European Journal of Orthodontics 19 (1997) 411–422

Evaluation of facial features in two groups of cleft lip and palate patients receiving centralized and non-centralized treatment regimes

Meropi N. Spyropoulos* and Sten Linder-Aronson**

*Department of Orthodontics, School of Dentistry, University of Athens, Greece and **Department of Orthodontics and Pediatric Dentistry, School of Dentistry, Karolinska Institutet, Huddinge, Sweden

SUMMARY The aims of the present study were: (a) to evaluate facial profile and other findings in a group of cleft lip and palate (CLP) patients receiving centralized services as compared with a group of patients who received non-centralized services and who were not submitted to bone grafting procedures; and (b) to evaluate and compare the outcome of early bone grafting procedures that were included in the centralized treatment regime to the outcome of a non-centralized treatment approach that did not include bone grafting procedures.

Forty-three lateral cephalometric radiographs of CLP Greek Caucasian children not receiving centralized treatment and 43 lateral cephalometric radiographs of CLP Swedish Caucasian children receiving centralized treatment, strictly matched for age, sex, and type of cleft, were compared as a total and in two subgroups, according to age. Differences were also evaluated in the unilateral (UCLP) and in the bilateral (BCLP) groups separately, as well as in groups discriminated by age, i.e. in the patients born before 1984 (age 11–19 years) and in those born after 1984 (age 4–10 years), as 1984 was the year when early bone grafting was discontinued in the Stockholm area.

The findings of this study revealed the following. The overall difference in facial and dental cephalometric findings between CLP children receiving a centralized treatment approach as compared with those treated without centralization was significant. The Swedish group showed a trend towards better cephalometric values throughout all the age groups.

When the early age groups were compared, the early bone grafting procedure that was included in the centralized treatment regime did not seem to be a positive factor, in comparison with the absence of bone grafting in the non-centralized treatment regime.

Introduction

The management of patients exhibiting clefts of the lip and palate demands a multidisciplinary approach involving many specialists co-operating towards a universal goal, that being the optimal physical, psychological and social outcome for the patient. These services are provided in various centres where different treatment regimes are followed. In order to increase the information needed to improve the outcome of the treatment regimes delivered in such centres, several retrospective inter-centre studies have been undertaken (Ross, 1987; Brattström *et al.*, 1991; Mölsted *et al.*, 1991; Asher-McDade *et al.*, 1992). From these studies, it was concluded that one of the factors that appeared to be of major significance for the final result was whether a bone grafting operation has been performed and, also, the timing of its performance (Friede and Johanson, 1974; Brattström and McWilliam, 1989). However, all samples studied in the above investigations were receiving a centralized team service, and no sample representing a randomized, non-centralized treatment approach was included in these studies. In the Stockholm area, there was a consistent early bone grafting procedure (Nordin, 1957; Nordin *et al.*, 1983), performed for all cleft lip and palate (CLP) children born before 1984. This procedure has been discontinued since then, and has been replaced by a regime prescribing the bone grafting

operation after the age of 10 years. Patients originating from the Stockholm Centre could be clearly classified into two separate entities, with the year of birth being used as a solid criterion. On the other hand, after the recent establishment of a Cleft Lip and Palate Clinic in the Department of Orthodontics of the University of Athens, it was possible to collect a sample of patients who had not received any centralized services, had never undergone any bone grafting operation, but who were treated in a randomized approach by individual specialists.

The aims of the present study were as follows: (a) To evaluate facial profile and other findings in a group of patients receiving centralized services from the day of birth, as compared with a group of patients who received non-centralized services. In the non-centralized services no bone grafting procedures were included. (b) To evaluate and compare the outcome of early bone grafting procedures included in a centralized treatment regime with the outcome of a non-centralized treatment approach in which no bone grafting operation was included.

Materials and methods

The material comprised in total 86 lateral cephalometric radiographs; 43 of them were of Greek Caucasian children and 43 of Swedish Caucasian children, all exhibiting unilateral or bilateral total CLP malformations. More specifically, the samples studied were as follows.

(a) The Greek sample consisted of 30 boys and 13 girls ranging in age from 4 to 19 years, randomly selected from those attending the Cleft Lip and Palate Clinic of the University of Athens. The selection was stratified for age and sex so as to obtain a reference group with all ages between 4 and 19 years, represented in a balanced proportion.

Sixteen boys had bilateral cleft lip and palate (BCLP) and 14 unilateral cleft lip and palate (UCLP); of the 13 girls, four had BCLP and nine UCLP.

All lateral cephalometric radiographs were taken when each one of the above patients attended the Cleft Lip and Palate Clinic to be examined for the first time. Treatment procedures that had been performed up to that time included various operations for lip and palate closure, but not bone grafting; also, minimal orthodontic attempts were made, but they were usually repeatedly discontinued and had no co-ordination whatsoever with the surgical procedures performed.

More specifically, it was mentioned in the history of some of the Greek patients that they had some type of removable appliance in the mixed dentition stage. However, no comprehensive orthodontic treatment was ever undertaken, and there was no follow-up or time matching with other therapeutic procedures.

(b) The Swedish sample was selected as follows. For every Greek patient, a reciprocal identical patient was selected from the files of the patients undergoing centralized treatment at the Cleft Lip and Palate Clinic of the Orthodontic Department of the Karolinska Dental School. Selection was based on strict matching criteria which included sex, age, and identical type of cleft. Classification of clefts was undertaken according to Fogh Andersen (1967) and only patients presenting complete clefts were included in this study. For the parameter of age, no more than 3 months difference was allowed for every pair of corresponding Greek and Swedish children. Therefore, the Swedish sample also comprised 30 boys and 13 girls, identical to the Greek sample as far as sex, age, and type of cleft were concerned.

The Swedish sample selected in this way was used as a control group, comprising children undergoing various stages of treatment as well as, young adults after completion of the planned treatment regime. Hence, a comparison of the total range of results was possible because all the stages of treatment as well as the final outcome were represented in the sample.

The treatment regime applied to the centralized Swedish patients was as follows.

Before January 1984

At birth, the patient was hospitalized for 6 months while the position of the jaw segments was corrected by pre-operative jaw orthopaedics and traction of the nasal septum. At 6 months, primary bone grafting was performed in the cleft area. Lip surgery at 3 months and closure of the

soft palate and/or of the hard palate at 18 months. Orthodontic treatment followed between 5 and 10 years of age, and secondary bone grafting in the cleft area at 10–11 years when needed, before the eruption of the canine. Orthodontic treatment, if necessary, continued to 20 years of age.

After January 1984

Lip surgery at 3 months and closure of the soft palate and/or of the hard palate at 12 months. Orthodontic treatment between 5 and 10 years of age. Bone grafting in the cleft area at 10–11 years, before the eruption of the canine. Orthodontic treatment, if necessary, to 20 years of age.

Evaluation according to age

Furthermore, on the basis of the date of birth of the Swedish sample, the two samples were divided into two subgroups as follows.

1. Those born after January 1984 and ranging in age from 4 to 10 years. The Swedish sample belonging to this subgroup was not submitted to any bone grafting procedures because early bone grafting in Sweden was discontinued at the end of 1983; since which time secondary bone grafting is performed only at 10 years of age.
2. Those born before 1984 and ranging in age from 11 to 19 years. The Swedish sample belonging to this subgroup had received an early bone grafting operation, performed usually at age 6–8 months.

Of these two subgroups, only the UCLP cases were compared, as the numbers of BCLP were small. All cephalometric radiographs were digitized, magnification corrections were made, and the landmarks shown in Figure 1 were used to create plots of tracings, linear and angular variables as follows.

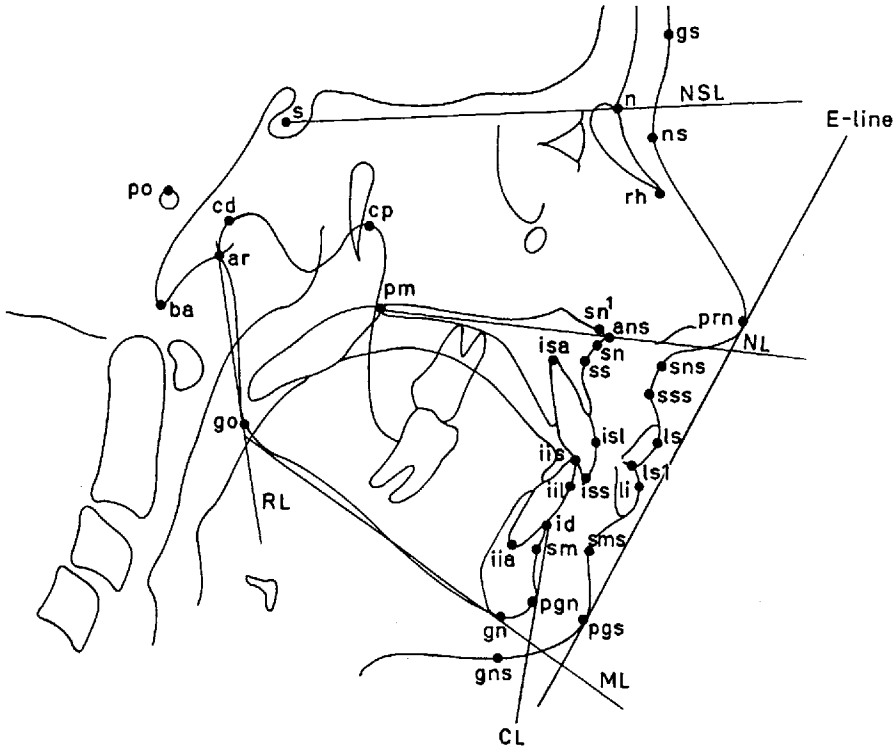

Figure 1 Reference points and planes used in the cephalometric analysis.

Reference points and planes used in the cephalometric analysis

ans: The tip of the anterior nasal spine
ar: Articulare. The intersection between the external contour of the cranial base and the dorsal contour of the condyle
ba: Basion. The most inferior point on the clivus of the occipital bone
cd: Condylion. The most superio-posterior point on the condylar head
cp: The most superior point on the coronoid process
gn: Gnathion. The most inferior point on the mandibular symphysis
gns: Soft tissue gnathion. The soft tissue point overlying gnathion
go: Gonion. The intersection between the external contour of the mandible and the bisector of the angle between the RL and the ML lines
gs: Soft tissue glabella. The most anterior point on the soft tissue of the forehead.
id: Infradentale. The most anterio-superior point on the lower dento-alveolar margin
isa: Upper incisor apex
iss: Upper incisor edge
isl: Upper incisor labial surface
iis: Lower incisor edge
iia: Lower incisor apex
iil: Lower incisor labial surface
li: Labrale inferius. The most prominent point of the prolabium of the lower lip
ls: Labrale superius. The most prominent point on the prolabium of the upper lip
lsl: The most inferior point of the upper lip
n: Nasion. The most anterior point on the frontonasal suture
ns: Soft tissue nasion. The deepest point on the frontonasal curvature
pgn: Pogonion. The most anterior point on the mandibular symphysis
pgs: Soft tissue pogonion. The most prominent point on the chin
pm: Pterygomaxillare. The intersection between the nasal floor and the posterior contour of the maxilla
prn: Pronasale. The most prominent point on the apex of the nose
rh: Rhinion. The most anterior point on the nasal bone
s: Sella. The centre of sella turcica
sm: Supramentale. The most posterior point on the anterior contour of the lower alveolar process
sms: Soft tissue supramentale. The point of greatest concavity in the midline of the lower lip between labrale inferius and soft tissue pogonion
sn: Subnasale. The point on the lower contour of the anterior nasal spine where its thickness is 3 mm
snl: The projection of sn on the NL-line
sns: Soft tissue subnasale. The deepest point on the nasolabial curvature
ss: Subspinale. The most posterior point on the anterior contour of the upper alveolar process
sss: Soft tissue subspinale. The point of greatest concavity or convexity in the mid-line of the upper lip between subnasal and labrale superius
CL: Chin-line. The line between id and pgn
E-Line: Aesthetic line. Line between prn and pgs
ML: Mandibular line. The tangent to the lower border of the mandible through gn
NL: Nasal line. The line through ans and pm
NSL: Sella–nasion line. The line through n and s
RL: Ramus line. The tangent to the mandibular ramus through ar

Variables measured in this study

ils/NSL: Inclination of upper incisor to sella–nasion line
NSL/NL: Angle between sella–nasion line and nasal line (inclination of maxilla)
NSL/ML: Angle between sella–nasion line and mandibular line
NL/ML: Angle between nasal line and mandibular line
sn–pm: Distance between subnasale and pterygomaxillare
n–sn: Distance between nasion and subnasale (upper facial height)

n–gn: Distance between nasion and gnathion (total facial height)
sn–gn: Distance between subnasion and gnathion (lower facial height)
Ul promin.: Distance of ls from sss–lsl line
Nasal acuteness: Angle at prn of tangents to the two nasal surfaces
Subnasale angle: Angle formed by a line tangent to the collumella of the nose and a line connecting ls and sns.
Ul inclin.: Angle between line ls–sns and NSL
UL to E-line: Distance of upper lip from E-line
Ul height: Distance between sns and lsl
Ul base thickness: Distance between sns and sn
Ul thick.: Distance between ls and isl

Method error

Intra-observer error was calculated for all variables on 16 randomly selected Greek children by double measurements. The method error was calculated using the following formula according to Dahlberg (1940):

$$\delta^2 = Sd^2/2N$$

where δ is the error of measurements, d is the double determination difference and N is the number of double determinations. The variance δ^2 in per cent of the total variance SD^2 for the different variables was calculated.

The variance of the intra-observer error was 0.06 = 0.6 per cent of the total variance for the different variables used. This indicates a satisfactory degree of accuracy in duplicating measurements. The error of the method was of little importance compared with the biological variation.

Statistical methods

Means and standard deviations were calculated. The differences between group means were tested for significance with Student's t-test. Significant differences were $P < 0.01$. Mean plots of tracings were computed for some of the groups.

Results

The results of this investigation are presented in Tables 1–7. Table 1 shows the comparison between the total Greek and the total Swedish sample for the 16 variables measured. Out of these 16 variables, the variables NSL/NL, NL/ML, UL prominence, subnasal angle (Subn), UL inclination, UL-E line and UL height showed a highly significant difference ($P < 0.001$). These differences show that the Swedes had a smaller inclination of the maxilla to the anterior cranial base, a larger inclination of the mandibular plane, more lip prominence, a less obtuse subnasal angle, more upper lip labial inclination, a less retrusive upper lip to E-line, and increased lip height.

The variable ils/NSL showed a significant difference ($P < 0.01$), revealing a greater labial inclination of the upper incisor to NSL for the Swedes.

The variables sn–pm, sn, sn–gn showed an almost significant difference ($P < 0.05$), revealing a tendency for the Swedes to have a smaller maxilla, a shorter upper facial height, but a larger lower facial height.

Tables 2 and 3 show the comparisons between males and females in every group, in order to reveal any sexual dimorphism present in the two groups. The differences found in both the Greek and the Swedish group do not support such dimorphism and, therefore, in subsequent comparisons, both males and females were combined in the respective groups.

Table 4 shows the comparison between all the Greeks and all the Swedes presenting UCLP. Highly significant differences ($P < 0.001$) were seen in variables NSL/NL with lower values for the Swedes, and NL/ML and UL prominence, with higher values for the Swedes. Variables sn and Subn angle showed significant differences, revealing shorter upper facial height and smaller subnasal angle for the Swedes. The differences in the variables ils/NSL and UL inclination were almost significant and revealed a tendency for the Swedes to have larger values for these measurements.

Table 5 shows the comparison between all the Greeks and all the Swedes presenting BCLP. Highly significant differences were observed in the variables UL prominence and UL height, with larger values for the Swedes. Also, the variables UL inclination and UL-E-line showed signifi-

Table 1 Comparison between Greeks and Swedes exhibiting UCLP and BCLP.

Variables	Greeks			Swedes			*t*-value
	N	*X*	SD	*N*	*X*	SD	
Age	43	11.6	3.6	43	11.6	3.6	0
ils/NSL	43	81.8	15.9	43	90.4	12.5	–2.788**
NSL/NL	43	12.9	4.6	43	7.3	5.3	5.232***
NSL/ML	43	36.3	6.1	43	37.3	6.0	–0.766
NL/ML	43	23.4	5.8	43	30.0	7.4	–4.603***
sn–pm	43	47.3	4.4	43	45.6	3.5	1.982*
n–sn	43	48.8	5.4	43	46.2	4.4	2.447*
n–gn	43	106.5	11.0	43	107.6	9.2	–0.503
sn–gn	43	59.3	6.6	43	62.5	6.3	–2.299*
Ul Pr	43	1.9	2.7	43	5.7	2.3	–7.025***
N.Acut	43	77.3	10.2	43	80.3	12.4	–1.461
Subn.A	43	112.9	18.5	43	97.4	20.8	3.651***
UL Incl	43	81.5	14.4	43	92.6	10.1	–4.138***
Ul to E	43	–5.7	4.3	43	–2.6	3.9	–3.501***
Ul h	43	14.7	2.9	43	17.0	0.2	–3.492***
UL B th	43	11.0	3.7	43	9.8	2.9	1.918
UL th	43	12.0	3.0	43	12.3	3.0	–0.463

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

Table 2 Comparison between Greek males and females.

Variables	Greek males			Greek females			*t*-value
	N	*X*	SD	*N*	*X*	SD	
Age	30	11.4	4.0	13	12.1	2.5	–0.695
ils/NSL	30	877.4	15.8	13	91.9	11.2	–3.420**
NSL/NL	30	12.7	4.8	13	13.4	4.3	–0.667
NSL/ML	30	36.2	6.6	13	36.3	5.1	–0.215
NL/ML	30	23.5	5.7	13	23.3	6.3	0.098
sn–pm	30	48.0	4.4	13	45.7	4.1	1.651
n–sn	30	48.7	6.2	13	49.0	3.2	0.315
n–gn	30	106.7	11.5	13	105.9	6.3	0.278
sn–gn	30	59.9	7.2	13	58.0	4.8	1.015
Ul Pr	30	2.1	2.1	13	1.4	3.9	0.609
N.Acut	30	75.7	10.7	13	81.0	8.2	–1.767
Subn.A	30	112.6	20.4	13	113.5	13.5	–0.169
UL Incl	30	82.5	13.3	13	79.3	16.9	0.606
Ul to E	30	–5.5	4.0	13	–6.0	5.1	0.314
Ul h	30	14.9	3.3	13	14.2	1.6	0.935
UL B th	30	9.9	13.5	13	13.5	2.6	–3.689***
UL th	30	12.3	3.1	13	11.2	2.6	1.199

**$P < 0.01$; ***$P < 0.001$.

cant differences with larger values for the Swedes. Finally, the variables NSL/NL, NL/ML, sn–gn, and subnasal angle showed almost significant differences with a tendency for the Swedes to have less inclination of the maxilla to NSL, a larger lower facial height and a smaller subnasal angle.

Table 3 Comparison between Swedish males and females.

Variables	Swedish males			Swedish females			*t*-value
	N	*X*	SD	*N*	*X*	SD	
Age	30	11.4	4.0	13	12.1	2.5	–0.695
ils/NSL	30	89.0	14.3	13	93.6	6.3	–1.464
NSL/NL	30	8.3	5.7	13	4.9	3.4	2.374*
NSL/ML	30	36.9	6.3	13	38.2	5.2	–0.704
NL/ML	30	28.6	8.0	13	33.3	6.3	–2.492*
sn–pm	30	46.3	3.7	13	44.0	2.0	2.631*
n–sn	30	46.6	4.8	13	45.1	3.5	1.146
n–gn	30	107.4	10.3	13	108.0	6.2	–0.225
sn–gn	30	62.1	7.0	13	63.5	4.5	–0.783
Ul Pr	30	F5.7	2.1	13	5.6	2.8	0.115
N.Acut	30	77.8	12.4	13	86.2	10.7	–2.250*
Subn.A	30	101.6	19.8	13	87.7	20.5	2.063*
UL Incl	30	91.2	8.3	13	96.0	13.0	1.000
Ul to E	30	–1.8	4.0	13	–4.5	3.2	2.349*
Ul h	30	16.9	3.5	13	17.3	2.6	–0.415
UL B th	30	10.2	2.9	13	f9.1	2.7	1.199
UL th	30	12.6	3.3	13	11.6	2.2	1.166

*$P < 0.05$.

Table 4 Comparison between the Greeks and Swedes exhibiting UCLP.

Variables	UCLP Greeks			UCLP Swedes			*t*-value
	N	*X*	SD	*N*	*X*	SD	
Age	22	12.0	4.2	22	12.1	4.2	0
ils/NSL	22	85.7	8.9	22	95.8	12.1	–2.591*
NSL/NL	22	12.6	4.4	22	6.0	3.6	5.445***
NSL/ML	22	36.1	6.3	22	36.9	5.9	–0.434
NL/ML	22	23.5	6.0	22	31.0	6.4	–4.009***
sn–pm	22	46.3	4.1	22	44.9	2.5	1.367
n–sn	22	50.0	5.7	22	45.6	4.5	2.841**
n–gn	22	108.9	13.3	22	107.7	9.9	0.339
sn–gn	22	60.4	7.9	22	62.9	5.8	–1.196
UlPr	22	0.4	2.6	22	4.9	2.0	–3.574***
N.Acut	22	81.0	8.3	22	84.7	10.2	–1.319
Subn. A.	22	106.8	15.7	22	92.7	15.9	2.959**
UL Incl	22	84.6	13.6	22	92.9	9.1	–2.379*
Ul to E	22	–5.9	4.1	22	–4.2	3.5	–1.479
Ul h	22	15.1	2.6	22	16.1	3.3	–1.116
UL B th	22	11.7	3.8	22	10.7	2.4	1.043
UL th	22	12.6	2.6	22	12.0	2.7	0.750

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

Owing to the fact that there has been a change in the treatment regime for the Stockholm group since January 1984, subgroups according to age were formed and the UCLP patients were further compared.

Table 6 shows the comparison between the

UCLP Greeks and Swedes who were born after 1984 and their age ranges from 4 to 10 years. Significant differences are seen in the variables ils/NSL, NSL/NL and subnasal angle, with the Swedes showing a larger inclination of the upper incisor, a reduced inclination of the maxilla to

Table 5 Comparison between the Greeks and Swedes exhibiting BCLP.

Variables	BCLP Greeks			BCLP Swedes			*t*-value
	N	*X*	SD	*N*	*X*	SD	
Age	21	12.0	2.8	21	11.2	2.9	0
ils/NSL	21	85.7	17.3	21	84.8	10.6	–1.626
NSL/NL	21	12.6	4.9	21	8.7	6.5	2.533
NSL/ML	21	36.1	6.1	21	37.7	6.1	–0.584
NL/ML	21	23.5	5.8	21	29.1	8.4	–2.558*
sn–pm	21	46.3	4.5	21	46.4	4.2	1.488
n–sn	21	50.0	5.0	21	46.7	4.4	0.688
n–gn	21	108.9	7.2	21	107.4	8.6	–1.430
sn–gn	21	60.4	4.7	21	62.1	6.9	–2.195*
UlPr	21	2.4	2.8	21	6.6	2.4	–6.585***
N.Acut	21	81.0	10.7	21	75.7	13.1	–0.623
Subn. A.	21	106.8	19.4	21	102.3	24.4	2.499*
UL Incl	21	4.6	14.8	21	92.3	11.2	–3.456**
Ul to E	21	–5.9	4.6	21	–1.0	3.8	3.379**
Ul h	21	15.1	3.1	21	17.9	3.0	–3.824***
UL B th	21	11.7	3.5	21	9.0	3.1	1.176
UL th	21	11.3	3.3	21	12.5	3.4	–1.160

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

Table 6 Comparison between the Greeks and Swedes with UCLP, born after 1984 (4–10 years of age).

Variables	UCLP Greeks			UCLP Swedes			*t*-value
	N	*X*	SD	*N*	*X*	SD	
Age	11	12.0	2.1	11	8.9	2.7	–0.387
ils/NSL	11	85.7	11.2	11	92.3	13.3	–2.861**
NSL/NL	11	12.6	4.3	11	7.4	4.0	3.557**
NSL/ML	11	37.8	6.1	11	37.6	4.9	–0.084
NL/ML	11	24.1	5.8	11	30.2	6.4	–2.528*
sn–pm	11	45.8	4.5	11	44.5	1.9	0.973
n–sn	11	46.4	5.0	11	43.0	4.0	2.363*
n–gn	11	100.8	7.2	11	101.6	8.9	–0.240
sn–gn	11	56.5	4.7	11	59.7	5.5	–1.547
UlPr	11	2.6	2.8	11	5.5	1.8	–2.558*
N.Acut	11	75.8	10.7	11	82.6	9.7	–1.995
Subn. A.	11	112.6	19.4	11	92.7	18.5	2.889**
UL Incl	11	81.7	14.8	11	93.9	11.2	–2.554*
Ul to E	11	–3.5	4.6	11	–2.6	2.9	–0.703
Ul h	11	14.6	3.1	11	15.8	3.1	–0.859
UL B th	11	9.8	3.5	11	9.8	2.1	0
UL th	11	10.9	3.3	11	11.9	2.8	–0.822

*$P < 0.05$; **$P < 0.01$.

the anterior cranial base and a smaller subnasal angle. Near-significant differences were seen in the variables NL/ML, sn, UL prominence and UL inclination, showing a tendency for the Swedes to have a larger anterior lower facial height, a shorter upper anterior facial height, a larger upper lip prominence and a smaller subnasal angle.

Table 7 shows the comparison between the UCLP Greeks and Swedes who were born before 1984 and their age ranges from 11 to 19 years. Significant differences were seen in the variables NSL/NL and sn, with the Swedes showing a reduced inclination of the maxilla to the anterior cranial base, and a shorter upper anterior facial height. There were almost significant differences in the variables NL/ML and UL prominence, showing a tendency for the Swedes to have a larger anterior lower facial height, and a larger lip prominence.

Discussion

In an effort to improve the treatment approach to CLP patients, the outcome of treatment regimes applied in various centres has been studied in the past by many investigators.

The intention of this cephalometric study was to compare the outcome of a centralized treatment regime with that of a non-centralized approach. Also, further elaboration of the results mentioned above was attempted by studying the outcome of a randomized treatment approach that did not include any bone grafting procedures as compared with a centralized treatment approach that included initially early bone grafting performed at 6 months of age.

The material in this study comprised two major groups, one randomly selected from the patients attending the Cleft Lip and Palate Clinic of the University of Athens, and the other from Swedish patients, used as a control, strictly matched to the Greek group by age, sex, and identical type of cleft.

Comparison of the two groups was undertaken in total and in two subgroups divided according to age, taking into consideration that patients born in the Stockholm area

Table 7 Comparison between the Greeks and Swedes with UCLP, born before 1984 (11–19 years of age).

Variables	UCLP Greeks			UCLP Swedes			*t*-value
	N	*X*	SD	*N*	*X*	SD	
Age	11	15.6	2.3	11	14.8	3.2	0.673
ils/NSL	11	94.1	9.5	11	98.9	10.8	–1.106
NSL/NL	11	11.4	4.4	11	6.3	3.7	2.942**
NSL/ML	11	34.5	6.3	11	36.3	6.6	–0.654
NL/ML	11	23.1	7.2	11	30.0	7.1	–2.263*
sn–pm	11	46.8	4.4	11	45.4	2.6	0.908
n–sn	11	53.5	5.9	11	47.2	4.3	2.862**
n–gn	11	116.9	13.7	11	111.3	7.6	1.185
sn–gn	11	64.3	8.9	11	64.6	3.7	–0.103
UlPr	11	2.3	1.8	11	4.1	1.8	–2.345*
N.Acut	11	86.1	7.1	11	86.5	10.6	–0.103
Subn. A.	11	100.8	15.9	11	92.7	13.8	1.276
UL Incl	11	87.4	13.2	11	91.6	6.7	–0.941
Ul to E	11	–8.3	3.7	11	–5.6	3.3	–1.806
Ul h	11	15.6	2.9	11	16.2	3.4	–0.445
UL B th	11	11.7	3.4	11	10.8	2.7	0.687
UL th	11	10.4	2.2	11	11.3	2.5	–0.896

*$P < 0.05$; **$P < 0.01$.

after January 1984 did not receive any primary bone grafting procedure.

In comparing the total Greek group with the total group of Swedes, the significant differences showed a better lip configuration of the Swedes. The values of the measurements related to upper lip prominence, subnasal angle, upper lip inclination, and length were consistently better for the Swedes.

Although it is well documented in the related literature that there is a strong multifactorial aetiology for the end results of treatment in CLP patients (Friede and Johanson, 1982; Figueroa and Polley, 1993), it should be emphasized that in the groups compared in this study, there were two distinct parameters that were totally different, i.e. (a) while the Greek children's treatment was carried out by plastic, paediatric and oral surgeons, and ENT specialists, the Swedish children's operations were only carried out by plastic surgeons, most probably applying a more advanced surgical technique, and (b) while the Swedish children were followed up in a co-ordinated team approach, this was not the case with any of the Greek children studied.

On the other hand, the Greek group showed a significantly larger upper face height in comparison with the Swedes. This can be attributed to ethnic differences and other factors. However, the effect of the surgery performed in the Swedes should not be overlooked as almost half of the children in the group of Swedes had been submitted to early bone grafting procedures. As was found in earlier studies, this procedure can have an adverse effect on the vertical growth of the maxilla (Brattström and McWilliam, 1989; Brattström, 1991).

In order to increase the homogeneity of the groups studied, the UCLP patients were compared as a separate group from the BCLP patients. The results of these comparisons were quite similar to those obtained by comparing the total groups. More specifically, the measurements again revealed a better lip configuration for the Swedes, but a definite tendency for a shorter upper anterior facial height and a larger lower anterior facial height as compared with the Greeks. The overall differences in these groups are also seen in superimposition of the mean plots (Figures 2 and 3). A characteristic finding from these plots is the severe anterior crossbite seen in all the Greek samples. This finding could be attributed to the lack of centralized treatment for the Greek group, which in turn might be the

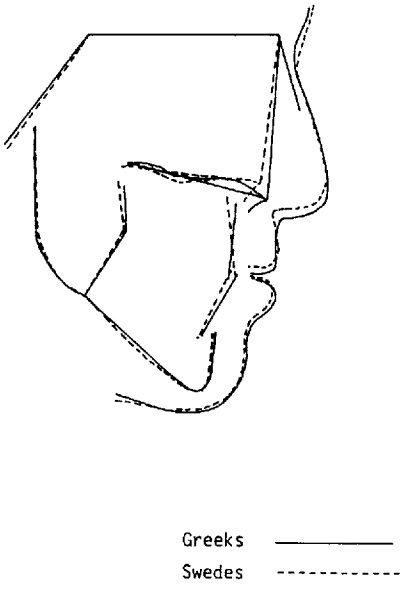

Figure 2 Superimposition of mean plots for the Greeks and the Swedes aged 4–19 years presenting UCLP.

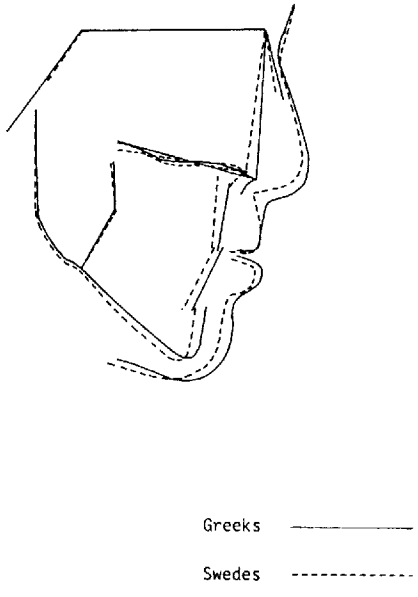

Figure 3 Superimposition of mean plots for the Greeks and the Swedes aged 4–19 years presenting BCLP.

main cause for the absence of orthodontic treatment at the appropriate age. The findings concerning the upper anterior facial height agree with those of Brattström *et al.* (1991) and Brattström (1991), when early bone-grafted groups were compared with a group that had no bone grafting. They concluded that the more favourable vertical facial proportions of the latter group could be explained as being due to the inhibited anterior maxillary growth in height in the primary bone-grafted group. Since the Greek group had no bone grafting procedures, there was no inhibition of the anterior maxillary growth.

One of the major conclusions of these investigations was that treatment regimes without bone grafting to the alveolus seem to be more favourable for maxillary and mandibular development, while primary bone grafting has a disturbing effect mainly on maxillary anterior height (Brattström, 1991).

In this respect, the differences between the subgroups aged 4–10 and 11–19 years, when the UCLP Greeks and Swedes are compared, are of interest. This is because of the different regime applied for the Swedes between these two age groups. As mentioned earlier, in the children aged 11–19 years, early bone grafting was undertaken and this seems to have an effect mostly on the vertical growth of the maxilla. This finding is in agreement with those presented by Larsson and Nilsson (1983). The difference between the Greeks and Swedes for the upper anterior facial height (sn) was significant for the ages 11–19. In comparison, for the children 4–10 years of age who had not received early bone grafting, the difference in this measurement was almost significant. These differences are also seen in the superimposition of the mean plots of the two subgroups (Figures 4 and 5).

Conclusions

This study has revealed the following.

1. Many differences in facial and dental cephalometric findings between CLP children receiving a centralized treatment approach, as compared with those treated randomly and non-centralized, were significant. The Swedish group tended to show better cephalometric values throughout all the age groups. These findings could be attributed to factors involved with the co-ordination of

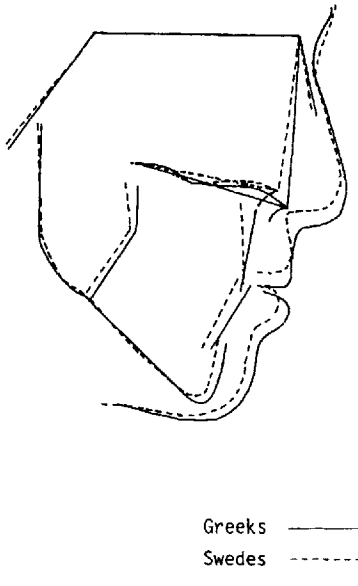

Figure 4 Superimposition of mean plots for the Greeks and the Swedes aged 4–10 years presenting UCLP.

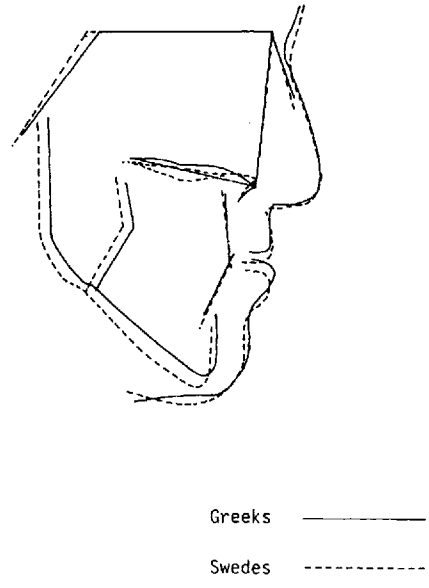

Figure 5 Superimposition of mean plots for the Greeks and the Swedes aged 11–19 years presenting UCLP.

services in a centralized regime; however, the variables between the groups are too great to draw definite conclusions.

2. Early bone grafting did not seem to be a positive factor in the centralized regime in comparison with the absence of bone grafting in the non-centralized regime.

Address for correspondence

Professor Meropi N. Spyropoulos
Department of Orthodontics
School of Dentistry
Thivon 2, Goudi
Athens
Greece

Acknowledgements

We wish to thank the School of Dentistry, Karolinska Institutet, for the financial support that made it possible for Dr Spyropoulos to work as a visiting scientist at the Department of Orthodontics and Pediatric Dentistry, Huddinge, Sweden, Dr C. M. Forsberg for his kind assistance with the computer programming, and Mr O. Ekberg for technical help with illustrations.

References

Asher-McDade C *et al.* 1992 A six center international study of treatment outcome in patients with clefts of the lip and palate. Part 4. Assessment of nasolabial appearance. Cleft Palate Craniofacial Journal 29: 409–412

Brattström V 1991 Craniofacial development in cleft-, lip- and palate children related to different treatment regimes. Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery Suppl 25

Brattström V, McWilliam J 1989 The influence of bone grafting age on dental abnormalities and alveolar bone height in patients with unilateral cleft lip and palate. European Journal of Orthodontics 11: 351–358

Brattström V, McWilliam J, Larsson O, Semb G 1991 Craniofacial development in children with unilateral clefts of the lip, alveolus and palate treated according to four different treatment regimes. 1: Maxillary development. Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery 25: 259–267

Dahlberg G 1940 Statistical methods for medical and biological students. Interscience Publications, New York

Figueroa A A, Polley J W 1993 Orthodontic management of the cleft lip and palate patient. Advances in management of cleft lip and palate. Clinics in Plastic Surgery 20: 733–753

Fogh Andersen P 1967 Genetic and non-genetic factors in the etiology of facial clefts. Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery 1: 22–29

Friede H, Johanson B 1974 A follow-up study of cleft children treated with primary bone grafting. Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery 8: 88–103

Friede H, Johanson B 1982 Adolescent facial morphology of early bone-grafted cleft lip and palate patients. Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery 16: 41–53

Larsson O, Nilsson B 1983 Early bone grafting in complete cleft lip and palate cases following maxillofacial orthopedics. VI: Assessments from photographs and anthropometric measurements. Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery 17: 205–223

Mölsted K *et al.* 1991 A six-center international study of treatment outcome in patients with clefts of the lip and palate. Part 2. Craniofacial form and soft tissue profile. Cleft Palate Craniofacial Journal 29: 398–404

Nordin K-E 1957 Treatment of primary total cleft palate deformity. Preoperative orthopaedic correction of the displaced components of the upper jaw in infants followed by bone grafting to the alveolar process clefts. Transactions of the European Orthodontic Society, pp. 333–339

Nordin K-E, Larsson O, Nylén B, Eklund G 1983 Early bone grafting in complete lip and palate cases following maxillofacial orthopedics I. The method and the skeletal development from seven to thirteen years of age. Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery 17: 33–50

Ross B 1987 Treatment variables affecting facial growth in complete unilateral cleft lip and palate. Cleft Palate Journal 24: 3–89