn-Sp	−3.16^{xx}	S-N-Sm	−2.67^{x}	Ss-N-Pg	+3.16^{x}
N′-Sto	+3.00	Prn-Sn	+2.50^{xx}	S-N-Pg	−2.43^{x}	N-Ss-Pg	−5.68^{x}
N′-Pg′	+5.35^{x}	Ss_t′	−1.14	S-N-Or	−3.28^{xx}	S-N′-Ss′	−1.68
Op-NSL	+8.34^{xx}	Ba-O	+2.04^{x}	S-N-Zm	−1.97^{x}	S-N′-Pg′	−2.44^{x}

The differences were not significant in the other measured characteristics including Apt-Apt +1.41, Lo-Lo +1.94 and Lf-Lf +1.68 (AP projection)

+ = $BCLP_c$ larger − = $BCLP_c$ smaller

^{x} Significant differences between bilateral and unilateral clefts

ess (ASL/PL) which was almost twice as marked in patients without setback. It was not possible to assess the retroinclination of incisors because of the small number of cases.

MANDIBLE: Mandibular body (Pgn-tGo) and ramus (Cd-Go) were shortened, while the anterior mandibular height (Ii-Gn) was increased. The gonial angle was obtuse (ML/RL) and the chin angle was more acute (CL/ML). Although the incisors were markedly retroinclinated (IIL/ML), their position in relation to the cranial base was less deviated (IIL/NSL).

Deviations in the position of the mandible were due mostly to changes of its shape. The mandible was retrognathic (S-N-Id, S-N-Sm, S-N-Pg) with a steeper slope of the body (ML/NSL). The mandibular angle was situated at a higher level (Ar-tGo) and in accordance with posterior growth rotation of the mandible (MAL/NSL) was displaced backwards (Go-VL). Total anterior growth (S-Pgn) was consistent with the norm, but showed a deviation in a distal direction (N-S-Pgn).

MAXILLOMANDIBULAR RELATIONS: Sagittal maxillomandibular relations (Ss-N-Sm and Ss-N-Pg) were not disturbed although the retroinclination of the dentoalveolar maxillar component caused an anterior crossbite. The steep slope of the mandibular body resulted in a hyperdivergency of vertical maxillomandibular relations (PL/ML).

FACIAL PROFILE: The skeletal profile was not significantly flattened (N-Ss-Pg) and in individuals without premaxillary setback virtually corresponded to the norm. However, its posterior obliquity was more marked (S-N-Pg). The thinner upper lip (Ss'_t) led to a flat soft tissue profile (N′-Sn-Pg′). There was a reduced distance between the tip of the nose and the anterior nasal spine (Prn-Sp), but not after a premaxillary setback. Anteroposterior relation between the upper and lower face (Ss′-N′-Sm′, Ss′-N′-Pg′) was disturbed. There were no differences in the configuration of the soft tissue profile between the subgroups: the displacement of the premaxilla backwards led to a slightly deeper nasolabial concavity and had a secondary effect on the thickness of the upper lip (Ss'_t, Pr_t).

The length and height of the nose (N-Prn, N-Sn) and height of the upper face (N′-Sto) were unchanged, while the height of the lip was reduced (Sn-Sto, Sn-Ls). The depth of the nose was increased (Prn-Sn) due to the surgical prolongation of the columella. Premaxillary setback had a significant effect on the height of the nose (N′-Sn) and upper face.

THE FACE AS A WHOLE: The total height of the face (N-Gn, N′-Pg′) was increased predominantly as the result of the in-

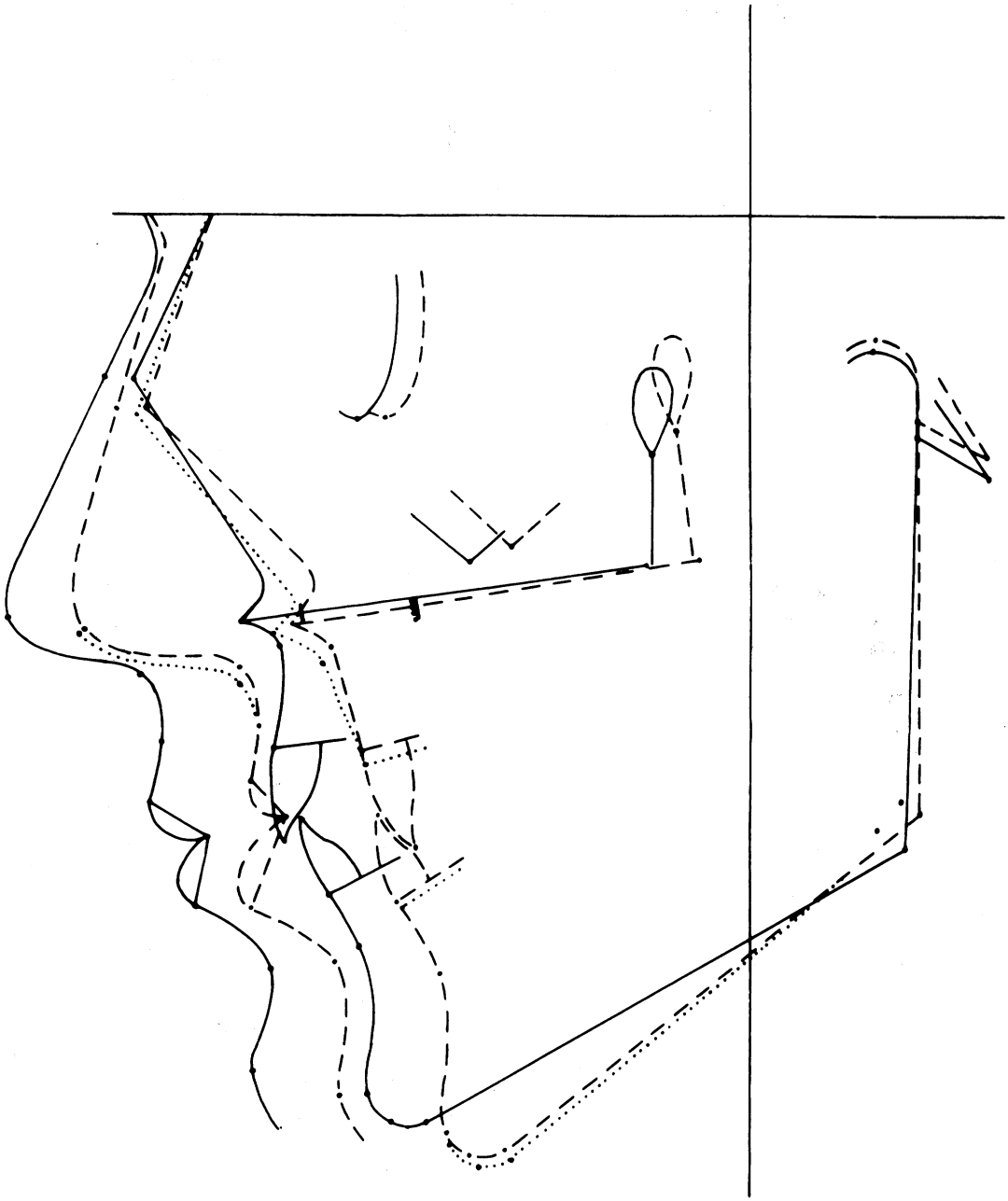

FIGURE 1. Faciograms in lateral projection (solid line = controls, dashed line = bilateral complete cleft lip and palate—the whole series, dotted line = bilateral complete cleft lip and palate without premaxillary setback).

creased height of the lower face (Sp-Pg). This increase was caused by the increased height of mandibular symphysis (Id-Gn) and by the prolongation of the distance Sp-Pr. The posterior height of the face was reduced (S-Go), so that the ratio of posterior to anterior height was 62.1% (67.7% in controls).

FACIAL ASYMMETRY: In anteroposterior projection there were no differences be-

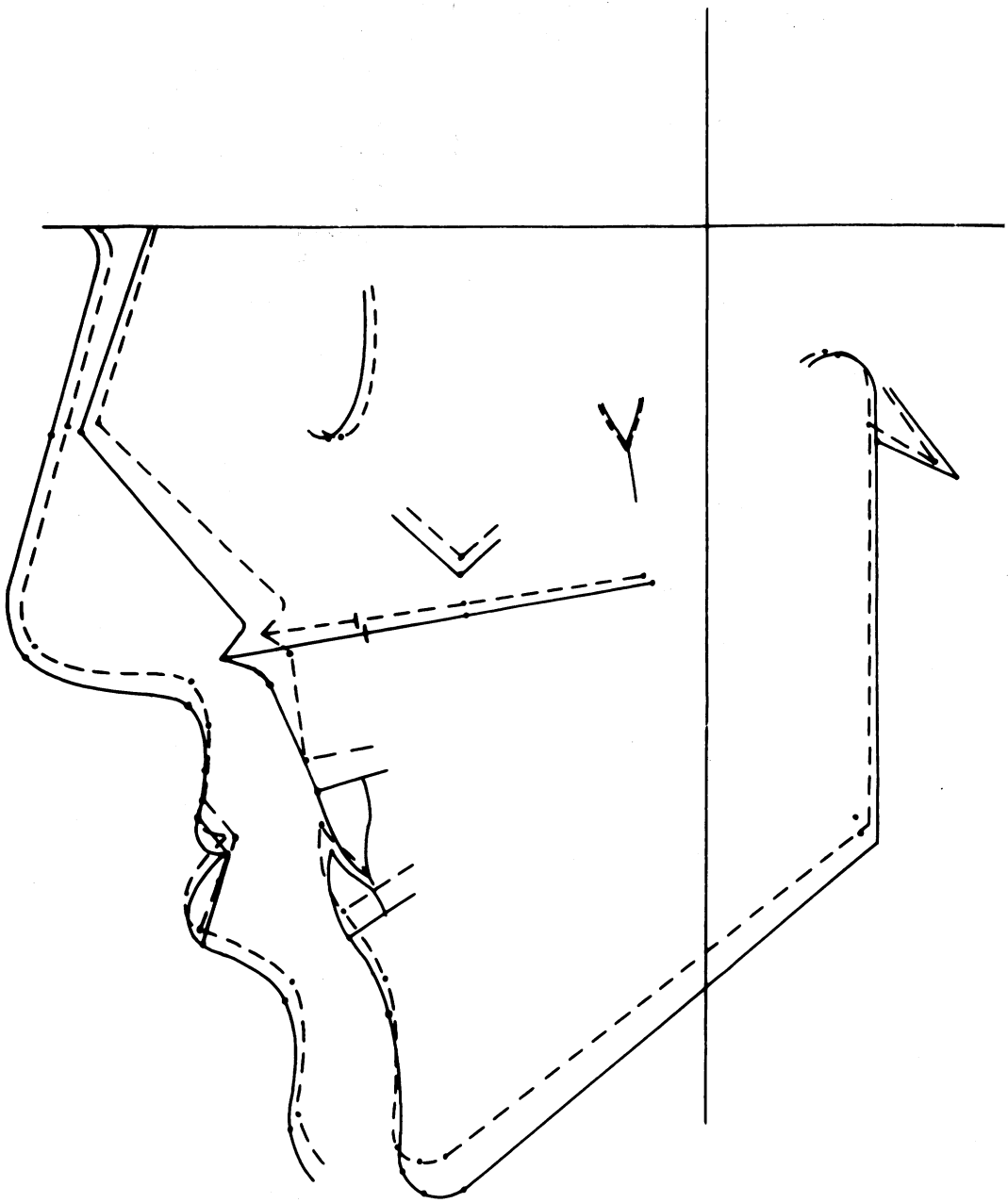

FIGURE 2. Faciograms in lateral projection (solid line = $BCLP_c$ without premaxillary setback, dashed line = $BCLP_c$ with premaxillary setback).

tween any of the investigated dimensions on the right and left side. None of the midline structures deviated significantly, though increased variability indicated that they were deviated more frequently.

VARIABILITY: Some characteristics of the upper jaw and profile showed increased variability. The variance ratio of maxillary depth was unchanged (M-Pl) and showed uniformity of its shortening.

CERVICAL SPINE: Synostoses of the cervical vertebrae was noted in two individuals (5.6%).

Discussion

One of our earlier papers (Šmahel and Brejcha, 1983) included a description of changes associated with unilateral cleft lip and palate. The basic skeletal deviations consisted of reduced upper face height, maxillary depth and mandibular growth, dentoalveolar retroinclination of the upper jaw, and widening of the nasal cavity and of the interocular distance. An independent deviation represented a displacement of the upper jaw backwards. The prolongation of nasal bones showed a good correlation with the retrusion of the upper jaw. These deviations resulted in changes of the profile, of maxillomandibular relations, as well as of the global parameters of the face.

The deficient vertical growth of the upper face was interpreted as the result of impaired interaction between the maxilla and the nasal septum. The retroinclination of upper incisors and of the alveolar process resulted from the increased tension exerted by the repaired lip. The shorter maxillary depth was due predominantly to the postoperative growth insufficiency within the circummaxillary sutures. The widening of the nasal cavity was related to the lateral displacement of maxillar segments in complete clefts. An enlarged interocular space occurred regularly in clefts of the primary palate (Šmahel, 1984b). Mandibular deviations were due to the deficient growth of its body and ramus which was partly of primary origin (Šmahel and Brejcha, 1983). The shortening of the ramus resulted in a steeper slope of the mandibular body and in an obtuse gonial angle which were compensated by the more acute chin angle and by the increase of the anterior height of the mandible. These interrelations were documented in one of our earlier reports (Škvařilová and Šmahel, 1980). The retrusion of both jaws was caused by their shortening and by the posterior shift of the maxilla or by the posterior growth rotation of the mandible resp. The configuration of the soft profile corresponded to that of the skeletal profile, yet the height and thickness of the upper lip were reduced. These changes represented primary sequelae of tissue deficiency.

A comparison of these characteristics with those recorded in bilateral clefts is presented on Figure 3; significant differences are summed up in Table 3. In bilateral involvement due to the displacement of the premaxilla forwards there was not a shortening of the total depth of the upper jaw. However because of a more marked displacement of the maxilla backwards (Pmp-VL) the retrusion of the upper face was similar to $UCLP_c$.

The increased length of the face as a whole (N-Gn, N′-Pg′) was more pronounced than in $UCLP_c$. It was associated with an even more marked posterior growth rotation of the face (N-S-Pgn) with a retroinclination of the palate plane (PL/NSL) and a greater retrusion of the mandible (S-N-Sm, S-N-Pg, Go-VL). With these changes was a posterior displacement of zygomatic bones and orbits (S-N-Zm, S-N-Or). Because of a more marked retrusion of the mandible, the skeletal profile was notflattened (N-Ss-Pg) and the maxillomandibular relations were not disturbed (Ss-N-Sm, Ss-N-Pg) as compared to $UCLP_c$. This was caused by the protrusion of the premaxilla alone (Sp-M). A higher degree of posterior growth rotation of the mandible (MAL/NSL) was accompanied by an even more marked compensatory increase of the anterior height (Ii-Gn) (Figure 4).

The third major difference from $UCLP_c$ consisted in a more pronounced retroinclination of upper incisors (ISL/PL) and of the alveolar process (ASL/PL). It was reflected by the significant difference between the angle S-N-Pr in these two series.

The configuration of the soft tissue profile corresponded to its skeletal framework. The significant increase in nasal depth (Prn-Sn) resulted from the surgical prolongation of the columella, while the smaller distance between the nasal tip and the anterior spine (Prn-Sp) resulted from the protrusion of the premaxilla.

The neurocranium in $BCLP_c$ showed no posterior rotation of the cranial vault (N-S-L, N-S-I, Op-NSL), related, probably, to the slightly flatter cranial base which was significant as compared to $UCLP_c$ (N-S-Ba,

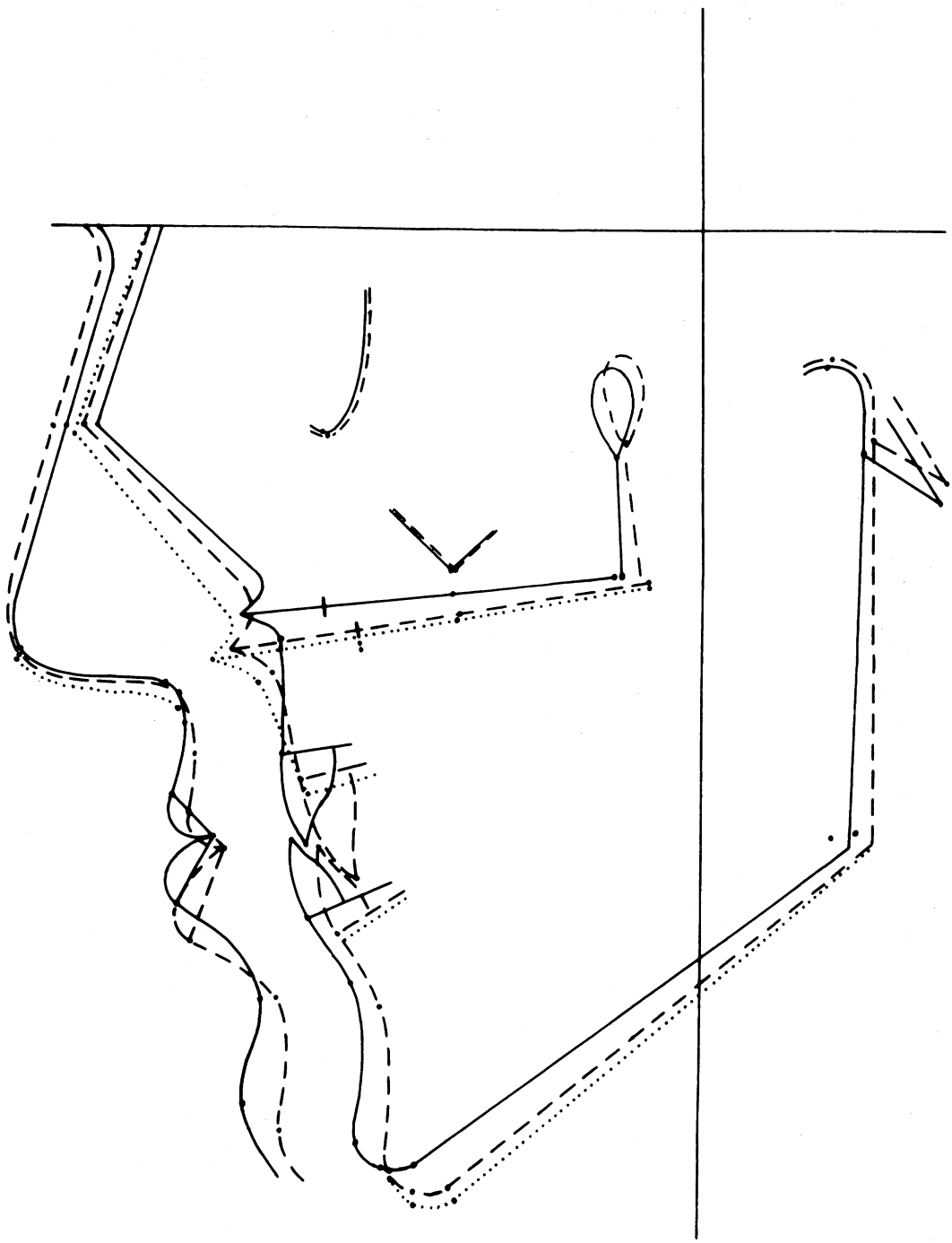

FIGURE 3. Faciograms in lateral projection (solid line = complete unilateral cleft lip and palate, dashed line = $BCLP_c$—the whole series, dotted line = $BCLP_c$ without premaxillary setback).

N-S-Cd). It was not possible to establish whether the flattening was primary or secondary due to the marked posterior growth rotation of the face. A shortened clivus (S-Ba) was present only in a series with $BCLP_c$. It did not occur in UCLP, CP or CL.

A shortening of maxillary depth (M-Pl) was similar to that recorded in $UCLP_c$, but

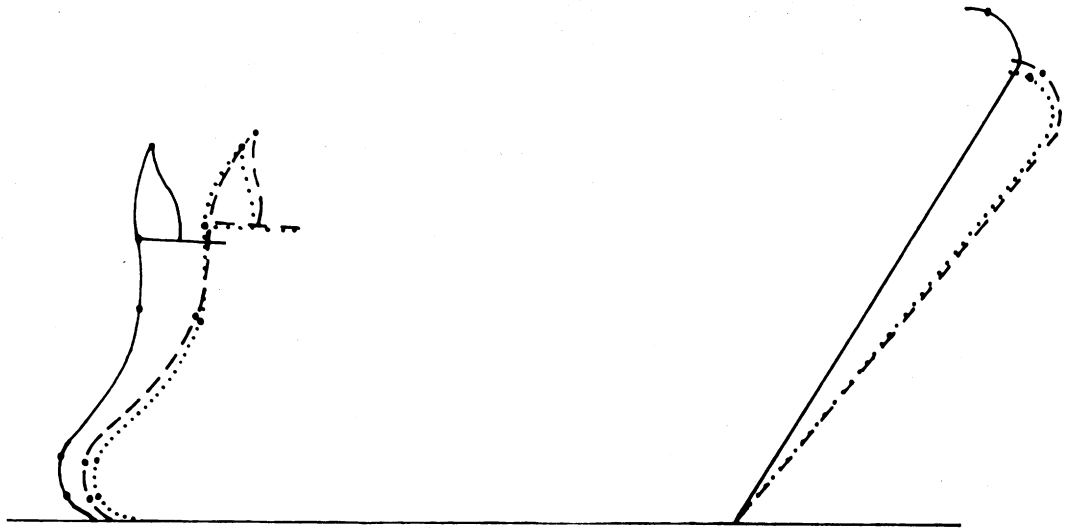

FIGURE 4. Morphograms of the mandible (solid line = controls, dashed line = complete bilateral cleft lip and palate, dotted line = complete unilateral cleft lip and palate).

with the greater displacement of the maxilla backwards the retrusion of lateral dentoalveolar segments and maxilla was even more marked than in unilaterals. This was confirmed by the higher degree of retroposition of zygomatic bones and orbits and was in agreement with the global posterior growth rotation of the face.

In spite of the differences, the deviations in the configuration of the face in unilateral and bilateral cleft lip and palate were characterized by identical basic patterns. They included the retroinclination of the dentoalveolar component of the upper jaw, the retroposition of the mandible and of the maxilla per se, the posterior growth rotation of the face, the reduction of the upper lip thickness and retrocheilia. There was an identical impairment of vertical growth within the lateral parts of the upper face.

These findings were compared with those recorded in the series with isolated cleft palate (Šmahel, 1984a) as well as those observed in cleft lip alone (Šmahel, 1984b). These comparisons disclosed a gradual increase of facial dysmorphogenesis in the following order: CL, CP, UCLP and BCLP. This was in agreement with conclusions reached by Cronin and Hunter (1980). The occurrence of cervical vertebrae anomalies was suggestive of a strong teratogenic impulse (this is in agreement with the demonstration of these anomalies in isolated cleft palate and with its absence in UCLP and CL, Šmahel 1984a).

In the literature were found only a few cephalometric studies aimed at a comparison of unilateral and bilateral complete cleft lip and palate. Dahl (1970) had also reported a more marked retroinclination of upper incisors and a slighter shortening of upper jaw depth in bilateral clefts compared to unilaterals. There were also signs of a greater retrusion and posterior growth rotation of the mandible with less marked impairment of sagittal maxillomandibular relations. Again, the retrusion of the upper jaw was almost identical in both conditions. Vaško (1975) found a higher degree of posterior obliquity of the profile and steeper slope of the mandibular body with an increased impairment of maxillomandibular vertical relations and a more obtuse gonial angle, a higher retroinclination of upper incisors and an increased height of the upper face in bilateral clefts as compared to unilaterals. The retrusion of the maxillary complex was identical in both forms of clefts. A similar observation was reported by Cronin and Hunter (1980) in their analysis of six pairs of twins discordant for BCLP as compared to twins with

UCLP. In the former there was a higher posterior shift of the maxilla, retrusion and posterior rotation of the mandible with a steeper slope of its body, and an increased total
length of the face due to the lower position of the mandible. Retroposition and a superior position of lateral maxillary segments in complete BCLP were reported also by Narula and Ross (1970), suggestive of deficient maxillar growth in anterior and distal directions. Horowitz et al. (1980) found also some differences of craniofacial morphology between complete BCLP and UCLP. A higher retroinclination of the palatal plane and a steeper slope of the mandibular body in BCLP provided signs of a more marked posterior growth rotation of the face. Contrary to the reduced posterior height of the upper face its anterior height was not smaller. The reduction of the former was not confirmed in our series when the posterior height was measured at the endpoint of palatal processes perpendicular to NSL. These authors observed also a smaller surface area of the pharynx.

Deviations in the configuration of the face in bilateral clefts were studied in early childhood by Hanada and Krogman 1975, Ishiguro et al. 1976, Krogman et al. 1982. The situation differed during this period of life, although the latter study confirmed an increased height of the upper face in BCLP as compared to UCLP or CP.

A comparison with data from the literature disclosed that our results were in good agreement.

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