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## CRANIOFACIAL CHANGES IN UNILATERAL CLEFT LIP IN ADULTS

Z. ŠMAHEL

The purpose of the present communication was the description of changes in craniofacial skeletal and soft tissues morphology in adults with unilateral cleft lip alone. These findings were characteristic for the final state of ontogenesis in this anomaly and represented the results of primary lesions, secondary effects of therapeutic procedures, as well as of the actual development and growth. This study dealt with similar items as our previous reports devoted to the investigation of craniofacial changes in unilateral cleft lip and palate — CLP<sub>uni</sub> (Šmahel 1982, Šmahel and Brejcha in press) as well as in isolated cleft palate — CP (Šmahel in press) in adult males. Identical criteria used for the admission of probands allowed the comparison of facial changes in all three basic types of clefts, as well as the determination of their interrelations. The study was based on direct cephalometry and on X-ray measurements. Somatoscopic facial characteristics and basic bodily parameters were included as well.

### MATERIAL AND METHODS

The series examined included 36 adult males ranging in age from 20 to 40 years. All probands had left-sided cleft lip without evidence of an involvement of the maxillar alveolar process (CL<sub>uni</sub>). With regard to the pathogenetic impulse this anomaly was characterized by the slightest involvement as compared to all other types of clefts. All Czech males with this type of involvement without any other inborn anomalies, operated upon at the Clinic for Plastic Surgery in Prague, were invited for check-up examinations. The rate of nonresponders was 31 per cent. Because of the delayed time of lip suture (above 2.5 years of age) four patients were excluded from the statistical analysis of measured characteristics (Dixon's test  $p < 0.01$ ) and other patient because of the anomalous cranial configuration ( $n = 31$  for cephalometry). All of them were included, however, into the assessment of characteristics determined by visual inspection.

At the time of this check-up the mean age of the patients was 26.23 years (SD = 4.20) and thus was similar to that in matched controls (27.18 years, SD = 5.79,  $t = 0.78$ ) inclusive of the distribution (F test,  $p < 0.1$ ). Primary cheiloplasty was carried out according to Randall-Tennison (in five cases according to Veau) at the mean age of 11.23 months (SD = 7.74). Their age did

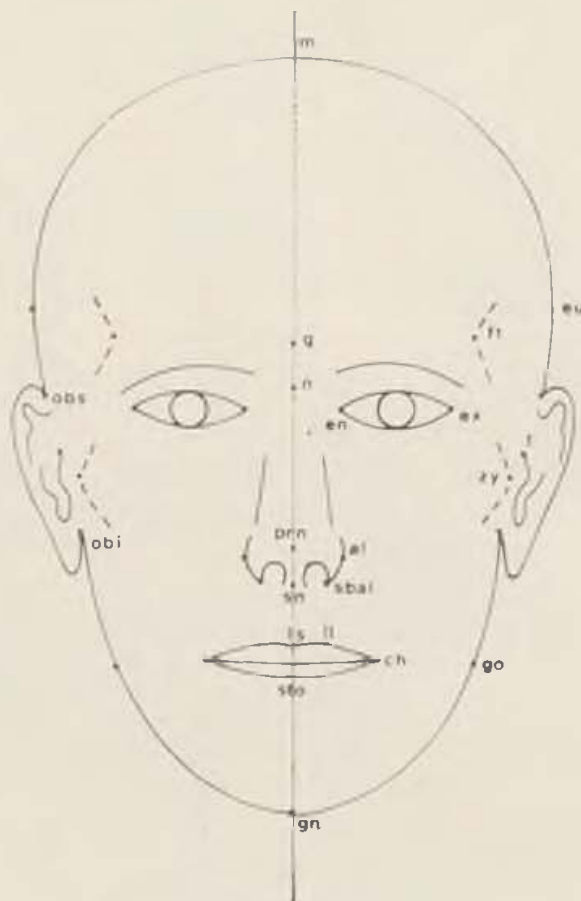


Fig. 1. Cephalometric points used in the study

not differ significantly from that in which lip suture was carried out in an earlier series with CLP<sub>uni</sub> (8.19 months,  $p < 0.1$ ). However, the age distribution at the time of surgery differed significantly and was less homogenous in the latter series ( $p < 0.02$ ). A secondary surgical repair within the lip and nose was carried out in four individuals only (12.9 %), contrary to cleft lip and palate where it was performed in 67.2 %. There was also differences between the technique of cheiloplasty according to Veau used in CLP<sub>uni</sub>. These differences and the extent of the clefts should be taken into consideration during the comparison of findings in these two series. Difference in the extent of orthodontic therapy should be taken into account as well, however, we failed to disclose in CL<sub>uni</sub> any substantial skeletal changes.

The series of controls consisted of 50 volunteers matched for age distribution. Their basic body characteristics (body height 176.88 cm and body weight

77.22 kg) were in full agreement with the norm of Czech population. They were described in more detail in our earlier study (Šmahel 1982).

Basic body dimensions and cephalometric characteristics were determined according to anthropometric principles. Cephalometrics points are presented on figures 1—2 and investigated characteristics in table 1 (the symbol + pre-

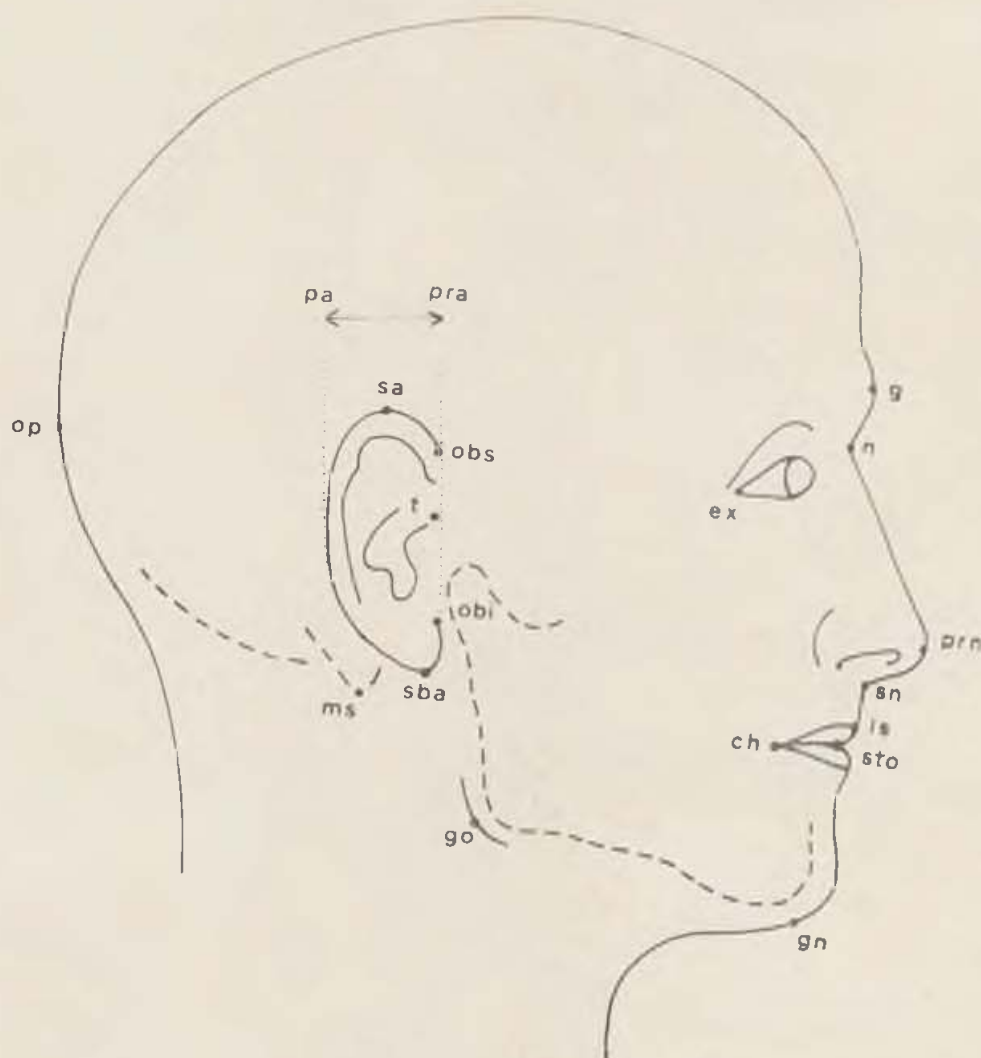


Fig. 2. Cephalometric points in lateral view

ceding the mean value denotes a deviation towards the right or a higher position of the right mouth corner, the symbol — a deviation towards the left of a higher position of the left corner of the mouth]. The method was described in an earlier study (Šmahel, 1982) inclusive of norms (Šmahel, in press). Of the anthropometric indexes also the cheilozygomatic index was calculated ( $100 \times \text{ch-ch} : \text{zy-zy}$ ) denoting the relation between the width of the oral slot and of the face.

The method used for the obtaining of X-ray films and their interpretation was also described in one of our earlier reports (Šmahel and Brejcha, in press).



Craniometric points and reference lines are illustrated on figures 3—5. A review of measured characteristics is presented in table 2 (in lateral projection) and in table 3 (in anteroposterior projection), however some insignificant dimensions were not included. For the distinction from direct cephalometry symbols of the reference points being always with a capital letter and in the

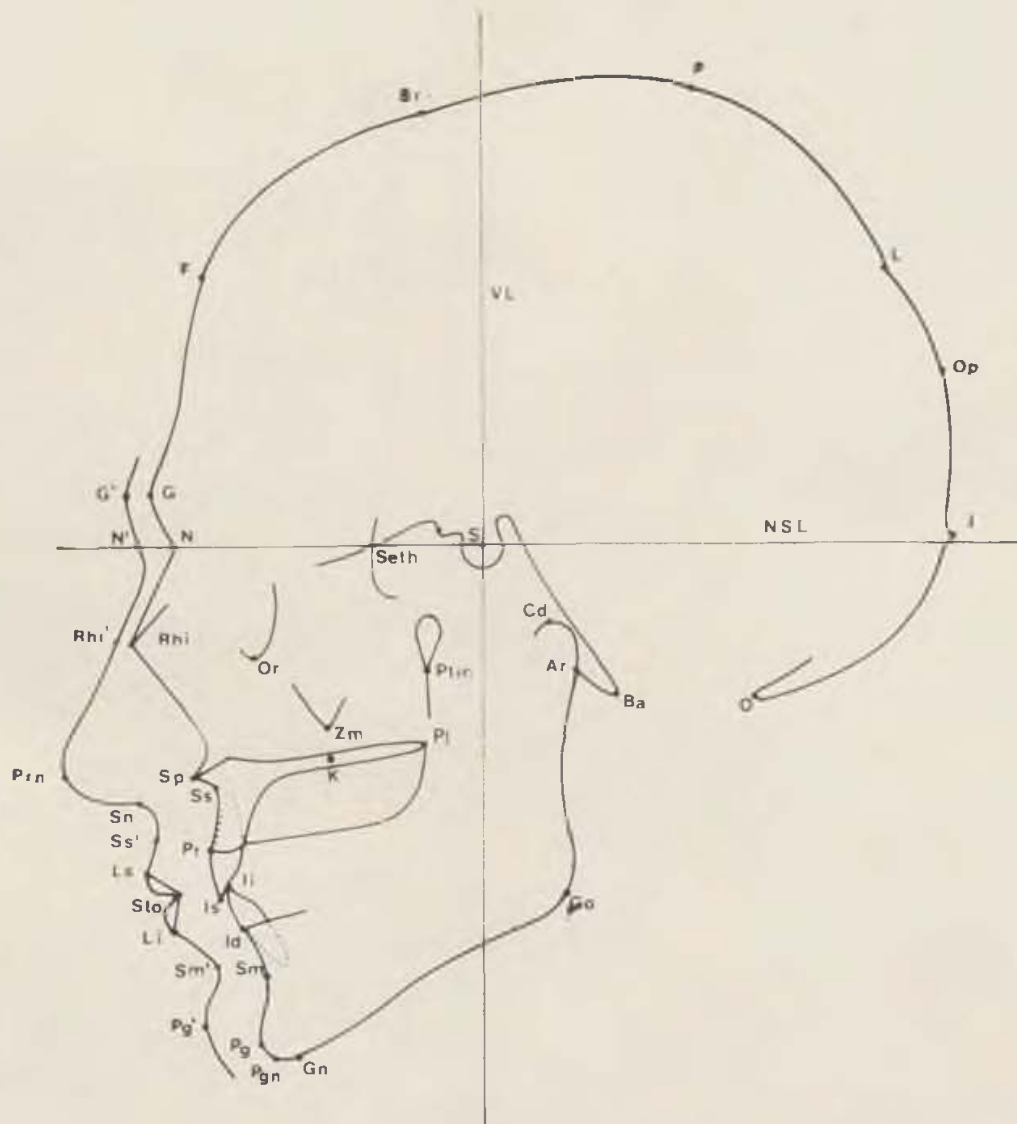


Fig. 3. Craniometric points used for the assessment of lateral X-ray films

case of a point on the soft profile which is marked by the same symbol as the corresponding point on the skeletal framework, the former is provided with an apostroph (Fig. 3). The perpendicular distance of the point from the reference line is designated as Cd-NSL, the angle by a symbol S-N-Ss, or as a fragment of two reference lines forming the given angle (ML/RL) and the profile soft tissue thickness e. g. at the level of soft pogonion as Pg'<sub>t</sub> etc. (Ss'<sub>t</sub> and Pr<sub>t</sub> were measured parallel with the palate plane, Id<sub>t</sub> and Sm'<sub>t</sub> as the minimum thickness and Pg'<sub>t</sub> perpendicular to the profile line N'-Pg'). The devia-

tions of mediosagittal structures were measured from MSL at point C and expressed in the same way as in cephalometric measurements (towards the right +, towards the left -). The numbers of cases were reduced by one in dimensions measured from the apex of the upper incisors (Is), where prosthetic treatment was applied.

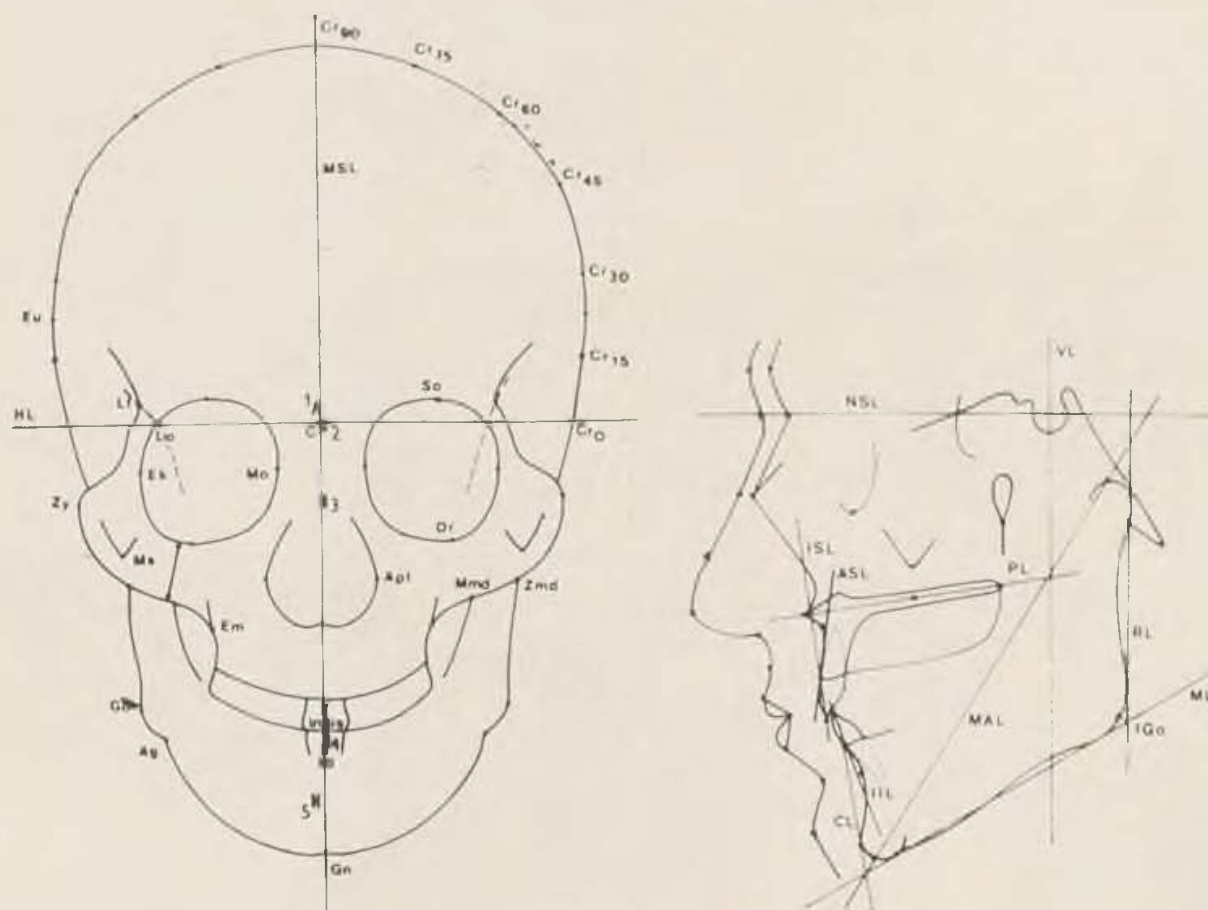


Fig. 4. Craniometric points on anteroposterior X-ray films (dimension zy-max — arrow below the orbita)

Fig. 5. Reference lines plotted on lateral X-ray films (NSL — line through N and S, VL — perpendicular to NSL through S, PL — line through Sp and Pl, CL — line through Pg and Id, ML — tangent to the mandibular body through Gn, RL — tangent to the mandibular ramus through Ar, MAL — line through Pgn and Cd, ASL — tangent to the maxillary alveolar process through Pr, ISL — line through Is and Pr, IIL — line through Ii and Id, tGo — intersection of ML and RL)

Somatoscopic characteristics included the estimation of ear lobe morphology and of deviations in facial configuration, in particular within the oronasal region. They were described in the above quoted study (Šmahel, 1982). The results obtained are mentioned in the corresponding paragraph of the text.

Basic statistical characteristics were computed from the frequency distribution and compared to those in controls with the F-test (variance ratio) and the t-test (inclusive of the frequency of visually inspected characteristics).

For Topinard's classification of the shape and position of the nares the method of quantifying the qualitative characteristics was used (Tab. 1). For the exclusion of individuals with delayed primary lip suture a modification of Dixon's test for extreme deviations was applied (the requested level was  $p < 0.01$ ). The modification consisted in a testing of all patients operated upon at a relatively

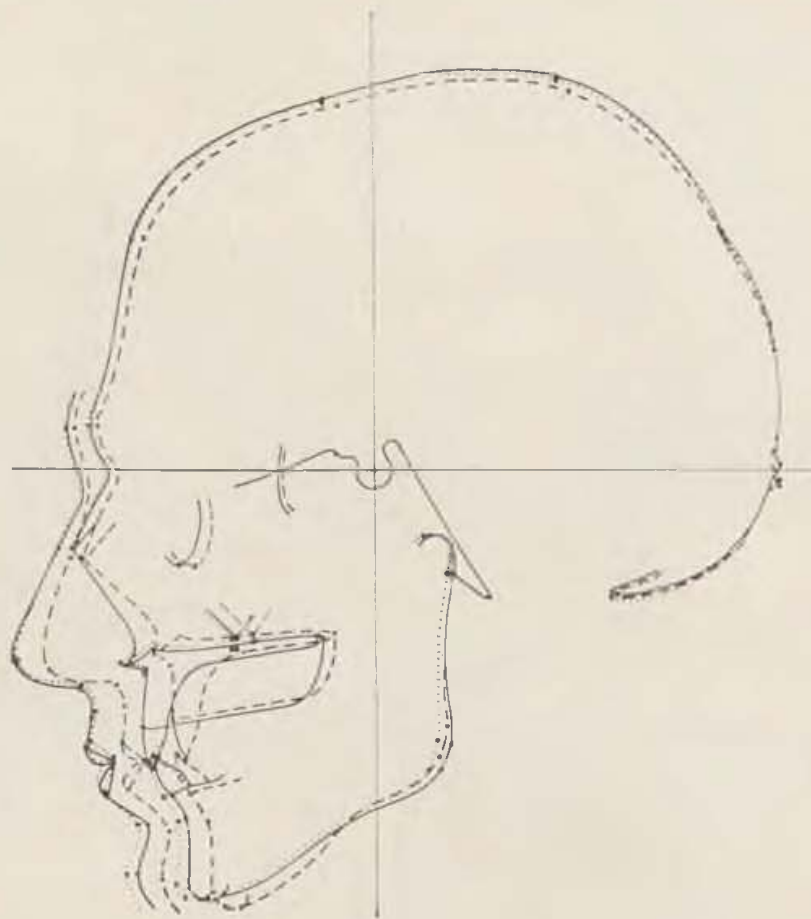


Fig. 6. Craniogram in lateral projection (solid line — controls, dashed line — unilateral cleft lip and palate, dotted line — unilateral cleft lip alone)

more mature age as compared to the last ascertained date which was within the range of the normal distribution ( $\bar{x} \pm 3 \text{ SD}$ ). The other details were described in the above quoted earlier study (Šmahel, 1982).

#### RESULTS

The results are presented in tables 1—3 and on figure 6. They are also compared with the findings in CLP<sub>uni</sub> published earlier (Šmahel, 1982; Šmahel and Brejcha, in press). The most important comparisons are illustrated in table 4.

**Somatic development** (Tab. 1): Showed no deviations whatever. Body height and weight, as well as the other basic somatometric characteristics were virtually identical with those in controls.



Tab. 1. Cephalometric and basic somatometric characteristics in adult males with leftsided cleft lip (the mea, standard error and difference from the control in mm are given)

[illegible]



Tab. 2a. X-ray cephalometric characteristics in lateral projection — skeletal dimensions (explanatory notes see tab. 1)

Cranium	191.94	0.87	+0.30	N-Gn	129.84	1.15	-0.32
N-Op	188.61	0.94	-0.27	Is-PL	31.50	0.70	+0.70
N-I	150.78	0.85	-1.74	Pr-Id	21.29	0.34	-0.01
Ba-Br	122.65	0.80	-2.47 <sup>x</sup>	Sp-Pg	68.03	1.43	+0.37
Ba-L	37.32	0.58	-0.20	S-Go	87.81	0.74	-0.29
Ba-O	84.52	0.60	-0.48	S-Pgn	137.29	0.92	+1.73
S-N-F	81.68	0.82	-0.50	S-Pl	50.71	0.53	-0.23
N-S-Br	145.61	0.91	+1.53	Zm-NSL	48.77	0.48	+0.19
N-S-L	181.65	1.04	+2.19	Facial depth			
N-S-I				Ss-P	51.03	0.57	-1.37 <sup>(c)</sup>
Base				Sp-Pl	56.42	0.72	-0.28
N-Ba	113.77	0.72	-0.07	Pl-Ba	48.77	0.69	+0.27
N-S	75.42	0.61	0.38	Pl-VL	14.77	0.57	+0.63
S-Ba	48.87	0.42 <sup>x</sup>	-0.45	Ptra-VL	13.90	0.38	+0.24
N-S-Ba	131.81	0.88	-0.35	Facial profile			
Mandible				S-N-Rhi	115.87	1.10	+0.61
Pgn-Go	79.42	0.80	+0.46	S-N-Ss	80.03	0.73	-0.65
Cd-Go	67.35	0.65	-0.07	S-N-Pr	82.77	0.61	-0.17
Ti-Gn	45.77	0.60	-0.17	S-N-Id	80.77	0.61	+0.69
Cd-NSL	19.42	0.38 <sup>x</sup>	+0.26	S-N-Sm	79.19	0.63	+0.99
Ar-tGo	58.19	0.53	+0.35	S-N-Pg	81.06	0.67	+1.22
Go-VL	15.26	1.01	-2.44 <sup>(c)</sup>	S-N-Sm	0.84	0.55	-1.64 <sup>x</sup>
N-S-Cd	129.71	1.00	-1.37	S-N-Pg	-1.03	0.64	-1.87 <sup>x</sup>
N-S-Pgn	67.10	0.68	-1.38	N-Ss-Pg	181.97	1.26	+3.85 <sup>x</sup>
ML/RL	124.55	1.05	+2.59 <sup>(c)</sup>	ASL/PL	109.29	1.09	+1.69
CL/ML	66.77	1.20	-3.99 <sup>x</sup>	ISL/PL	91.93	1.23	-0.33
RL/NSL	85.55	0.92	-2.61 <sup>x</sup>	PL/NSL	7.39	0.58	-0.63
ML/NSL	30.39	0.95	+0.33				
PL/ML	23.00	1.08	+0.96				
III/ML	73.55	1.43	-6.01 <sup>x</sup>				
III/NSL	76.06	1.60	-5.28 <sup>x</sup>				
Facial height							
N-Rhi	24.97	0.66	+0.03				
N-Sp	55.90	0.46	-1.24 <sup>(c)</sup>				
N-Pr	74.68	0.72	-0.76				

Tab. 2b. X-ray cephalometric characteristics in lateral projection — soft profile (explanatory notes see tab. 1)

Height							
N'-Prn	58.84	0.54	-0.50	Jaw position	86.16	0.76	-0.92
N'-Sn	63.06	0.52 <sup>∞</sup>	-0.98	S-N'-Ss'	80.74	0.57	+0.82
N'-Sto	85.03	0.78	-1.75	S-N'-Sm'	83.39	0.60	+1.05
N'-Pg	120.16	1.09	-0.22	S-N'-Pg'			
Sn-Ls	15.52	0.59	-2.14 <sup>∞</sup>	Profile relations			
Sn-Sto	22.84	0.61	-1.50 <sup>∞</sup>	Ss'-N'-Sm'	5.42	0.54 <sup>∞</sup>	-1.74 <sup>∞</sup>
				Ss'-N'-Pg'	2.77	0.62 <sup>∞</sup>	-1.97 <sup>∞</sup>
Thickness				Facial convexity			
Ss' <sub>t</sub>	15.19	0.45 <sup>∞</sup>	+0.39	N'-Sn-Pg'	169.78	1.52 <sup>∞</sup>	+5.14 <sup>∞</sup>
Pr <sub>t</sub>	15.58	0.44 <sup>∞</sup>	+0.32	N'-Prn-Pg'	137.68	1.29	+3.68 <sup>∞</sup>
Id <sub>t</sub>	11.55	0.21	-0.05				
Sm' <sub>t</sub>	11.84	0.19	-0.40				
Pg' <sub>t</sub>	14.77	0.35	+0.09				
Depth							
Prn-Sn	19.65	0.29	-0.35				
Prn-Sp	30.48	0.45	-1.82 <sup>∞</sup>				

Tab. 3. X-ray cephalometric characteristics in anteroposterior projection (explanatory notes see tab. 1)

Cranium									
Eu-Eu	163.03	0.87	-0.36	Orbits		28.45	0.45	+1.55 <sup>23</sup>	
Lf-Lf	111.16	0.66	+1.87	Mo-Mo		103.52	0.68	+1.93 <sup>24</sup>	
Ms Ms	119.06	0.95	-1.35	Lo-Lo		110.03	0.72	+0.38	
				Ek-Ek		40.90	0.23 <sup>25</sup>	-0.61	
Upper face				Mo-Ek dx		40.45	0.24 <sup>26</sup>	-0.86	
Zy-Zy	149.03	0.64	+1.85 <sup>27</sup>	Mo-Ek sin		25.81	0.30	+1.20 <sup>28</sup>	
Apt-Apt	35.32	0.41	+0.65	i. interorb.					
Em-Em	68.00	0.75	-0.35	Mandible					
Em-HL dx	61.97	0.64	-0.60	Go-go		113.42	1.05	+0.87	
Em-HL sin	61.77	0.67	-0.41	Ag-Ag		97.65	0.75	-0.39	
zy-max dx	19.00	0.40	+0.27	Zy-Go dx		67.71	0.83	+0.26	
zy-max sin	19.00	0.41	+0.45	Zy-Go sin		67.19	0.86	+0.25	
dec. Baptn	-0.32	0.21	0.45	dev. I3		+0.06	0.18	0.16	
dev. Intis	-0.10	0.17	0.08	dev. Gn		+0.29 <sup>29</sup>	0.14	0.47 <sup>30</sup>	

<sup>29</sup>not significant deviation (+ deviation to the right, - deviation to the left)



Tab. 4, Differences in unilateral cleft lip (CL<sub>sin</sub>) and unilateral cleft lip and palate (CLP<sub>dx</sub>) from controls with significance levels (see tab. 1 cl = cleft side, nc = noncleft side)

Variable	CL <sub>sin</sub>	CLP <sub>dx</sub>	Variable	CL <sub>sin</sub>	CLP <sub>dx</sub>
al-al	+0,64	+0,83(·)	ch-ch	-1,68 <sup>x</sup>	-2,18 <sup>xxx</sup>
prn-sn	-0,34	-0,11	t-sn-t	-5,35 <sup>x</sup>	-10,08 <sup>xxx</sup>
prn-sbal cl <sup>++</sup>	-0,77	-1,82 <sup>xxx</sup>	obi-sn cl(+)	-0,78	-3,96 <sup>xxx</sup>
prn-sbal nc <sup>***</sup>	-2,01 <sup>xxx</sup>	-3,48 <sup>xxx</sup>	obi-sn nc*	-2,56 <sup>x</sup>	-6,15 <sup>xxx</sup>
sn-sbal cl <sup>+++</sup>	+0,92 <sup>x</sup>	+0,55(·)	Sn-Ls	-2,14 <sup>x</sup>	-2,35 <sup>xxx</sup>
sn-sba nc <sup>***</sup>	-1,20 <sup>xxx</sup>	-0,94 <sup>x</sup>	Prn-Sp	-1,82 <sup>x</sup>	-2,77 <sup>xxx</sup>
<sup>1</sup> nose deviat,	1,42 <sup>x</sup>	2,43 <sup>xxx</sup>	Ss-N-Sm	-1,64 <sup>x</sup>	-3,03 <sup>xxx</sup>
<sup>2</sup> colum. dev,	2,87 <sup>xx</sup>	0,95	Ss'-N'-Sm'	-1,74 <sup>xx</sup>	-4,16 <sup>xxx</sup>
<sup>1</sup> m-prn	1,03 <sup>x</sup>	1,40 <sup>xx</sup>	N'-Sn-Pg'	+5,14 <sup>x</sup>	+10,34 <sup>xxx</sup>
<sup>1</sup> m-sn	1,84 <sup>xxx</sup>	1,79 <sup>xxx</sup>	Mo-Mo	+1,55 <sup>xx</sup>	+2,88 <sup>xxx</sup>
Topinard cl <sup>+++</sup>	+0,58 <sup>xxx</sup>	+0,71 <sup>xxx</sup>	Lo-Lo	+1,93 <sup>x</sup>	+2,08 <sup>xx</sup>
Topinard nc <sup>***</sup>	-0,13	-0,05	Lf-Lf	+1,87 <sup>x</sup>	+2,39 <sup>xx</sup>

<sup>+</sup>significant differences between right and left sides in CL<sub>sin</sub>

<sup>\*</sup>significant differences between right and left sides in CLP<sub>dx</sub>

<sup>1/2</sup>in the characteristics the mean values are presented (<sup>1</sup>deviation to the noncleft side, <sup>2</sup>deviation to the cleft side)

Neurocranium (Tab. 1—3): But for one exception (Ba-L,  $p < 0.05$ ) the neurocranial dimensions were not reduced. Similarly as in CLP<sub>uni</sub> there was a slight increase of the minimum frontal width (ft-ft and Lf-Lf,  $p < 0.05$ ). This was related to enlarged interorbital distance. Contrary to CLP<sub>uni</sub> the frontal slope remained unchanged (S-N-F) and the posterior rotation of the cranial vault was not significant (N-S-Br, N-S-L, N-S-I).

Cranial base (Tab. 1, 2): We failed to disclose any changes in its width (t-t), length (N-Ba, N-S, S-Ba) or curvature (N-S-Ba).

Nasopharyngeal bony framework (Tab. 2, 3): The dimensions characteristic for the nasopharyngeal bony framework, i. e. its depth (Pl-Ba), height (S-Pl), length (S-Ba), or width (Em-Em) did not differ from those in controls.

Upper face (Tab. 1—3): The dimensions remained unchanged inclusive of the depth (Ss-Pl, Sp-Pl) and position (S-N-Ss, Pl-VL, Ptm-VL) of the upper jaw. The increase of bizygomatic width (zy-zy, Zy-Zy) was at the margin of significance. The only marked deviation within this region was an increase of the interorbital distance (Mo-Mo,  $p < 0.01$ ) accompanied by widening of the distance between the upper outer orbital margins (Lo-Lo,  $p < 0.05$ ). The difference was smaller than in CLP<sub>uni</sub> without a narrowing of the orbits (Mo-Ek). These impaired proportions were documented by the interorbital index ( $p < 0.01$ ). However, these changes were not yet reflected by soft tissue deviations, i. e. of the distance between the inner eye canthi (en-en). This deviation was always less marked (see CLP<sub>uni</sub>). Equally no changes in the width of the dentoalveolar arch at its base (Em-Em), in the width of nasal cavity

(Apt-Apt), in the vertical dimensions of the upper face (N-Sp, N-Pr, Is-PL, N'-Prn, n-sto, Em-HL etc.), or in the inclination of upper incisors (ISL/PL) and of the maxillary alveolar process (ASL/PL) were recorded.

The lower jaw (Tab. 1—3): Mandibular dimensions inclusive of the length of its body (Pgn-Go) and ramus (Cd-Go) were identical with those in controls (Go-Go, li-Gn etc.). The position of the mandibular joint remained unchanged as well (Cd-NSL, N-S-Cd). There was, however, a slight displacement of the mandible forwards (S-N-Pg insign., Go-VL  $p < 0.1$ ) which was due to a less steep slope of its ramus (RL/NSL,  $p < 0.05$ ). This resulted in a more acute chin angle (CL/ML,  $p < 0.01$ ) and a retroinclination of lower incisors (IIL/ML and IIL/NSL,  $p < 0.01$ ). Both represented an adaptation to an overbite. Of the same character was a slightly more obtuse gonial angle (ML/RL,  $p < 0.1$ ). Conceivably all above mentioned changes were small and did not exceed the 5 per cent significance level but for the deviation of the dentoalveolar mandibular component which generally showed the most marked compensatory adaptation. Therefore the changes were virtually of no significance. However they resulted in some deviations of the soft profile. The inclination of the mandibular body was unchanged (ML/VL).

Facial profile (Tab. 2): Because of the slight mandibular displacement forwards, both the skeletal (N-Ss-Pg,  $p < 0.05$ ) and soft profile (N'-Sn-Pg',  $p < 0.01$  and N'-Prn-Pg',  $p < 0.05$ ) were flatter with a disturbed relation between upper and lower face in anteroposterior direction (Ss'-N'-Sm' and Ss'-N'-Pg',  $p < 0.01$ ). The deviations revealed more marked changes in the soft profile ( $p < 0.01$ ), due to the slight retrusion of the upper lip (S-N'-Ss', by  $1^\circ$ , insign.). It was associated with a corresponding reduction of the subnasal arch (t-sn-t,  $p < 0.05$ ). There was also a reduction of the distance between the tip of the nose and the anterior spina (Prn-Sp,  $p < 0.01$ ) which was caused by nasal malformation in cleft lip. However, the thickness of the upper lip remained unchanged (Ss', Prt).

Maxillo-mandibular relations (Tab. 2): The slight mandibular prognathia resulted also in a slight disorder of the sagittal jaw relations (Ss-N-Sm,  $p < 0.05$ ). However the difference of  $1.6^\circ$  was fully compensated by the mandibular dentoalveolar component. Therefore an overbite was maintained (in 83.3 % as compared to 88 % in controls, i. e. insign.); an anterior cross bite developed in a single patient (2.8 %), while the remaining had an edge to edge bite (14 %). There were no changes in the vertical maxillo-mandibular relations (PL/ML).

The face as a whole (Tab. 1, 2): Both the anterior (N-Gn) and posterior (S-Go) heights of the face showed no changes. Their ratio was identical with that in controls (67.63 % as compared to 67.69 %) and was characteristic for the anterior growth rotation in the development of the face. The proportions of the face (indexes) inclusive of vertical proportions were not impaired as well. The height of the lower face (Sp-Pg) was identical with that in controls.

**O r o n a s a l   r e g i o n** (Tab. 1, 2): This region showed the same deviations as in CLP<sub>uni</sub>. Their extent was mostly smaller; while some of them on the contrary appeared larger (e. g. the width of the nares thresholds, height of the lip and deviation of the columella). This was obviously due to the lack of secondary surgical repairs. The width of the nose (al-al) was not significantly increased yet the width of the oral slot was reduced (ch-ch  $p < 0.05$ , cheilozygomatic index  $p < 0.01$ ). The height of the upper lip was smaller both in the median plane (sn-ls,  $p < 0.001$ , Sn-Ls,  $p < 0.01$ ) and laterally below the insertion of nasal wings (sbal-ll dx et sin  $p < 0.001$ ). The shortening was somewhat more marked on the involved side (sin). The nose was deviated towards the normal side ( $p < 0.05$ , m-prn  $p < 0.01$ ), the nasal columella towards the involved side and contrary to CLP<sub>uni</sub> the latter attained a significance level ( $p < 0.01$ ). The nasal wing was significantly shorter (prn-sbal) only on the normal side ( $p < 0.001$ ), while on the involved side because of the contralateral deviation of the nose the nasal wing was stretched. The difference between the right and left side was significant ( $p < 0.01$ ). The width of the nares threshold (sn-sbal) was increased on the involved side ( $p < 0.01$ ) and decreased on the uninvolved side ( $p < 0.001$ ) because of the dislocation of the columella basis towards the normal side (m-sn,  $p < 0.001$ ). The difference between both sides was again significant ( $p < 0.001$ ). These deviations and asymmetries fully corresponded to the situation in CLP<sub>uni</sub>, however no vertical differences were disclosed in the position of the mouth corners (diff. ch dx: sin). The depth of the nose (prn-sn, Prn-Sn) was unchanged, similarly as in CLP<sub>uni</sub>. According to Topinard's classification an average type of the nostril on the involved side was 2.6 ( $p < 0.001$ ) and on the uninvolved side 1.9 (dx: sin,  $p < 0.001$ ). A widening and deviation of the nose and the reduction of the width of the oral slot were of the same size as in incomplete CLP<sub>uni</sub> (Šmahel, 1982).

**L a t e r o f a c i a l   r e g i o n s** (Tab. 1): No significant deviations were disclosed within these regions. Out of the large number of characteristics only two (go-ex and go-ch) were somewhat reduced because of the slightly anteriorly displaced mandibular angle (mostly  $p < 0.1$ ).

**E a r   l o b e s** (Tab. 1): No deviations of the size (sa-sba, pra-pa), protrusion, inclination or localisation (obs-n, obi-sn) were disclosed. The reduced distance of the columella basis from the lower margin of ear lobe insertion on the uninvolved side (obi-sn, dx,  $p < 0.05$ ) resulted from the dislocation of columella basis in this direction (dx: sin,  $p < 0.1$ ; similarly as in t-sn dx: sin). A retroinclined ear lobe was diagnosed by measurements in five individuals ( $p < 0.05$ ), but only in two of these it was bilateral.

**F a c i a l   a s y m m e t r y** (Tab. 1): An asymmetry occurred only in the oronasal region as described above (deviations of nasal structures, position of the nares and differences in the length of nasal wings and in the width of the nares thresholds between the involved and the uninvolved sides). Differences between the right and left sides in two further parameters (t-sn and obi-sn), within this region resulted also from a deviation of columella basis



towards the normal side. Other metric differences were not demonstrated. The same held true for the anteroposterior projection (inclusive of deviations of mediosagittal structures — dev. Bsptn etc.).

**Visually inspected characteristics:** No changes in the normal ear lobe morphology were detected and anomalies did not occur more frequently. Deviations of facial characteristics were related to the asymmetry within the oronasal region. Dislocation of insertions of nasal wings between the right and left side in vertical direction were recorded in 53 per cent of individuals examined (as compared to 32 per cent in controls,  $p < 0.05$ ) and in anteroposterior direction in 47 per cent (as compared to 16 per cent,  $p < 0.001$ ). However they did not differ significantly from the average size in controls (smaller than 0.5 mm). An asymmetry in the position of the nares was recorded in 47 per cent of cases (8 % in controls,  $p < 0.001$ ), while a deviation of the nasal septum into the passage of the nostril on the normal side occurred in 8.3 per cent only (insign.). The tip of the nose was never markedly flattened. The frequency of differences in the position of the mouth corners (28 %) and of the inner eye canthi (22 %) between the right and left side in vertical direction did not significantly differ from controls (18 and 10 %). Retrocheilia occurred in a single patient (2.8 %), but in another seven patients (19.4 %,  $p < 0.01$ ) the upper lip was displaced in anteroposterior direction to the level of the lower lip (it was prominent in 77.8 %, as compared to 100 % in controls). We have also frequently recorded a high or gothic palate (30.6 %) and anomalies of second incisors on the involved side (25.0 %, of the other incisors in 8.3 %).

**Variability** (Tab. 1—3): Among cephalometric characteristics the variance was increased in deviations of nasal structures and in some dimensions of oronasal region, while with one exception no changes of other characteristics were revealed. Of the roentgenocephalometric characteristics an increase of variance was present in those related to the described changes of the soft profile and in the upper lip thickness ( $Ss'_i$ ,  $Pr_i$ ). On the average, the latter was not enlarged, but the F-test disclosed a higher scatter of values. In a few further characteristics the variability was decreased (S-Ba, Cd-NSL, Ar-tGo, N'-Sn, Mo-Ek), yet in the presence of large numbers of parameters this could be considered as accidental. The results obtained showed that both series were homogenous and comparable. Significant increase of variance was due to the presence of the cleft.

#### DISCUSSION AND COMPARISONS

From the above described findings it follows that neither the development of the body nor that of the neurocranium and of the cranial base are subjected to changes in cleft lip alone. The skelet of the face shows equally only a few deviations. They are all of them related to two basic changes consisting of an enlargement of the interorbital distance (lateral displacement of the orbits with frontal widening) and of a less steep slope of the mandibular ramus displacing the chin forwards and influencing the soft profile and

the shape of the mandible. The latter deviations, however, are only very slight and may be due to the composition of our series. The inclination of the ramus is considered in roentgencephalometric studies as a stable characteristic and we failed to disclose any changes of this feature in any of the series which were so far examined (CLP<sub>uni</sub>, CP, and CLP<sub>bilat</sub>). The configuration of the bony face therefore showed no substantial changes in cleft lip alone, as was confirmed by the large number of investigated cephalometric characteristics. Thus there were no changes in the proportions of facial characteristics, in facial anterior growth rotation, in maxillomandibular relations and occlusion of incisors, or in any other characteristics, inclusive of the inclination of upper incisors and the alveolar maxillary process. The dentoalveolar inclination remained unchanged in spite of the increased tension exerted by the repaired lip. However since the alveolar process remained intact and the incisors were in an overbite no retroinclination developed. It is not clear whether it develops in the presence of cleft in the alveolar process. However it appears probably as documented by several studies concerned with incisors (Grabner, 1954 and Dahl, 1970). The deviation obviously was related also to the applied orthodontic treatment.

The situation differs in the configuration of the orbital region. An increased interorbital distance was found in our earlier series with cleft lip and palate (Šmahel and Brejcha, in press) in which facial changes typical for clefts were recorded. This increase was found even in cleft lip alone, in which the facial skeletal framework, (in particular of the upper face), showed no substantial changes. Yet we failed to demonstrate this increase in our study dealing with isolated cleft palate (Šmahel, in press), where the basic skeletal deviations were actually identical with those in CLP. The interorbital index was changed only in cleft lip either alone or in association with cleft palate. These findings were in favour of the hypothesis about the primary association of an increased interorbital area with cleft lip, or with cleft of the primary palate, resp. (though the difference was smaller in CL than in CLP).

In contrast to skeletal changes the oronasal region showed the same deviations in unilateral cleft lip as in unilateral cleft lip and palate (Šmahel, 1982). They consisted of a slight increase of nasal width, reduction of the oral slot width, shorter height of the upper lip and typical deviations and asymmetries of nasal structures. However the thickness of the upper lip was not reduced since the tissue deficiency within the region of the incomplete cleft lip was originally not excessive. This situation was in agreement with our findings in incomplete CLP<sub>uni</sub> (Šmahel and Brejcha, in press), where equally the thickness of the lip was not reduced. Nasal changes were caused mainly by the deviated insertion and function of some muscles of the lip and nose (Novoselov, 1979). The reduced width of the oral slot was related to cheiloplasty, while the lower height of the lip was due primarily to the tissue deficiency and secondarily to the lip suture. The frequent occurrence of incisors anomalies indicated a damage to the region of the apparently intact alveolar pro-



cess and was reported by other authors as well (Peterka, 1979, found in 50 per cent of the patients a supernumerary, or bifurcated lateral incisor, or some other forms of tooth tissue hyperplasia).

The above mentioned allows the conclusion, that the skeletal facial configuration in cleft lip alone remains unchanged, with the exception of the interorbital distance, while soft tissues within the oronasal region show deviations and asymmetries which are of the same character as in unilateral cleft lip and palate. The oronasal region was always directly affected by cleft lip and the changes described represented its sequelae. Their extent resulted from the degree of malformation and from the preceding repair procedures. The earlier described findings in cleft lip and palate (Šmahel, 1982, Šmahel and Brejcha, in press) and in isolated cleft palate (Šmahel, in press), as well as the present results provided evidence that facial skeletal changes were related to cleft palate (either primarily or secondarily) while soft tissue changes were due to cleft lip, with the exception of the increased interorbital distance which occurred regularly in cleft lip. An isolated cleft palate was associated with some specific features within the oronasal region (i. e. gracility and tendency towards microstomia). It was possible to draw a simplified conclusion that the final state of changes associated with cleft lip and palate consisted of deviations present in the other two types of clefts, i. e. in an isolated cleft palate (mainly skeletal changes) and in cleft lip (mainly soft tissue changes), however with the additional occurrence of some other deviations (Šmahel and Brejcha, in press). They include in the first place dentoalveolar retroinclination of the maxilla resulting from the increased tension exerted by the repaired lip and the deficient vertical growth of the upper face, due to the interruption of continuity between the alveolar process or the lateral segment of the upper jaw resp. and the nasal septum (as the sequelae of cleft in the alveolar process).

The literature contains much less data on the configuration of the skull in cleft lip alone and on the somatic development of individuals involved, as compared to the other types of clefts. There are most probably not substantial differences of body characteristics. Hunter (1975) showed that in twins discordant for cleft lip alone, deficient body growth was smaller in degree than in other types of clefts and was not marked. In adult males Dahl (1970) ascertained a reduction of body height as compared to that in a control group of students (by 5.7 cm), contrary to the data on conscripts where the difference was only slight (by 1.3 cm). A higher than average stature, in the control group of students represented most probably the cause why the dimensions of the neurocranium and some other basic facial measurements in CL were smaller in his series, as he underlined himself. The global configuration of the face, however, did not show substantial differences as compared to the norm, with the exception of the increase of the interorbital distance and retroinclination of upper incisors. Slightly changed were also some parameters of mandibular shape (an obtuse gonial angle, an acute chin angle and a retroinclination of lower incisors). Similarly as the identical observations

in our series they represented adaptive changes to a less steep slope of the ramus. The studies reported by Graber (1954), Derichsweiler (1959) and by Ross and Coupe (1965) suggested that facial growth was not affected in cleft lip alone. This was confirmed also by Cronin and Hunter (1980). The latter authors found in fifteen twins discordant for cleft lip only a single within-twin difference consisting of a posterior rotation of the mandible due to a steeper slope of the ramus. This finding is in disagreement with the less steep slope of the ramus recorded both by us and by Dahl (1970), yet the deviations varied within a small range ( $\pm 2.5^\circ$ ) and confirmed that they were by no means typical for clefts. No differences in dimensions of the mandible were found by Nakamura et al. (1972) in children with cleft lip, and by Ross (1965) in the configuration of the cranial base. These observations equally allowed the conclusion that with the exception of the increased interocular distance and the retroinclination of upper incisors occurring mainly in a simultaneous cleft of the alveolar process, cleft lip alone was not associated with any facial skeletal changes.

The increase of the interocular width in cleft lip alone was confirmed by Dahl (1970), Aduss et al. (1971), Hirschfeld and Aduss (1974) and by Figalová et al. (1974). All these authors reported in agreement that an increase of interocular distance occurred also in cleft lip and palate, yet it was not present in isolated cleft palate. These observations could be explained by the impaired development of nasofrontal processes leading to cleft lip (primary palate) and affecting the interocular distance as well (Aduss et al., 1971).

So far facial soft tissue characteristics in cleft lip alone were not quantitatively studied in detail. The preoperative increased nasal width, the deviation of the nose towards the normal side and of the columella towards the involved side, as well as a vertical and anteroposterior dislocation of nasal wings insertions were described by Hajniš and Figalová (1973). We failed to find any other metrical data in the available literature. The purpose of the present communication was to supply additional and more precise information than were so far available.

#### SUMMARY

Somatometric, cephalometric, roentgencephalometric and visual examinations were carried out in 36 adult males with left sided cleft lip alone without an involvement of the alveolar process.

Body characteristics corresponded to the norm and equally no changes of the dimensions of the neurocranium and of the cranial base occurred. The face showed an increased interorbital distance and, due to a lateral displacement of orbits, a wider front. Slight changes of the lower jaw which affected the facial soft profile resulted from an adaptation to the less steep slope of the ramus (anteinclination). However the latter was not characteristic either for cleft lip, or for other types of clefts. We failed to disclose any other skeletal changes inclusive of the inclination of upper incisors, of the alveolar process and of the occlusion of incisors. The proportions and other

parameters of facial development (anterior growth rotation a. o.) were not impaired. Thus cleft lip was not associated with substantial skeletal deviations, but for an increased interorbital distance occurring regularly in cleft lip (with or without cleft palate). On the contrary the soft tissues within the oronasal region showed the same changes as in unilateral cleft lip and palate, i. e. slightly increased width of the nose, a smaller width of the oral slot, shorter upper lip height and deviations and asymmetries of nasal structures. The thickness of the upper lip did not differ from that in controls. Anomalies of second upper incisors on the involved side and a high palate were more frequent. There were no changes of the size and configuration of ear lobes.

## R E S U M E

### **Des changements craniofaciaux chez la division labiale unilatérale à l'âge adulte**

Š m a h e l, Z.

Par des examens somatométriques, céphalométriques, radiocéphalométriques et visuellement on a examiné 36 hommes adultes avec une division labiale à gauche. C'était une seule lèvre qui était atteint, sans affection du promontoire alvéolaire.

Des caractéristiques corporelles correspondent à la norme, des dimensions de la boîte crânienne et de la base crânienne ne sont pas changées. Sur le splanchnocranium la distance interorbitaire augmentée a été constatée, ou plutôt le déplacement latéral des orbites, auquel est relié l'élargissement du front. De petites anomalies de la mâchoire inférieure qui ont influencé aussi le profil du visage résultent compensativement de l'obliquité du rameau (antéinclinaison). Toutefois, cette obliquité n'est point caractéristique ni pour les divisions labiales, ni pour d'autres types des divisions. On n'a pas remarqué d'autres changements sur le squelette du visage, y compris l'inclinaison des incisives supérieures, le promontoire alvéolaire ou la denture qui ne prouvent pas de changements. La proportionnalité, aussi que d'autres paramètres du développement du visage (antériorotation ou pareillement) ne sont pas changés. Quand il s'agit de la division labiale simple, le splanchnocranium ne montre pas de graves anomalies, en exception de la distance interorbitaire augmentée qui est toujours présente chez une division labiale (avec ou sans une division palatine). Au contraire, sur des tissus mous de la région oronasale on a constaté de mêmes déviations que celles de la division labiale et palatine unilatérales, c'est-à-dire: élargissement du nez, rétrécissement de la fissure labiale, abaissement du lèvre supérieure, déviation et asymétrie des structures du nez. L'épaisseur du lèvre supérieure correspond au contrôle, fréquemment on a remarqué des anomalies des secondes incisives supérieures du côté atteints et un palais haut. La grandeur et la formation du pavillon d'oreille ne présente pas de déviation.

## Z U S A M M E N F A S S U N G

### **Kraniofaciale Veränderungen bei einseitiger Lippenspalte bei Erwachsenen**

Š m a h e l, Z.

36 erwachsene Männer mit linksseitiger Spalte der Lippe allein, ohne dass der Alveolarfortsatz betroffen war, wurden somatometrisch, kephalometrisch, roentgenkephalometrisch und visuell untersucht.



Die körperlichen Charakteristiken entsprachen der Norm, und ebenfalls die Ausmasse der Hirnhöhle und der Schädelbasis waren nicht verändert. Am Splanchnokranium wurde eine vergrösserte interorbitale Entfernung bzw. eine laterale Verschiebung der Augenhöhlen festgestellt, mit der die Erweiterung der Stirn in Zusammenhang steht. Ferner wurden geringere Abweichungen am Unterkiefer gefunden, die auch das Profil des Gesichts beeinflussten und sich kompensationsmässig aus der mehr nach hinten verlaufenden Abschrägung des Zweigs ergaben (Anteinklination), die jedoch weder für eine Lippenspalte noch für sonstige Typen von Spaltungen charakteristisch ist. Andere Veränderungen wurden am Skelett des Gesichts nicht registriert, einschliesslich der unveränderten Inklination der oberen Schneidezähne und des Alveolarfortsatzes und Zahnreihenschlusses. Auch die Proportionalität sowie weitere Parameter der Entwicklung des Gesichts (Anteriorrotation) waren nicht verändert. Das Splanchnokranium bei der Lippenspalte selber wies also keine wesentlichen Abweichungen auf, mit Ausnahme der vergrösserten interorbitalen Entfernung, die stets bei einer Lippenspaltung auftritt (mit oder ohne Gaumenspaltung). Dagegen wurden in den weichen Geweben des Oronasalgebiets die gleichen Abweichungen festgestellt wie bei einer einseitigen Lippen- und Gaumenspalte, also Verbreiterung der Nase, Verengung der Mundspalte, Senkung der Oberlippe und Deviation und Asymmetrie der Nasenstrukturen. Die Dicke der Oberlippe entsprach der Kontrolle, häufiger jedoch waren Anomalien der oberen zweiten Schneidezähne der betroffenen Seite und ein hoher Gaumen. Die Grösse und Form der Ohrmuscheln wies keine Abweichungen auf.

#### RESUMEN

##### **Cambios craneofaciales producto de cisión labial unilateral en la edad adulta**

Šmahel, Z.

Se hizo el examen somatométrico, cefalométrico, radiocefalométrico y visual de 36 hombres adultos con cisión en el lado izquierdo del labio sin afectación del saliente alveolar.

Las características somáticas corresponden a la norma y también las proporciones del craneo y la base craneana quedan inalterados. En el esplanocraneo se detecta un aumento de la distancia interorbital, resp. un desplazamiento lateral de las órbitas con el cual tiene que ver la dilatación de la frente. Pequeñas diferencias registradas en la mandíbula que se proyectan igualmente en el perfil de la cara se originaron como compensación que se debe a la inclinación posterior (anteinclinación) del ramo facial, que sin embargo es poco característica para las cisiones labiales y de otro tipo. En el esqueleto de la cara no fueron detectados más cambios incluyendo la inalterada inclinación de los incisivos superiores, del saliente alveolar y del mordex. También la proporcionalidad y otros parámetros del desarrollo de la cara (la anteriorrotación y otros) quedan sin cambio. El esplanocraneo, en el caso de la sola cisión labial, no arroja pues ningunas diferencias sustanciales con excepción de la mayor distancia interorbital que siempre acompaña la cisión labial (con o sin la cisión del paladar). En cambio, en los tejidos blandos de la zona oronasal fueron detectadas las mismas asimetrías como en el caso de la cisión unilateral del labio y el paladar, es decir dilatación de la nariz, estrechamiento de la fisura bucal, descenso del labio superior así como desviación y asimetría de las estructuras de la nariz. El grueso del labio superior corresponde al control, sin embargo más a menudo se registran anomalías de los incisivos superiores segundos de la parte afectada y un paladar alto. No hay desviaciones en el tamaño y la conformación de los pabellones.

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## ANNOUNCEMENT

Ministry of Health, Union of the Scientific Medical Societies and Republican Scientific Society of Surgeons organize

### IV. NATIONAL CONFERENCE ON BURNS AND PLASTIC SURGERY

with international participation in **Sofia, October 19—20, 1984**

Scientific Programme:

- Intensive treatment of burns
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The IV. National Conference on Burns and Plastic Surgery will be held in the hall of the Clinic of Thermal Trauma of Institute "N. I. Pirogov" — Sofia.

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Dr. Y. Chervenkov, d. m. sci.



Gorkovskiy Science and Investigation Institute of Injuries and Orthopedics, Gorkiy  
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Director Prof. M. G. Dmitriev

## SCAR DEFORMITIES OF THE MAMMARY GLANDS-SURGICAL TREATMENT.

S. M. PAKHOMOV, G. I. DMITRIEV

The cases of deep burns of chest are often involved with the deformities of the breasts in female, causing physical and mental complications. The plastic restoration of the shape and site of breasts represents complicated and only partially solved problem in reconstructive surgery.

To treat scar deformities of the mammary glands, the local skin plasty (Smith, 1950), free transfer flaps (Ponten, 1968; Dipirro, 1970; N. P. Ivanova and L. A. Bolkhovitionova, 1977; V. V. Yudenich et al., 1981) were applied. They even advice to excise preserved sound skin to avoid subsequent spotting (Stark, 1962). Tube flap is supposed an appropriate biological material to restore the lost breast (Holdsworth, 1966; F. Burian, 1967; M. V. Mukhin, 1973). M. V. Mukhin (1973) and Holdsworth (1966) were transferring a great layer of the full-thickness flap from abdomen on 2 tube flaps. F. Burian transferred a part of the remained mammary gland of a women, whose second breast was missing due to the deep burn in childhood. O. V. Dolnitskiy (1971) was carrying out combined skin plasty. After excising scars, the denuded part of mammary gland is covered with triangular flaps taken from local tissues, they are lined along the margin of the wound and injury on the chest is covered with full-thickness flap. Still this method is not suitable when the case is of heavy deformities of the breast glands, when both the tissues and surrounding skin are scarring. As the author states, this method demands combined grafting of sound local skin covers and full-thickness flap. This operation method is said to be justifiable in the defects of breast, involving no shifting of nipple downwards. Hence the described method is convenient only in cases of inconspicuous scarring contractures of breasts, when the nipples are not deformed or shifted.

### TREATMENT METHODS

We were treating 27 patients from 12 up to 27 years of age, with occuring postburn skin contractures and 34 breast's deformities. They were surgically treated 5 up to 25 years after exposure.

To treat scar deformities local plastic operation (5 women), free transfer flaps (9 women), combination of various skin grafting methods (7 women) were used. 13 patients were treated with grafting, performed according to our new method (author's certificate No 731960).



Fig. 1. Post-burn deformity of the left breast. — Fig. 2. Cutting peninsula full-thickness flaps

Our new method of procedure in performing operation is following. All the scars in the area of the mammary gland, causing its deformity and shifting nipples, more often downwards (Fig. 1) are incised. The most rough scars are excised. Shifted gland is separated with the covering fascia from the adherent tissues and transposed upwards to the position, symmetrical to the sound breast or to the ordinary site in case of bilateral deformity. Then it is sutured on the new site with cutgut sutures. The lower side of the transposed breast is now bare of skin.

To cover the wound on the lower side of breast 2 symmetrical or asymmetrical (according to condition of local tissues) peninsula skin flaps with sub cutis are cut (Fig. 2). Peninsula shape of the flaps enables grafting even with scarring tissues. The flaps are mobilized (Fig. 3) and transposed towards each other. They cover the lower part of gland and are sutured together by their tops. This way ensures reliable fixing of mammary gland on its new site and prevention from the secondary shifting is reached. The remaining, some-

times quite major wounds resulting from transposing the issue of mammary gland and taking of full-thickness flaps are covered with thick split skin flaps (Fig. 4).

The shape and the size of peninsula full-thickness flaps depends on the size of wound and condition of neighbouring skin. Length (L) of each flap is equal to half the breast defect length on its lower border, and the width (L<sub>1</sub>) to the curve of the breast between upper margin of wound, near nipple and areola, to lower margin of wound (Fig. 5). If it is not possible (due to scars) to take 2 flaps with sub cutis, we can graft with 1 major flap.

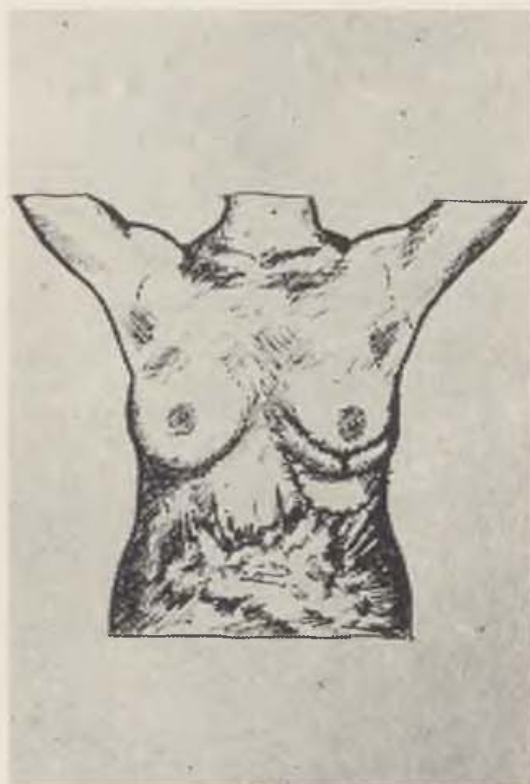
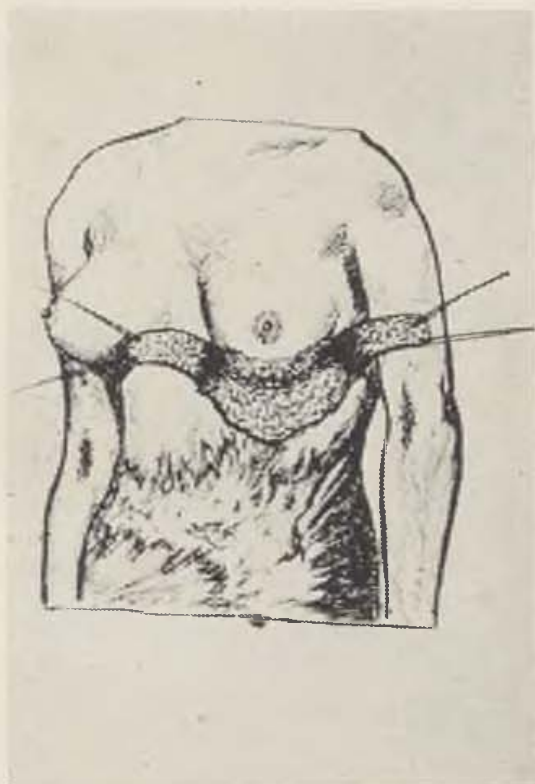


Fig. 3. Full-thickness flaps mobilised, put aside on the clamps. Lower part of the mammary gland denuded. — Fig. 4. Full-thickness flaps sutured together, covering the lower part of breast. Wound under the mammary gland covered with free transfer flap

#### RESULTS AND DISCUSSION

We have applied local skin grafting in cases of limited scars and inconspicuous contractures of mammary gland, when sufficient area of adjacent sound and easy transferrable tissues provided. In those cases entirely satisfactory effect was reached, when triangular flaps with sub cutis were transposed towards each other or mobilized wound edges closed the excised scars. The deformities being severe and the shifting of the mammary glands substantial, local skin grafting is only limited.



Analysing results of free skin grafts plasty, carried out by many surgeons to treat postburn mammary glands deformities, we have brought forth some of its shortcomings. Taking the skin flap by gland tissue is complicated, frequently followed with necrosis or melting out of flaps, giving rise to scarring and recurrence of the deformity. Besides, even having taken transplant can involve secondary retraction later, resulting again at the relapse of deformity.

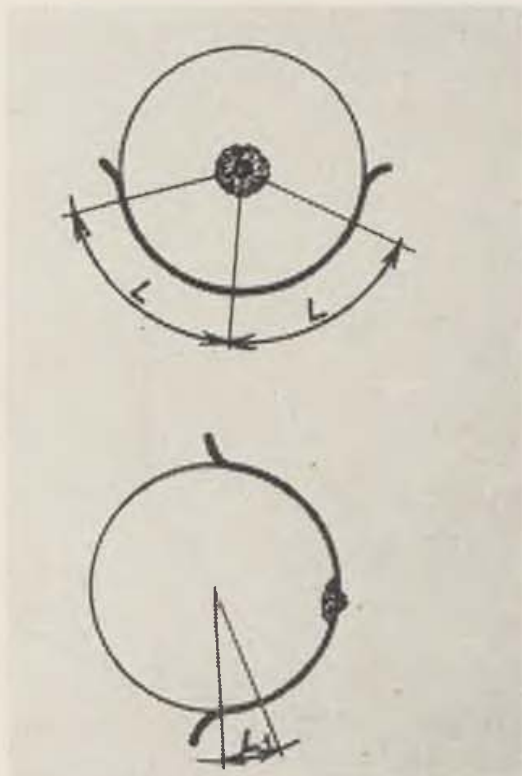


Fig. 5. Scheme, showing shape and size of full-thickness flaps. L — length of peninsula flaps,  $L_1$  — width of peninsula flaps. — Fig. 6. Patient P. before treatment. Rough scars of the chest and abdominal wall, causing deformation and ill development of mammary glands

When the female chest is contracted by scars in the large area, particularly in young girls, it gives often rise to severe deformities of breasts with partially or completely missing nipple and aerola. In cases like that it is inevitable to transfer major layers of skin, to carry out combination of local tissues grafting and free transfer flaps.

Application of the local tissues as triangular flaps to cover denuded lower part of mammary gland after its mobilization and transposing does not give constant effects, as the tops of scar affected flaps often involve necrosis, resulting in relaps of deformity.

Our new combined skin plasty method, grafting with composed flaps with sub cutis from local tissues and free transfer flaps solves a lot of problems.

It enables to improve severe deformities of mammary glands after burns, accompanied by shifting gland and also nipple and aerola. Peninsula shape of flaps excludes rise of necrosis of their tops, thus preventing relapse of deformity, and makes it also possible to form adequate outlines of breast. Covering denuded part with full-thickness flaps is much more likely to be reliable, than dermal transplants, taken by gland tissues much worse. Full-thickness flaps sutured together on lower side of breast are besides supporting it in a new position also preventing its secondary shifting and hence minimize the possibility of the relapse of deformity. Skin flaps with sub cutis from local tissues are covering its lower side and keep it on a new place on the one hand and we can in this way to model the natural-like globe-angular shape of breast on the other hand.

Application of split dermatome transplants enables to graft major wounds, arising after transposing of mammary gland tissue and taking of full-thickness flaps.

The combined skin plasty of peninsula flaps with sub cutis from the local tissues and free transfer flaps brings about constant effect of the performed operation.

We give one case report as an example.

The patient P., 14 years old, was exposed by flame burn of chest and upper extremities on the area of 30 % of body surface at the age of 4. She was treated and skin grafting was applied, but donor sources being limited, alloplasty was used. As the girl was growing rise was given to shifting and deformity of the mammary glands (Fig. 6). In July 1974, combined skin plasty was carried out to treat the deformity of the left mammary gland. After the excision of contracting scars, mammary gland was mobilized and sutured on the new site, corresponding with the ordinary position of gland. On either lateral side of the transposed gland 2 peninsula flaps with sub cutis were cut.



Fig. 7. The same patient after operation of combined skin plasty of the left mammary gland deformity



The tops of flaps were affected by scars. After mobilization and transposing, the flaps covered the denuded part of the mammary gland. The distance of areola to lower border of gland was equal to that to the upper border. The remaining defect on chest-abdominal wall (210 cm<sup>3</sup>) was grafted with split transplants 0,5 mm thick (Fig. 7). Similar operation was performed on the right mammary gland June 25, 1975. As the result of the 2 operations the deformities of both the mammary glands were mended (Fig. 8). The long-term checking was done after 7 years. The female patient got married. She was delivered of a child and was nourishing it with both her right and left breast.

M. D.



Fig. 8a), b) The same female patient. Result of mending of the postburn deformities of breasts by the combined skin plasty according to author's method

#### SUMMARY

The treatment of 27 patients in the age from 12 up to 27 years was analysed involving 34 postburn mammary glands deformities. Various methods of skin plasty were used. In case of major scarring areas of chest the combined skin plasty proved to bring about the best effects, applying local tissues peninsula full-thickness flaps and free skin grafts. Local tissues are used to form the outline of the gland and to cover the wound in its lower part. Free skin graft is applied for grafting the tissues impaired by the mammary gland transposing and by taking the full-thickness flaps from the local tissues.

## RESUME

### **Le traitement chirurgical des déformations cicatricielles des glandes mammaires**

Pachomov, S. P., Dmitrijev, G. I.

On a exécuté l'analyse de 27 malades âgés de 12 à 27 ans, atteints de déformation de la glande mammaire (34 glandes atteints en tout), conséquence de la brûlure. On a utilisé des méthodes variées de la plastie cutanée. En présence de vastes changements cicatriciels du thorax, on obtient de meilleurs résultats par une plastie cutanée combinée, en utilisant des greffons cutanés en forme d'une péninsule avec une strate sous-cutanée des tissus locaux ou des greffes cutanées libres. Les tissus locaux sont appliquées pour former une circonférence de la glande et pour couvrir la plaie dans sa partie inférieure. Une greffe cutanée libre est utilisée pour des plasties des tissus qui sont endommagés par le déplacement de la glande mammaire ou par le prélèvement des greffons cutanés avec leur strate sous-cutanée.

## ZUSAMMENFASSUNG

### **Chirurgische Behandlung narbenartiger Deformationen der Brustdrüsen**

Pachomov, S. P., Dmitrijev, G. I.

Es wurde eine Analyse der Behandlung von 27 Patientinnen im Alter von 12 bis 27 Jahren unternommen, bei denen es infolge einer Verbrennung zur Deformierung von 34 Brustdrüsen kam. Es wurden dabei verschiedene Methoden der Hautplastik angewendet. Bei ausgedehnten narbenartigen Veränderungen des Brustkorbs werden die besten Ergebnisse mit kombinierter Hautplastik unter Anwendung von Hauttransplantaten in Form von Halbinseln mit der Unterhautschicht aus lokalem Gewebe und freien Hauttransplantaten erzielt. Das lokale Gewebe wird zum Formen des Drüsenumkreises sowie zum Verdecken der Wunde in ihrem Unterteil verwendet und das freie Hauttransplantat zur Plastik des Gewebes, das durch die Verlegung der Brustdrüse und die Entnahme des Hauttransplantats mit der Unterhautschicht aus dem lokalen Gewebe beschädigt wurde.

## RESUMEN

### **Tratamiento quirúrgico de las deformaciones queloidales de las glándulas pectorales**

Pajomov, S. P., Dmitriev, G. I.

Se hizo un análisis del tratamiento de 27 pacientes, de 12 a 27 años de edad, en los que, como consecuencia de quemaduras se produjeron 34 deformaciones de las glándulas pectorales. Fueron utilizados diferentes métodos de la dermoplastia. En caso de extensos cambios queloidales del tórax, los mejores resultados se consiguen al implementarse la plástica combinada de piel utilizándose trasplantes dérmicos en forma de península con capa subcutánea de los tejidos locales así como trasplantes dérmicos libres. El tejido local es utilizado para conformar el perímetro de la glándula así como para cubrir la herida en su parte inferior. El trasplante dérmico libre se utiliza para la plástica de los tejidos deteriorados por la transferencia de la glándula pectoral y por la toma de los trasplantes dérmicos con la capa subcutánea de los tejidos locales.

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Department of Congenital and Acquired Pathology of the Hand

Head G. S. Godunova, M. D.

## RECONSTRUCTIVE SURGERY OF THE THUMB HYPERPHALANGISM COMBINED WITH RADIAL POLYDACTYLIA

G. S. GODUNOVA, I. V. SCHVEDOVCHTENKO

Various techniques of surgical removal of hyperphalangism of the thumb and of radial polydactylia are dealt with in a considerable number of studies. However, to our knowledge, no special technique has been developed for treatment of rather rare simultaneous occurrence of these two congenital defects.

We have operated on 12 patients, aged from 2 to 12 years, suffering from the above mentioned combination of the thumb congenital deformities. We have encountered quite different variations of these deformities in each of our patient and atypical operative techniques were required for their reconstructive treatment. As examples we will give three case histories.

1. Patient K., aged 10 years. Diagnosis: hyperphalangism of the thumb with radial polydactylia (Fig. 1). Hypoplastic distal and middle phalanges deviated from the longitudinal axis of the proximal phalanx at a right angle. Ulnary, at the level of the proximal phalanx metaphysis, there was a supernumerary digit with two phalanges.

Clinically, as well as roentgenologically, aplastic interphalangeal joints of both fingers and total syndaktylia were diagnosed. Syndaktylia consisted of skin and subcutaneous tissue only; the bones and nails were not connected. The first metacarpal bone was longer than usual one and it had an accessory distal epiphysis.

The thenar muscles as well as the length and form of the first interdigital space were normal. Function of the first finger, set in the opposing position, was quite satisfactory, except the immobilization of all interphalangeal joints. However, elongated, twinned and distorted thumb was a serious obstacle to work and a conspicuous cosmetic defect as well.

Owing to remarkable hypoplasia of the distal and middle phalanges we used a reconstructive operation based on the technique of Bilhaut [1890] and formed one out of the two thumbs. We made a partial longitudinal excision of the nails, soft tissues and adjacent parts of the phalanges of the thumb and of the supernumerary digit and joined their remaining parts (Fig. 1a). More-



over, the length of the thumb was corrected, and, simultaneously, the clinodactyly removed, by resecting two thirds of the proximal phalanx. The marrow cavity of the remaining third of the proximal phalanx was enlarged and the joined phalanges inserted into it.

Thus, one thumb with two phalanges of the thumb and the supernumerary digit (Fig. 1d).



Fig. 1. Triphalangism of the thumb in combination with radial polydactyly in patient K., aged 10 years

a) scheme of the formation of the thumb with two phalanges (the hatched parts were resected)



Fig. 1b) X-rays of the hand before the treatment. — c) the hand immediately after the reconstructive operation

2. Patient P., aged 3 years. Diagnosis: duplication of the thumb (Fig. 2) with three phalanges, hyperphalangism. Accessory rudimentary phalanx was present at the radial aspect of the middle phalanx of the thumb. Both triphalangeal thumbs were hypoplastic and set in the same plane as the other



Fig. 1d) the hand two years after the operative treatment

fingers, and not in the opposing position. The first metacarpal bone was not duplicated. The first interdigital space was short, the interdigital fold reached the level of the head of the 2nd metacarpal bone. X-rays revealed partial synostosis of the proximal phalanges of the duplicated thumb and the presence

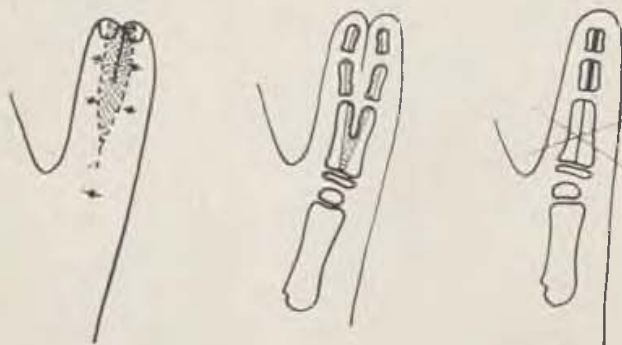


Fig. 2. Duplication of the triphalangeal thumb in combination with hyperphalangism in patient P., aged 3 years. — a) scheme of the formation of single triphalangeal finger [hatched areas were resected]

of both the proximal and distal epiphysis of the first metacarpal bone. The thenar muscles were absent, and, consequently, the opposition and proper grip impossible.



Fig. 2b) X-rays of the hand before the treatment. — c) a photograph taken during the operation after resecting of the medial parts of both fingers (resected parts of the phalanges shown in the right)



Fig. 2d) The newly formed finger with three phalanges immediately after the operation. — e) X-rays of the hand after the operation



Surgical treatment was performed in three stages. At first, the accessory rudimentary phalanx was removed. In the second stage the operation according Bilhaut (1890) was used and the duplicated thumb was reduced to single thumb with three phalanges (Fig. 2a, s-d). The small fragments of the distal and middle phalanges were joined using intraosseous sutures; proximal phalanges were wired. After 8 months pollicization of the triphalangeal first finger was performed using the method of Buck-Gramcko (1971).

These reconstructive operations resulted in considerable improvement of both the form and function of the thumb (Fig. 2g).



Fig. 2f) 2 months after the operation. — g) the hand two years after the pollicization of the triphalangeal finger



Fig. 3. Triphalangism of the thumb in combination with radial polydactyly (triplication of the thumb) in patient T., aged 2 years. — a) scheme of the operation (hatched parts were resected)



3. Patient T., aged 2 years. Diagnosis: triplication of the thumb (Fig. 3). Movements of the thumb and radial supernumerary finger were synchronized. The digits had three phalanges and separate metacarpal bones. The second supernumerary digit at the ulnar side had two phalanges, its metacarpal bone was rudimentary and no active movement was possible. There was additional deformity — the clubhand with a shortened and widened radius.

We have performed pollicization of the triphalangeal thumb with simultaneous removal of the two supernumerary digits and of their metacarpal bones (Fig. 3a, d). During the surgery we found that the non-functional biphalangeal thumb had no tendons. The hypoplastic tendons of the flexor and extensor muscles of the radial supernumerary finger appeared to be branches of the normally developed tendons of the thumb, which was the cause of synchronised movements of these two digits.

Reduction of the supernumerary phalanges of the thumb was achieved by resecting the first metacarpal bone. The thumb on its neurovascular bundle was shifted proximally into the opposing position, and the proper interdigital space was established. Thus, the basal phalanx of the first digit was transformed into the first metacarpal bone (Fig. 2d, e). The transposition of the first dorsal and volar interosseous muscles according to Buck-Gramcko (1971) secured the permanency of the new position of the thumb and permitted its full function (Fig. 2g).

One year later the clubhand was corrected by prolongation of the radius using the distractive apparatus of Ilizarov (Fig. 3).

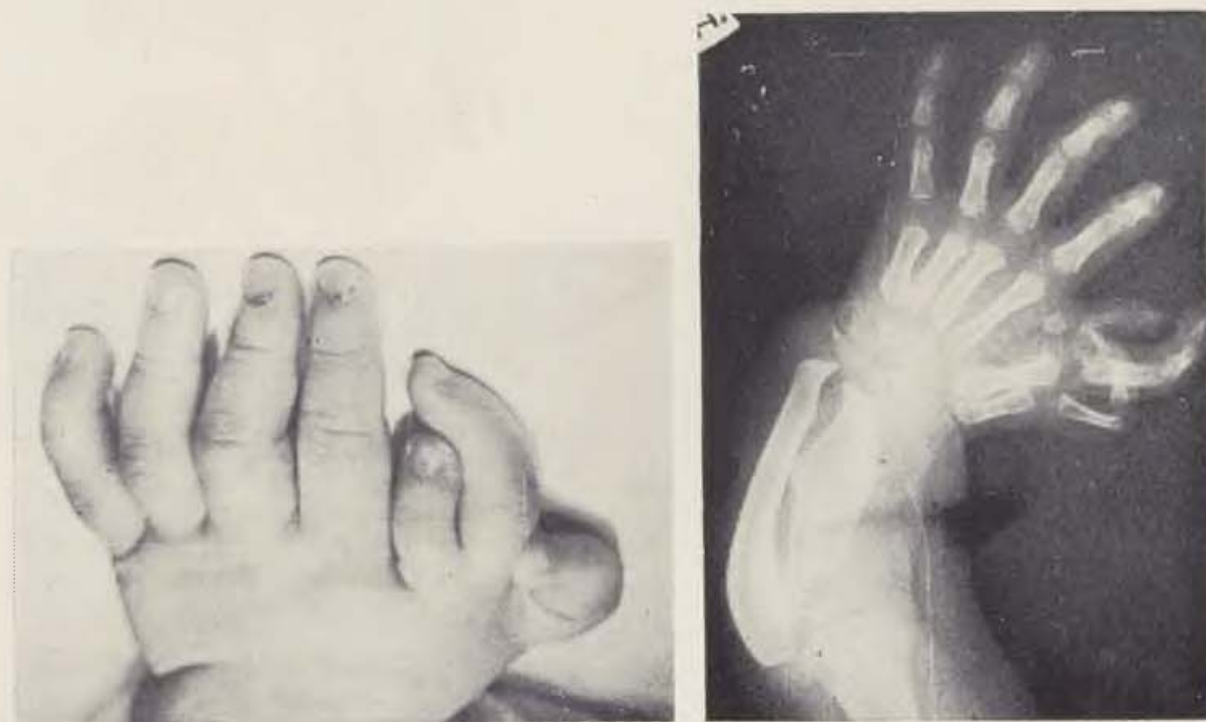


Fig. 3b) The hand before the treatment. — c) X-rays of the hand and forearm before the treatment]



Fig. 3d) X-rays after the pollicization of the triphalangeal first finger and removal of the two supernumerary digits. — e) X-rays two years after the operation



Fig. 3f, g) The hand and forearm two years after the pollicization and removal of the clubhand

To summarize, hyperphalangism of the thumb combined with radial polydactyly represents very often a considerably variable and complicated congenital defect. Therefore, each patient requires an operative technique chosen individually with regard to special features of the defect. This approach, i. e., usage of various operative techniques, enables us to reach good functional and cosmetic results.

M. D.

## SUMMARY

The paper deals with the treatment of 3 patients (aged 2, 3 and 10 years) suffering from complicated congenital defects of the hand (various forms of triphalangism of the thumb in combination with radial polydactylia). Reconstructive treatment utilizing the principle of pollicization and the technique of Bilhaut (1890) has good functional as well as cosmetic results.

## RESUME

### **L'opération reconstructive de la triphalangie du pouce combinée avec polydactylie radiale**

Godunova, G. S., Schevchenko, I. V.

Le travail apporte des informations sur des résultats du traitement des défauts congénitaux de la main (différentes formes d'apparition de la troisième phalange du pouce en combinaison avec la polydactylie radiale). Chez 3 malades âgés de 2, 3 et 10 ans, on a exécuté des opérations reconstructives en utilisant la policisation et des méthodes modifiées de Bilhaut (1890). Les résultats fonctionnels et cosmétiques étaient satisfaisants.

## ZUSAMMENFASSUNG

### **Rekonstruktive Operationen eines dreigliedrigen Daumens, kombiniert mit radialer Polydaktylie**

Godunova, G. S., Schevtchenko, I. V.

Die Arbeit informiert über die Ergebnisse der Therapie kombinierter angeborener Gebrechen der menschlichen Hand (verschiedene Formen des Auftretens dritter Glieder des Daumens in Kombination mit radialer Polydaktylie). Bei der Patienten im Alter von 2, 3 und 10 Jahren wurden rekonstruktive Operationen ausgeführt unter Anwendung von Polizisation und der modifizierten Methode von Bilhaut (1890). Die Funktions- und kosmetischen Resultate waren gut.

## RESUMEN

### **Operación reconstructiva de la trifalanga del pulgar combinada con la polidactilia radial**

Godunova, G. S., Schevchenko, I. V.

El trabajo informa sobre los resultados del tratamiento de los defectos combinados congénitos de la mano (diferentes formas de existencia de la tercera falange del pulgar combinadas con la polidactilia radial). Tres pacientes, de 2, 3 y 10 años de edad fueron sometidos a operaciones reconstructivas al utilizarse la policización y el método modificado de Bilhaut (1890). Se consiguieron buenos resultados funcionales y cos-

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## RESULTS OF MICROSURGICAL SUTURE IN 200 NERVES

D. IONESCU, A. IONESCU

Over the past twenty-five years, our hospital has treated a large number of patients with peripheral nerve lesions. Our constant endeavour has been to improve on our results by adopting the most up-to-date conceptions and techniques and to compare them with our own experience and potentialities.

The use of microsurgical techniques resulted in some spectacular progress while improvement on those techniques by fascicular suture made it possible to obtain very good results.

We do not share the opinion of those researchers who maintain that the epineural suture can be as beneficial as the fascicular one, and that the latter would be a mere technical complication.

Unfortunately, there are cases where the fascicular suture cannot be made because of certain local conditions of the nerve lesion, and neither can a nerve grafting be performed for various other reasons (the patient's poor general condition, rejection, etc.). In such cases, a well trained microsurgeon can still obtain good results even with epiperineurial or interfascicular sutures. We are not considering here those cases where the nerve was transected at a level where it is mono- or oligofascicular.

In our opinion, Millesi, Terzis and other authors have made an essential contribution to understanding and improving the technique of nerve suture and, consequently, in the present article we use roughly the same terminology as that found in their report "Problems of Terminology in Peripheral Nerve Surgery — Committee Report of the International Society of Reconstructive Microsurgery", H. Millesi, M. D. and J. K. Terzis, M. D. (Microsurgery, No. 1, Vol. 4, 1983).

Progress in peripheral nerve reparatory surgery can only be estimated by a strictly objective analysis of the final results, eliminating as much as possible all subjective factors in the evaluation of the result and, at the same time, comparing only patients with the same type of lesions, and matched for age. All this required a division of the material into groups growing smaller and smaller in number, as well as a comparison of genuinely comparable cases.



The greatest variations result from the way in which the microsurgical operation itself is performed since one of the essential, and perhaps most decisive, factors in the final results consists in the surgeon's accuracy and rigour in making the nerve suture. That is why, in order to estimate the results as objectively as possible, we considered it extremely useful to analyze the results obtained by the same microsurgeon.

#### MATERIAL AND METHODS

In the present paper we shall report on the results of peripheral nerve repair performed over a period of three years, from December 1980 until August 1983.

During that period, microsurgical techniques were used in 172 patients with 215 peripheral nerve lesions, namely:

- 68 median nerve lesions,
- 38 ulnar nerve lesions,
- 42 median and ulnar nerve lesions (81 nerves),
- 5 radial nerve lesions,
- 3 external popliteal sciatic nerve lesions,
- 6 digital nerve lesions,
- 14 cases of neurolysis.

Indeed, an analysis of material divided into such small groups would have required a much longer article, consequently, a number of statements in the present study, such as the level of the nerve lesions, will also indicate the degree of the lesion it determined, the analysis comprising only those cases which were not subject to equivocal interpretation.

Having to operate on a large number of patients, we chose only young patients or young adults for this kind of suture, very few of whom had reached the age of 50.

The best moment for the nerve suture, three to four weeks after injury, could only be made use of in a limited number of cases since in each the time of surgery was dictated by specific conditions.

Obviously, the longer the post-injury interval, the more modest the results.

Generally, we may say that differences appear the nearer the patient gets to the end of the one-year time interval from injury, especially where older patients are involved. However, we were glad to see good recovery in some young patients operated on after two or even more years from injury.

Nerve repair surgery took place under the following circumstances:

a) Patients who were admitted in our hospital as emergencies, had their wounds surgically cleaned, their lesions inventoried, and only their skin sutured. Good nerve repair was achieved after three to four weeks.

b) Patients who came from other hospitals with teguments healed per secundam without any attempt at nerve suture. Microsurgery was performed two months after the complete healing of the skin cover.

c) In patients with complex sequelae, "frozen" minds, etc., operated or reoperated on in other hospitals, the sometimes tegumentary, but usually tendinous, problems had to be dealt with by preliminary surgery, the nerve repair operation being performed separately, after another two months.

The tables only refer to lesions of the long tendons requiring surgical repair, the tendon being indicated in Roman figures, and the number of patients with the same type of concomitant lesions in Arabic figures. The lesions of the short tendons sutured or repaired in a wrong way are ignored as they are almost a general rule in nerve lesions.

In the middle and proximal thirds of the forearm nerve lesions were always accompanied by muscle lesions.

Short flexor tendons were, as a rule, not repaired; and if the level of the tendon transection was at the same level as that of the nerve suture they were resected in a way designed to prevent block-scar formation between tendons and nerves.

Where the distal ends of the short flexor tendons were withdrawn into the carpal tunnel, the latter was opened and the tendons excised at the level of the palm.

In the case of associated lesions where grafting or lengthening was required for long flexor repair and the "bed" for nerve repair was or became inadequate, the nerve repair operation was postponed until after the tendons had been reconstructed.

Thanks to this, we never had any complications, suppurations, and the like; the neuro-tendinous recovery was always good, and we obtained the kind of results listed below.

As a rule, the operation started under intraosseous anaesthesia (1% novocaine), with microscopic time under general anaesthesia.

The following techniques of microsurgery were employed:

- fascicular repair in fascicular groups or peripheral fascicle suture were performed on a total of 147 nerves. The average time for the fascicular suture of one nerve was 3 hours.

- in three cases involving median nerve transection, the nerve's artery was sutured after the fascicular suture, the treatment lasting thirty to sixty minutes. All this time, it was perfectly functional. Five to six suture points were made with a 10/0-11/0 atraumatic needle on an artery diameter of 0.2 to 0.3 mm.

- there were only six cases of interfascicular suture when the fascicles were extremely fine and the interfascicular connective tissue was better represented.

- epiperineurial suture was resorted to only where a degree of tension was present at the level of the suture and where for subjective or objective reasons nerve grafting was ruled out (the patient's refusal, etc.). The operation was performed on 33 patients.

— in cases of nerve defect we made an indirect coaptation by means of nerve grafting of the fascicular group — cutaneous nerve — fascicular group type (interfascicular graft), the nerve stumps being prepared by means of interfascicular dissection. Except for two cases in which the nerve graft was taken from the ulnar nerve dorsal sensory branch, the sural nerve was used in the remaining thirteen cases. The length of the defect varied from 1.5 to 11 cm. Depending on the size of the donor nerve, three to four fascicular groups were applied to the median, two to three to the ulnar, and five to six to the external popliteal sciatic nerves. The operation took an average of six to eight hours to complete. It was used on a total of fifteen nerves.



Fig. 1 — Delimitation of nevroma and fascicular groups

#### RESULTS

For an easier record of the results the patients were divided into two groups:

- one for children (included in one table)
- the other for adults, each subgroup of nerve lesions being included in a separate table.

The heading of each table contains — for each patient or identical group of patients — the following data: age, level of transection (which in this particular case also means the complete loss of the motor and sensory functions in the respective nerve area), time of surgery after injury (in months), nerve surgery method, associated tendon lesions (for long tendons only), and the result obtained as seen at the last check-up, the respective month being also mentioned.

Table 1. Nerve Suture results in injured children (29 nerves)

	Evaluation		Number of patients	Age in years	Level of nerve lesions	Months since injury	Nerve repair techniques • fascicular • interfascicular • epiperineurial	Lesion of tendons	Check-up in months	Two-point discrimination	Note
	motor function	sensory function									
Median	M5	S4	1	5	palm	48	• — —	I, II, III, IV, V	8	0.4	
			8	3-14	1/3 distal forearm	1-7	• — —	2	6-4	0.4-0.8	
	M5	S3	1	5	1/3 distal forearm	12	• — —	I, II	5		
Ulnar			1	14	1/3 distal forearm	24	• — —	I, II	7		
	M5		3	13-14	1/3 distal forearm	1-3	• — —	I, II ulnar nerve	3-5		
	M3		1	14	palm	2	• — —		4		
Median and ulnar			1	7	1/3 distal forearm	4	• — —		3		
	M5	S4	1	9	1/3 distal forearm	3	• — —		7	0.7	
	M4				1/3 distal forearm		• — —				
	M5	S4	1	15	1/3 distal forearm	3	• — —		12	0.5	
	M5				1/3 distal forearm		• — —				
	M4	S3	1	12	palm	2	• — —		2		
Nerve radial Ext popliteal sciatic (peroneus communis)			1	11	1/3 distal forearm	5	• — —	II, III, IV, V	2		
	M3	S3	1	8	1/3 middle forearm	3	• — — + graft		7		
	M4				1/3 distal arm		• — —				
	M4		1	14	1/3 distal arm	3	• — —		6		
	M5				peroneus head		• — —		9		
	function recovery	95 %	1	7	peroneus head	3	• — —	operated on before	3		
		40 %	1	7	peroneus head	12	• — —				
Total — 24 patients											



Table 2. Results of suture of median nerve lesions

Evaluation		Number of patients	Age in years	Level of nerve lesions	Months since injury	Nerve repair techniques • fascicular • interfascicular • epineurial	Lesion of tendons	Check-up in months	Two-point discrimination	Note
motor function	sensory function									
M5	S4	1	25	1/3 distal arm	3	• — —		12	1,3	
		1	26	1/3 middle forearm	2	• — —		5	0,7	
		1	23	1/3 distal forearm	3	• — —		4	0,3	suture of median nerve artery
		7	24—25	1/3 distal forearm	4—5	• — —	4	4—10		
M5	S3	2	19—25	1/3 distal forearm	2—3	— — —		4—8		
		2	21—28	palm	1—5	• — —	I, II	3—4		
		1	31	1/3 middle forearm	9	— — —	I, II	6	0,8	
		2	32—38	1/3 middle forearm	1—2	• — —		3—4	0,5	median nerve artery
		2	32	1/3 middle forearm	1—2	• — —	2	3—11		
		1	31	palm	1	• — —	II	12		
		4	25	1/3 distal forearm	3—5	• — —	2	2—5	0,5	
		1	50	1/3 distal forearm	3	• — —	III	6	1,3	
M4	S4	1	21	palm	1	• — —		7		
		1	30	1/3 distal forearm	6	• — —		6	0,8	
M4	S3	1	24	1/3 middle forearm	2	— • •		5		
		9	20—29	1/3 distal forearm	1—6	• — —	3	1—5		
		2	32—40	1/3 distal forearm	5	• — —	1	1—3		

M3	S3	2	25-38	1/3 distal forearm	3-5	.	2	1-2	normal motor functions
M1	S2	1	31	1/3 middle forearm	3	.	I, II, III, IV, V	1	
	S2	1	34	palm	1	.		1	
		8	absent at check-up						

Total — 51 patients



Fig. 2-3 — Interfascicular grafts of the type of fascicular group — cunatenous nerve — fascicular group

The evaluation of sensory and motor function recovery was made for the median and ulnar nerves after Highet, and for the radial nerve after Lovett. For the sciatic nerve the results were given in recovery percentage.

There is a separate group of patients who received treatment with electromagnetic current (diapulse therapy — DT) at the level of the nerve repair.

The diapulse machine produces an electromagnetic field by means of a short-wave generator working on a frequency of 27.12 MHz. Pulsed frequency is between 80 to 600 times per second, and penetration is available in 6 steps between 1 and 8 inches. Each pulse lasts 65 microseconds with peak power being up to 975 W per pulse.



Fig. 4 — Final appearance

#### Children — Table I

1. All median nerve sutures (11) gave very good results even when they had other associated lesions. A child with a palm lesion and all his long tendons transected was operated on 48 months after injury. Before surgery, he was only able to use his fingers (digits II-V) as a hook. Eight months after the operation the results were found excellent.

Another child, 14 years old, was operated on 24 months after injury. We repaired only his median nerve, and the results after 7 months were also very good. (An ulnar nerve transplant would have been necessary but the boy's parents refused to give their consent). We conclude that median nerve suture



in children should give good results even when the operation takes place later than the accepted norm.

2. Motor recovery in the ulnar nerve region in children was invariably very good perhaps because the lesions were localized in a lower position, and the time interval from injury was 1 to 3 months.

It is to be noticed that motor recovery took place before the restoration of the sensory function.

3. Median and ulnar nerve lesions were also treated with good results. Two children were followed up over a period of only two months, after which they no longer reported for check-ups.

4. One child with a lesion in the middle third of the forearm whose ulnar nerve was grafted with two fascicular groups, each 2 cm long, from the dorsal sensory branch of the ulnar nerve came out with a result of M4S3/M4 after 7 months.

5. The only child with radial nerve lesion in the distal third of the arm had a fascicular suture performed. Six months later, the recovery was M5.

In other words, satisfactory results were obtained in all the 24 children operated on, irrespective of the type of the nerve involved. Our conclusion is that nerve repair should be performed even after a long time interval from the accident, as surgery can only be beneficial and completely harmless. Thus, for instance, in a group of children given surgical treatment recently, one child was operated on 10 years after injury. A fascicular nerve suture was performed.

#### Adults — Table II

68 patients with median nerve lesions were observed. Median nerve suture was performed on 14 patients aged 19—30 after a post-injury time interval of one month to one year. Five of them had also associated flexor tendon lesions (usually long thumb flexor and finger 2 flexor profundus). After 3 to 12 months, the results were M5S4 for the whole group.

In a fascicular suture requiring also the respective artery suture, tactile and thermic sensitivity appeared in the first month. The result was M5S4 with 0.3 cm two-point discrimination after 4 months.

The second group consisted of 6 patients, aged 31—38. Five of them had lesions in the distal third of the forearm, one in the middle third, and four had also tendon lesions. In addition, suture of the nerve artery was performed on two patients. A result of M5S4 with 0.5 cm two-point discrimination was obtained within 3 to 4 months after surgery.

For 6 patients, aged 18 to 32, and one aged 50, the result was M5S3. M4S4 was the result seen in one patient six months after surgery.

12 patients had M4S3. In the case of one patient aged 24, operated on 2 months after injury, all we could do was to perform interfascicular and epiperineurial sutures while nine other patients required fascicular sutures, the result being assessed within a time interval of 1 to 5 months. In two patients (31 and 40 years old) the result was M4S3 after 2 months.



Table 3. Results of suture of ulnar nerve lesions

Evaluation motor function	Number of patients	Age in years	Level of nerve lesions	Months since injury	Nerve repair techniques • fascicular • interfascicular • epiperineurial	Lesion of tendons	Cheek-up in months	Note
M5	1	29	1/3 middle arm	1	— •		3	oligofascicular nerve
M5	4	25	1/3 distal forearm	2-3	• — —		3-8	
M5	2	33	1/3 distal forearm	3	• — —		3-6	
M4-5	1	40	1/3 distal forearm	2	• — —		4	
	1	40	1/3 distal forearm	1	— — •		7	
M5	2	24-30	1/3 distal forearm	5-7	• — —	1	5-7	
M4	1	32	palm	1	— — •		5	
	2	20	1/3 superior forearm	2	• — —		5-9	
	2	25	1/3 middle forearm	11	— — •		6-8	
	1	25	1/3 distal forearm	4	• — •		8	
	1	25	1/3 distal forearm	4	• — —		2	
M3-4	1	30	1/3 distal forearm	8	• — —		5	
M2	1	30	1/3 distal forearm	7	— — •	I, II, III, IV, V	2	
Total — 27 patients		patients absent at control						

### Ulnar nerves — Tables III

29 separate ulnar nerve sutures were performed on adults. Out of these, 6 failed to report for check-up, while three were operated on not long ago. The remaining twenty are included in Table III. Out of these, eleven were rated M5. One of them had a lesion in the middle third of the forearm when an epiperineurial suture was made. Also worth mentioning is the fact that at this level the ulnar nerve presented only 4 large fascicles.

6 fascicular sutures were performed at the distal third of the forearm with M5 results. In two other patients, aged 40, one with fascicular, the other with epiperineurial sutures, the result was M4/5. At palm level, one of the two patients also had a lesion of tendons III, IV, V. The results were also M5.

In 3 patients, the results in the proximal third and the middle third of the forearm were M4. In the distal third of the forearm, 3 patients had M4 after 8 months. The rest of the results are recorded in the Table.

### Ulnar and median nerve lesions — Table IV

81 nerves were surgically treated in 41 patients suffering from median and ulnar nerve lesions.

Mention should be made of the fact that the ulnar artery in each of those patients was always severed, too, while about half the patients had also their radial artery severed. In each case, the time interval from injury was over 3 months, and all the patients had previously been operated on in other hospitals. These patients were divided into groups determined by the level of transection.

In the group suffering from lesions in the middle third of the forearm we had one patient, aged 21, whose forearm we replanted after it had been shortened by 5 cm. He was operated on successively at 3 and 4 months after replantation with fascicular sutures performed on the median and ulnar nerves. 12 months later, the result was M5S4/M5, 1 cm two-point discrimination, the patient being able to do the same kind of work he had been doing before injury (precision engineering lathe operator). The other results can be found in the Table.

### Nerve grafts — Table V

Nerve grafts were used 6 times for median nerve continuity repair, 6 times for the ulnar nerve, once for both the median and ulnar nerves in one and the same patient, and once for a defect of the external popliteal sciatic nerve.

All the patients were operated on after at least 2 other operations performed previously in other hospitals.

As a rule, we performed reconstructive surgery of the flexors before nerve grafting.

Ulnar nerve transplant operation for a 10 cm defect in the proximal third of the forearm was performed on a young man, aged 18, five years after injury. The result after 12 months was M4.

Table 4. Results of suture in median and ulnar nerve lesions

Evaluation		Number of patients	Age in years	Level of nerve lesions	Months since injury	Nerve repair techniques · fascicular · interfascicular · epiperineurial	Lesion of tendons	Check-up in months	Two-point discrimination	Note
motor function	sensory function									
M5	S4	1	26	1/3 sup forearm	6	· — —		11	1,2	
M5	S2	1	42	1/3 sup forearm	5	· — —		6		
M3/4	S4	1	21	1/3 middle forearm	3-4	· — —	replantation	12	1	
M5	S4	1	29	1/3 middle forearm	3	· — —	II, III, IV, V	8	1,2	
M4	S3	1	36	1/3 middle forearm	9	· — —	I, II, III, IV, V	2		
M3	S2	1	42	1/3 middle forearm	3	· — —	I, II, III, IV, V	2		
M2		3	30	1/3 middle forearm	3	· — —	I, II, III, IV, V	too short an interval to be estimated		
M3								5-6		
M5	S4	2	22	1/3 distal forearm	1-2	· — —	III, IV, V			
M5		1	27	1/3 distal forearm	3	· — —	II, III, IV, V	5		
M5	S4	1	25	1/3 distal forearm	5	· — —	II, III, IV, V	6	1,2	
M3	S3	1	24	1/3 distal forearm	2	· — —	I, II, III, IV, V	7		
M5	S3	2	24	1/3 distal forearm	2	· — —	I, II, III, IV, V	3-4		
M4	S4	1	32	1/3 distal forearm	2	· — —		12	1,2	
M4	S3	1	26	1/3 distal forearm	2	· — —	I, II, III, IV, V	4		
M3	S2	1	16	1/3 distal forearm	2	· — —	I, II, III, IV, V	2		





Table 5. Results of nerve graft repair

	Evaluation		Number of patients	Age in years	Months since injury	Level of nerve lesions	Length of defect (cm)	Lesion of tendons	Number of group fascicles (cable)	Check-up in months	Two-point discrimination	Note
	Motor function	Sensory function										
Median	M5	S4	1	23	10	1/3 distal forearm	10	I, II, III, IV, V	3	12	0.6	
	M4	S3	1	27	7	1/3 middle forearm	8	I, II, III, IV, V	3	6	0.8	
			1	42	24	1/3 middle forearm	5		5	6	1	
	M5	S4; M5	1	26	6	1/3 sup forearm	1.5		1	11	1	
			1	27	4	1/3 middle forearm	4		4	absent* at control		fascicular suture of ulnar nerve branches ulnar dorsal cutaneous branches used as graft
Ulnar			1	28	5	1/3 sup forearm	4.5		3			
	M4		1	28	2	1/3 sup forearm	7.5		1	6		
			1	18	62	1/3 sup forearm	10		2	12		
	M3-4		1	34	7	1/3 distal forearm	4.5		4	6		
	M4		1	37	4	1/3 distal forearm	5	I, II, III, IV, V median nerve	4	8		Median M4 S3 M5 S4 M5 S4
			1	8	3	1/3 middle forearm	2		2 of ulnar nerve dorsal cutaneous 4 branches		7	
	M2		1	30	7	1/3 distal forearm	6			10 and 6		

Median and ulnar	Evaluation		Number of patients	Age in years	Level of nerve lesions	Months since injury	Nerve repair techniques • fascicular • interfascicular • epiperineurial	Check-up in months	Note
	M4 M4	S3							
Ext. popliteal sciatic (peroneus communis)	1	1	23	9	1/3 distal forearm	6	II, III, IV, V	2 1	8
	75 % function recovery		16	6	head of the fibula	5		6	5

Total — 14 patients : 15 nerve grafts

Table 6. Results of suture in radial nerve lesions

Evaluation	motor function	sensory function	Number of patients	Age in years	Level of nerve lesions	Months since injury	Nerve repair techniques • fascicular • interfascicular • epiperineurial	Check-up in months	Note
M5			2	18—19	1/3 sup. forearm	2—3	— — —	6	
M5			1	14	1/3 distal forearm	6	• — —	6	
M4			1	18	1/3 middle forearm	6	• — —	8	
		S4	1	22	forearm	4	• — —	6	

Total — 5 patients

Also worth mentioning is the case of an adult, aged 42, who was operated on 24 months after injury. His median nerve continuity was restored by grafting 5 fascicular groups on a defect of 5 cm. The result after 4 months was M4S3.

A 6 cm median nerve defect was grafted with two fascicular groups, and a 10 cm ulnar nerve defect was grafted using a single fascicular group nine months after injury in a 23-year old patient. The result after 8 months was M4S3/M3-4.

An external popliteal sciatic nerve which had been twice operated on before and which presented a 5 cm defect at the point of its ramification was grafted with 6 fascicular groups. After five months, there was a 70 % functional recovery.

In another case, fascicular suture was made on 75 % of the median nerve fascicles; the other fascicles had a 1.5 cm defect which was grafted using the ulnar nerve sensory dorsal branch. The result was M5S4/M5 after 11 months.

In 13 cases the graft was taken from the sural nerve and in only 2 cases from the ulnar nerve sensory dorsal branch.

#### Radial nerves (included in Table VI)

Out of five patients, two had radial nerve lesions at arm level, two in the proximal third of the forearm, and one presented with a triple transection of the radial nerve. In the first four patients the results were very good. As far as the last patient was concerned, only the repair of the sensory branch of the radial nerve was feasible with good results.

#### External popliteal sciatic nerve

Only three patients were operated on, two of them being referred to in Table I (children), one in Tab. V (nerve grafts).

As already mentioned, DT was post-operatively applied to the site of surgery in 48 patients. For many years now, we have been using DT in order to improve wound healing (in burns, trauma, hand-trauma, radio-necrosis, etc.). The effect of DT used in patients who had undergone peripheral nerve microsurgery was evident and beneficial. When DT is applied at the level of the nerve injury before the operation, the patient cannot feel anything, but when applied after fascicular suture new sensation appears within a mere 48 hours in the form of impulses passing along the nerve at the level where we now find the Tinel sign, more distal than usual.

#### CONCLUSION

As a point of importance, our conclusion takes into account only the 215 nerves operated on over a period of 3 years by one and the same microsurgeon, although many other patients were surgically treated in our hospital for nerve lesions during the same period.

— It is obvious that we favour and make use of the fascicular suture, labour-consuming technique as it may be requiring a certain amount of microsurgical training.

— Suture of the respective nerve artery (0.2 mm in diameter) obviously enhances and speeds up recovery but it cannot be used too often as the vessels are usually thrombosed.

— DT accelerated the rate of recovery after nerve suture with the Tinel sign becoming distal much more rapidly.

— We share the opinion that the shorter the time interval from injury and the younger the patient, the better the results of nerve suture.

— The microsurgical techniques for nerve repair in associated lesions always produced better results if they were preceded by good reconstructive surgery of the tendons.

— In all our cases we made successful use of nerve grafts to make good for nerve defects ranging from 1.5 to 11 cm, being always in favour of grafting even small defects.

— No palliative surgery to restore motor function was necessary in any of the 172 patients reported on in the present study.

#### SUMMARY

Our experience is based on a total of over 200 peripheral nerves (172 patients) operated on by means of microsurgical techniques between December 1980 and August 1983. The most frequently method used was that of fascicular suture while epiperineurial and interfascicular sutures were only seldom used. Our results demonstrated once again that fascicular sutures produced better motor and sensory recovery. All three cases of median nerve artery suture in combination with fascicular suture resulted in total recovery with a discrimination of 0.4 cm four months after surgery. An electromagnetic field (DT therapy) was used in 48 patients with clearly positive effect, the Tinel sign appearing much more distal than usual 48 hours after surgery.

#### RÉSUMÉ

##### **Des expériences microchirurgiques avec plus de 200 nerfs.**

Ionescu, D., Ionescu, A.

Nos résultats se basent sur plus de 200 opérations des nerfs périphériques exécutées par une technique microchirurgicale, dans la période du décembre 1980 au août 1983, ce qui représente 172 malades. La méthode utilisée la plus fréquente c'était méthode des sutures fasciculaires. Des sutures épineurinales et interfasciculaires étaient très rares. Nos résultat ont de nouveau montré que l'utilisation des sutures fasciculaires est plus favorable sous l'aspect de mobilité et sensibilité. Dans tous les trois cas de reconstruction de nervus medianus, par la suture fasciculaire, l'artère a présenté une guérison complète au quatrième mois après l'opération et la faculté discriminatoire était 0,4 cm. Chez 48 malades le champs électromagnétique a été utilisé (thérapie diaphysique) avec de très bons résultats. L'apparition du symptôme de Tinel s'est présentée beaucoup plus distalement que d'habitude, 48 heures après l'opération.



## ZUSAMMENFASSUNG

### **Erfahrungen mit der Mikrochirurgie von mehr als 200 Nerven.**

Ionescu, D., Ionescu, A.

Unsere Ergebnisse gründen sich auf mehr als 200 Operationen der peripheren Nerven, die mit Hilfe der Technik der Mikrochirurgie vom Dezember 1980 bis zum August 1983 an 172 Patienten ausgeführt wurden, am häufigsten mit Hilfe der Methode faszikulärer Nähte. Epiperineurale und interfaszikuläre Nähte waren eine Seltenheit. Unsere Ergebnisse erwiesen erneut, dass bei Anwendung faszikulärer Nähte die Erneuerung der Beweglichkeit und Empfindlichkeit ganz offensichtlich besser wird. In allen drei Fällen einer Rekonstruktion des nervus medianus bei Anwendung einer faszikulären Naht erwies sich die Arterie 4 Monate nach der Operation als völlig geheilt, und die Diskriminierfähigkeit betrug 0,4 cm. Bei 48 Patienten wurde ein elektromagnetisches Feld angewendet (Diapulstherapie) mit offensichtlich positivem Resultat. Das Tinel'sche Symptom erschien viel distaler als normal 48 Std. nach der Operation.

## RESUMEN

### **Experiencias con la microquirurgia de más de 200 nervios.**

Ionescu, D., Ionescu, A.

Nuestros resultados se fundan en más de 200 operaciones de los nervios periféricos realizadas mediante la técnica microquirurgica durante el período de diciembre de 1980 a agosto de 1983 (173 enfermos), mayormente por el método de costuras fasciculares. Fueron raras las costuras epiperineurales e interfasciculares. Nuestros resultados volvieron a demostrar que utilizándose la costura fascicular, la renovación de la movilidad y la sensibilidad resulta mucho mejor. En los tres casos de la reconstrucción del nervus medianus al implementarse la costura fascicular, la arteria presentaba 4 meses después de operada una curación completa y la capacidad discriminatoria fue de 0,4 cms. En 48 pacientes se utilizó el campo electromagnético (terapia de diapulsos) con resultados evidentemente positivos. El síntoma Tinel aparecía en forma mucho más distal de lo que generalmente sucede al cabo de 48 horas realizada la operación.

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## BRAIN OEDEMA IN BURNED CHILDREN

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Central nervous system damage belongs among the major organ complications of burns in children. The most frequently used literary reference to such damage is "burn encephalopathy". Brain oedema is increasingly mentioned in this particular connection.

The purpose of the present communication is to draw attention to the incidence of neurological disorders in burned children treated at our centre, to some of the major pathophysiological changes possibly contributing to the development of brain oedema, and to the need for team co-operation as a prerequisite for early diagnosis and adequate treatment.

### ANALYSIS OF CASES

A total of 72 children were hospitalized at the Košice-Šaca Burn Treatment Centre in the first half of 1983. In accordance with the clinical, laboratory and repeated EEG test results, brain oedema was suspected in 5 children (6.9 %).

A brief analysis of the cases can be seen in the Table — Fig. 1. Listing those pathological clinical and laboratory findings which were suspected to have had the greatest share in the development of brain oedema. As the data suggest, neurological signs appeared already during the first few days except in patient No. 5 who did not develop Jacksonian convulsion until after 6 weeks from the burn trauma although slight consciousness disturbances were noted already on admission. Patient No. 3, a girl, with inadequately treated primary shock before she was referred to our hospital died 5 days after a severe scald.

EEG recordings were similar for all the children including the one who died with diffuse high and slow delta waves or ones arranged in a certain, mostly posterior, connection. As an example, let us demonstrate EEG recordings in patient No 4, a 2-year old girl admitted four days after she had fallen into simmering soup, with severe 3rd-degree scalds involving 44 % of the body surface. On the second post-trauma day she lost consciousness showing

signs of generalized tonic convulsions and recurrent apnoea. On admission, there were signs of stupor-type consciousness disorders, pneumonia, and progressive sepsis. The initial EEG shows the presence in all leads high delta waves of 1—2 c/s — Fig. 2. Two weeks later, after her clinical condition had

Fig. 1. Case analysis. Only clinical and laboratory findings of major significance for the development of brain oedema are listed

Table 1. Potential pathogenic factors in brain oedema

Age in years	Pat. 1 V. M. 4 y.	Pat. 2 B. D. 2 y.	Pat. 3 M. S. 3 y.	Pat. 4 D. M. 2 y.	Pat. 5 Š. M. 8 y.
Extent of burn	40.5% 2nd—3rd	16% 2nd—3rd	40% 2nd—3rd	44% 2nd—3rd	70% 3rd degree
Onset of neurological disturbances	2nd day	2nd day	3rd day	4th day	6 weeks
Shock, circulatory impairment	+	+	+	+	+
Wound infection, sepsis	+	—	—	+	+
Hypoproteinaemia, hypoalbuminaemia	+	+	+	+	—
Hyponatraemia	+	+	—	+	—
Metabolic acidosis	—	—	+	+	—
Blood hypoosmolality	—	+	—	—	—
Respiratory impairment, increased hypoxaemia	—	—	—	+	—
Pathological values of other ions	—	—	—	Ca ↓	K ↓, Ca ↓

+ = present  
— = absent

improved, a follow-up EEG record still shows the presence of slow graphoelements but also of normal, 4—5 c/s theta activity — Fig. 3. The third EEG record taken six weeks after the second one, or about 2 months after injury, there is a predominance of normal theta activity of 4—5 c/s with many muscular artifacts but already without any signs of deafferentation, or without the presence of delta waves — Fig. 4. In the deceased girl, the EEG test was made while she was in deep coma, one day prior to her death. The conspicuous feature are diffuse slow graphoelements of the type of diffuse 1 ½ c/s delta waves — Fig. 5. The postmortem findings confirmed a relatively severe case of brain oedema. A microscopic section of the brain with glial tissue in view there are clear signs of pericellular and perivascular-pericapillary brain oedema — Fig. 6.

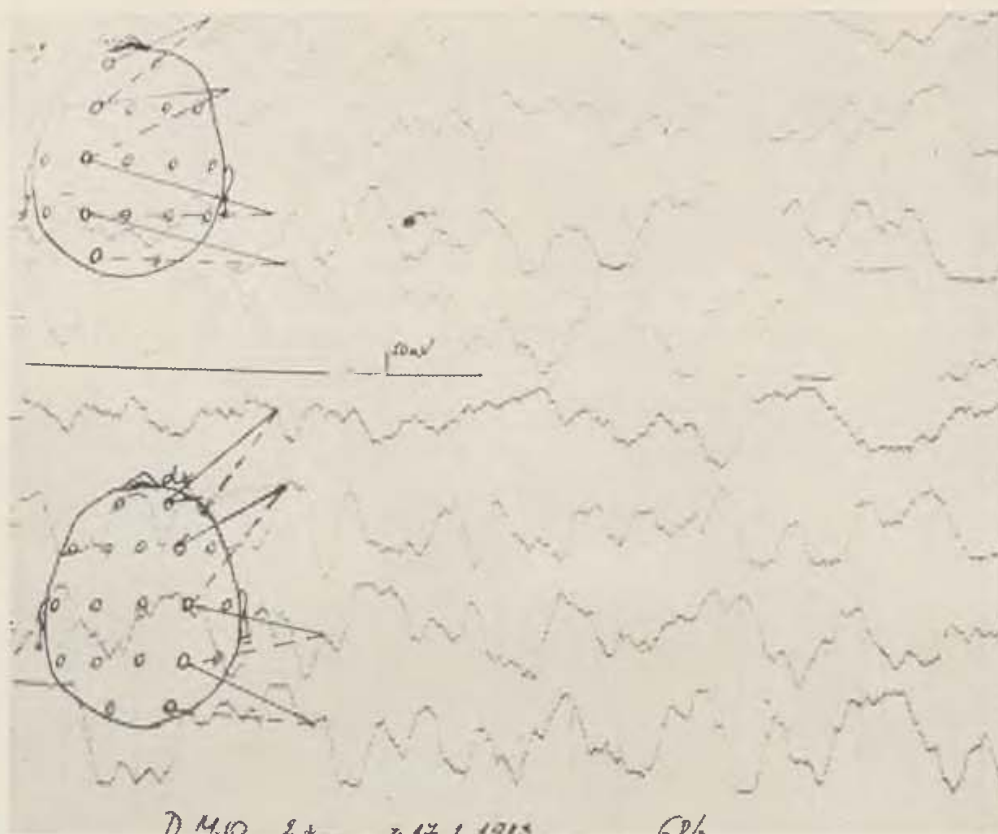


Fig. 2. First EEG record for patient No. 4. All leads show the presence of 1—2 c/s high and slow delta waves

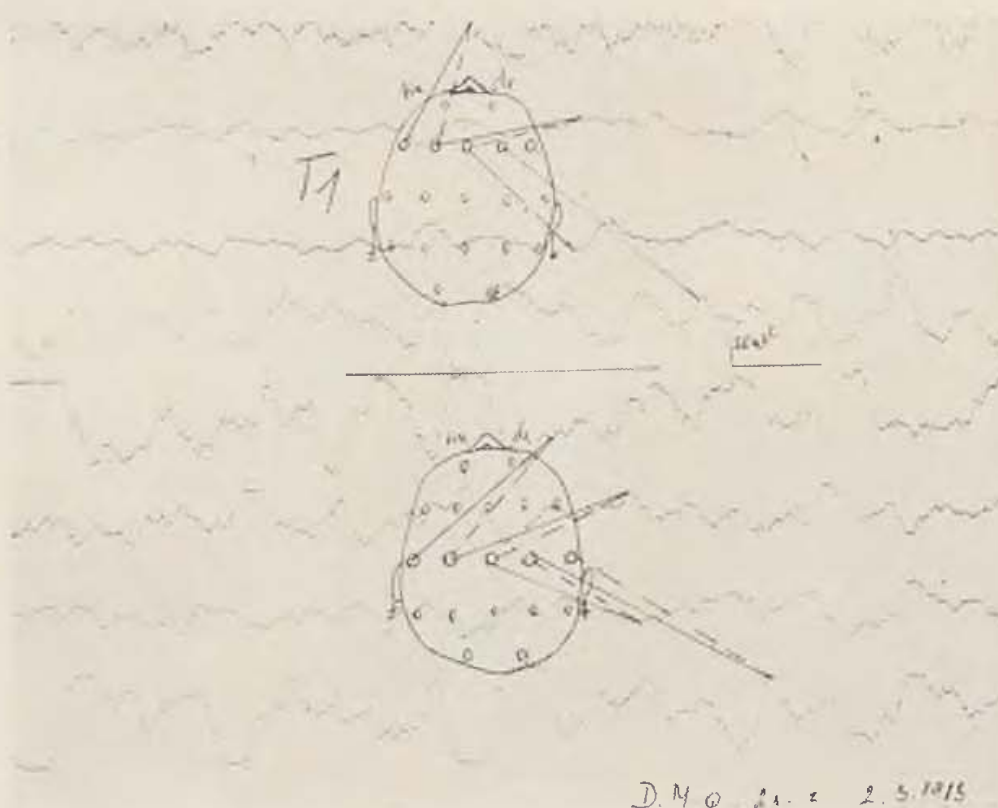


Fig. 3. 2nd EEG for patient No. 4 with persisting traces of slow delta waves though in the presence of also normal 4—5 c/s theta activity



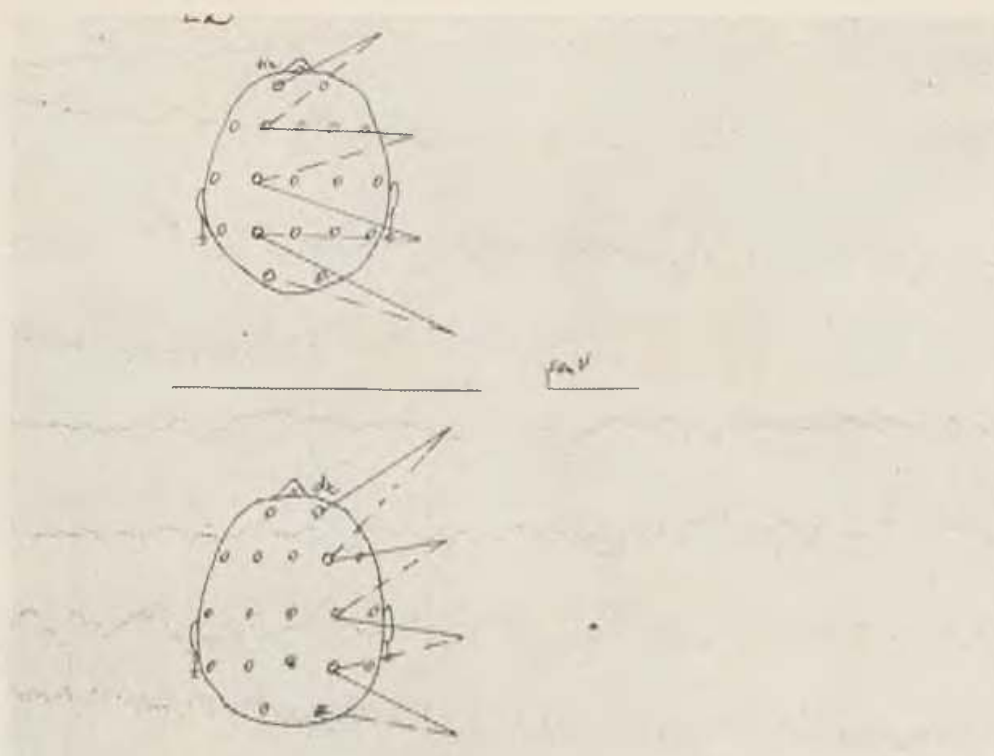


Fig. 4. 3rd EEG for patient No. 4 two months after burn injury already with a predominance of normal theta activity in the absence of delta waves. There is an interference by high-frequency muscle artifacts

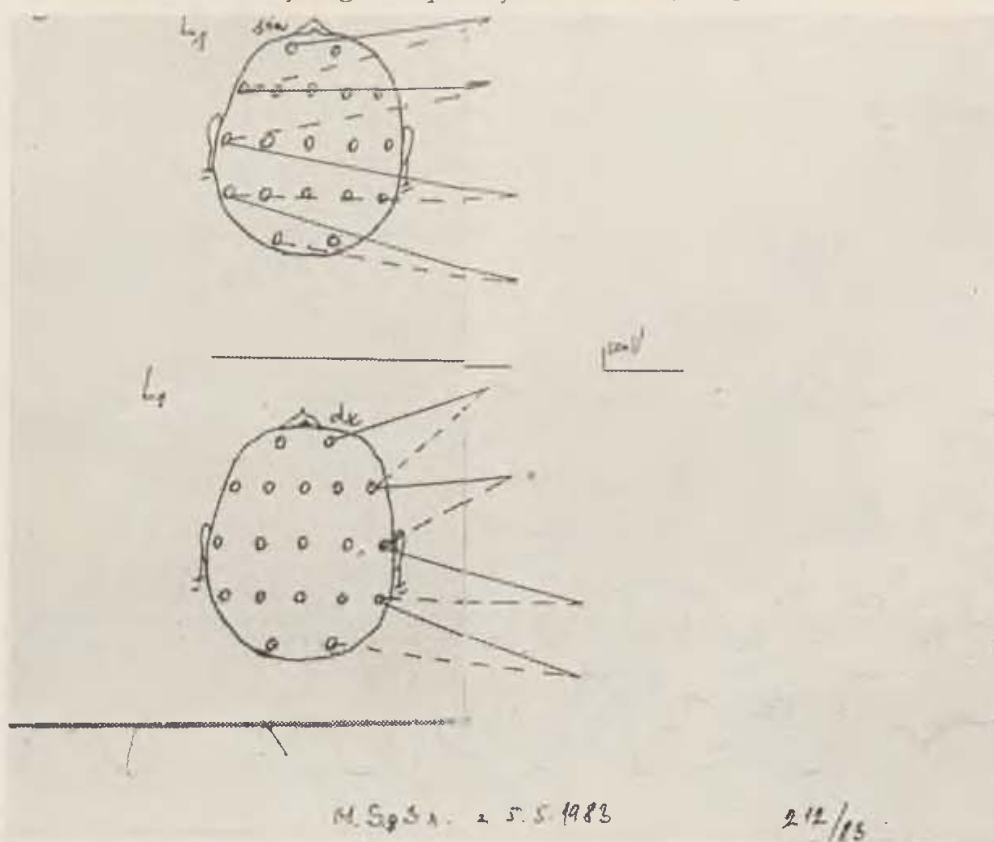


Fig. 5. EEG recording of patient No. 3, the child who died, showing conspicuous diffuse 1-2 c/s delta waves

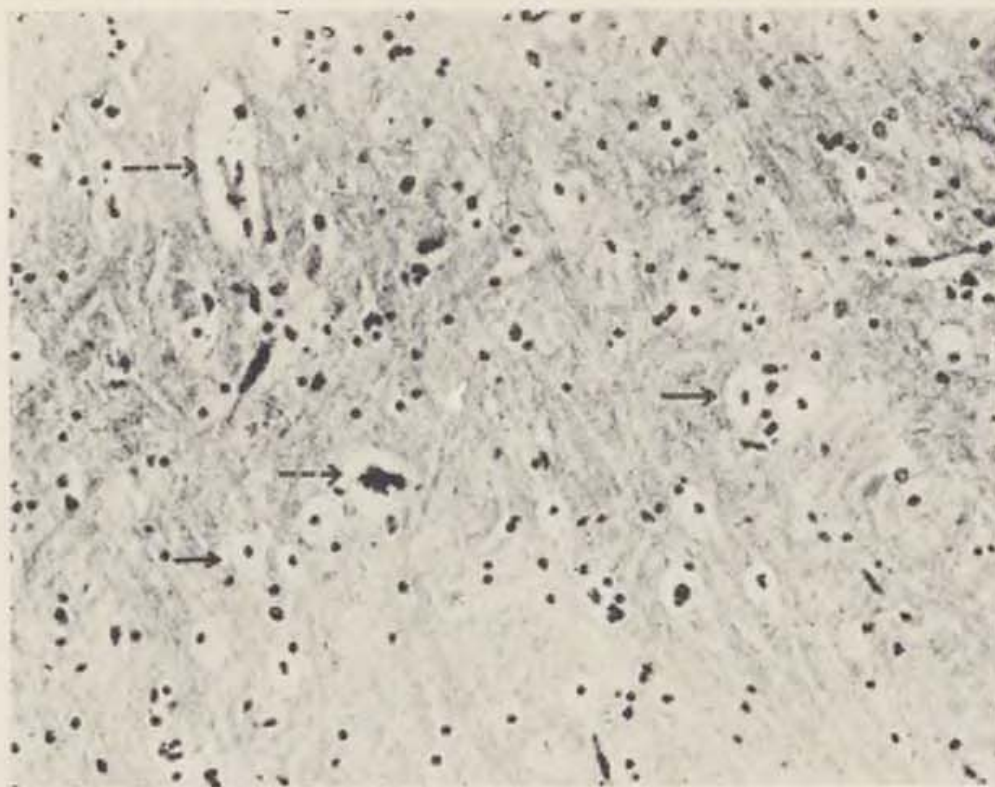
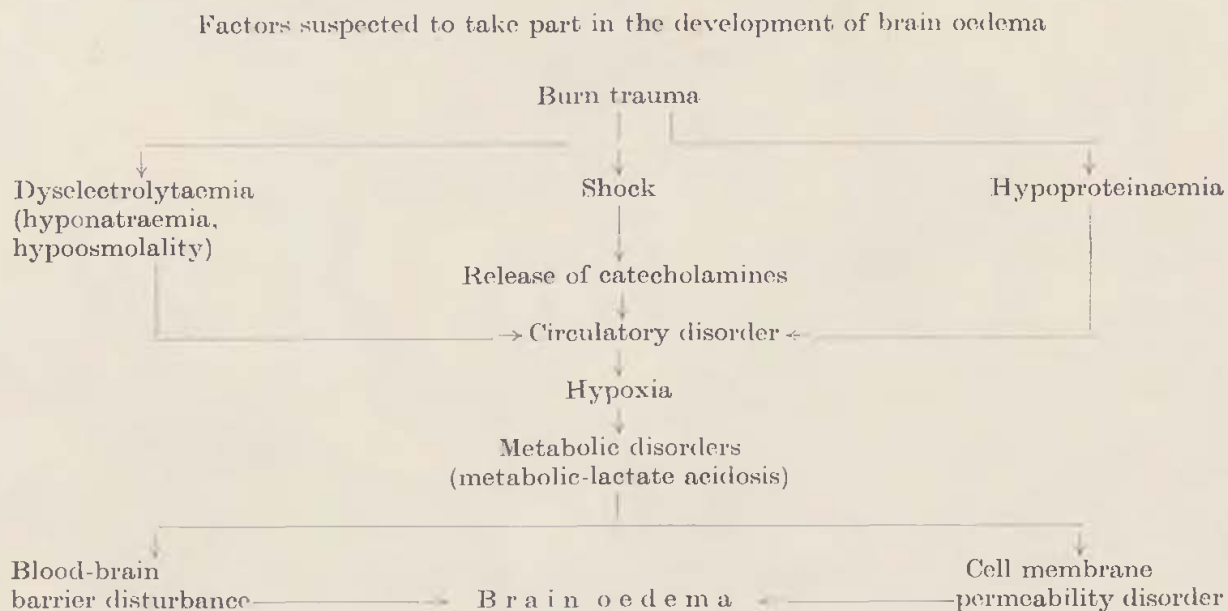


Fig. 6. Microscopic finding of glial brain tissue in patient No. 3, M. S.; clear signs of brain oedema pericellularly (—>) and pervascularly (- - ->)

Fig. 7. Diagram of salient suspected factors involved in the development of brain oedema in burns



## DISCUSSION

Antoon et al. [1] report 20 %, or 14 %, incidence of neurological disorders in burned children. McManus [3] describes convulsions in 6.6 % of the total

number of cases. In our own series, neurological disturbances were seen in 6.9 %. The symptoms are most those suggesting the presence of brain stem disorders such as impaired consciousness, pathological eye pupil reactions, mydriasis, tremor, spontaneous sucking and mastication reflex, muscle tone changes, convulsions — mostly of the tonic-clonic type, respiratory impairment or even apnoeic pauses. EEG tests were repeatedly made in each of our cases. Slow delta wave activity, mostly of the diffuse type, was the most frequent finding. Although this can hardly be taken as entirely pathognomic for brain oedema, quite a few authors [2,5] find them a predominant feature of brain oedema. In the deceased girl where brain oedema was actually found at post-mortem the EEG recording was similar to those in the rest of the children, all of them survivors. The pathological EEG finding disappeared at the rate the affected children's clinical condition improved. It should be noted here that none of the children had burns in the head.

The pathogenesis of non-traumatic brain oedema presents a complex and still largely uncharted problem. Literary reports often refer to Laboritt's conception, according to which any unnatural intervention in the organism is bound to trigger off a complex of biochemical, at first biologically purposeful changes. However, once a certain degree of intensity has been exceeded it may become more dangerous that the pathological causative noxa itself (quote 2). In cases of burn, a substantial part is played by the burn shock which is the underlying factor and a part of metabolic and circulatory disorders. The most important factors likely to have a share in the appearance of brain oedema in burn victims are summed up in a diagrammatic form in Fig. 7.

In addition to shock, the burn trauma itself resulting from vascular damage at and around the site of the burn will cause proteins, sodium and water to be lost in the extravascular space and result in subsequent hypovolaemia and decreased volume of circulating blood. A major role is also played by circulatory disorders due mainly to shock and to the release of catecholamines. The resulting hypoxaemia is then responsible for more major metabolic disorders in the brain tissue itself. These include primarily lactate acidosis, electrolyte balance disorders, especially hyponatraemia and hypoosmolality in the blood, sometimes conditioned by the infusion of solutions of pure 5 % or 10 % glucose [1, 3, 4]. All those changes may result in blood-brain barrier impairment, in ganglionic cell membrane disorder, and in the intracellular dissipation of sodium and water with the development of brain oedema [2].

The less significant factors likely to touch off brain oedema include increased hypoxaemia resulting from pathological changes in the respiratory tract, hyperpyrexia with subsequent convulsions [1, 3, 4] and hypertension [3, 5]. Also reported is the possible convulsive effect of some of the drugs [3, 5]. Sepsis, too, may prove to be an underlying factor sharing responsibility for the development of brain oedema [1, 4].

Opinion seems to differ as for the prognosis of neurological complication and brain oedema in children's burn. While Antoon et al. [1] believe in favourable prognosis in burn encephalopathy, other [2, 4] warn of the possible development of irreversible changes, mainly in the white matter of the brain,



with lasting consequences such as severe psychomotor retardation, central paralysis, extrapyramidal disorders, etc.

Early and adequate therapy for burns, in particular correct anti-shock parenteral treatment, is the most effective method of preventing the development of neurological complications. If, however, the first manifestations of encephalopathy appear alongside with possible EEG signs of brain oedema, instant and comprehensive anti-oedema treatment is imperative. Intravenous hypertonic glyceride and protein solutions are avoided only in cases of safely diagnosed blood hyperosmolality.

#### CONCLUSION

1. Neurological complications, resulting most likely from brain oedema were seen in 6.9 % of our series of children, all of them cases of severe burn.

2. Brain oedema in burns is noted for a complex pathogenesis. Shock is a prominent feature there with the ensuing circulatory and metabolic disturbances.

3. Burn brain oedema should be seen as a serious complication since it aggravates prognosis *quo ad vitam* and threatens the child with possible lasting complications.

4. At the earliest clinical symptoms suspected brain oedema should be accurately diagnosed using neurological examination and EEG.

5. In the case of clinical and EEG manifestations of brain oedema early and comprehensive anti-oedema treatment should be started. As soon as the clinical and EEG disorders have abated we recommend long-term therapy aimed at improving metabolism and at reducing any possible trophic disorders in the brain tissue. The child should be given long-term surveillance by a paediatric neurologist.

6. To meet those requirements it is essential to organize diagnostic and therapeutical care of the burned child in close team co-operation involving the burn surgeon, paediatrician and paediatric neurologist.

#### SUMMARY

Reporting from the Košice-Šaca Burn Treatment Centre the authors describe cases of serious neurological disorder in 5 out of 72 children hospitalized there during the first half of 1983 i.e. 6.9 %. Their general condition, neurological as well as EEG findings suggested brain oedema. The EEG findings were similar in all the children with a predominance of high and slow delta waves 1—2 c/s. One of the children died. The postmortem examination confirmed brain oedema. Since burn shock is a prominent feature of the pathogenesis of brain oedema, correct and timely anti-shock treatment is the most effective mode of prevention. The authors stress the need for team co-operation for an early diagnosis of brain oedema, including EEG examination, as well as for comprehensive anti-oedema therapy to prevent any possible lasting neurological damage.



## R É S U M É

### **L'oedème du cerveau chez des enfants brûlés.**

Prekop, R., Bárdošová, G., Šimko, Š., Várady, L.

Les auteurs décrivent de graves lésions neurologiques chez 5 enfants hospitalisés au Centre pour le traitement des brûlures, appartenant à l'Etablissement de ville ou à l'Etablissement d'Etat de la Santé publique dans la ville de Košice-Šaca. Les 5 enfants présentaient 6,9 p. 100 de 72 enfants hospitalisés au Centre dans la première moitié de l'année 1983. L'état général, l'exploration neurologique aussi que des examens électroencéphalographiques rappelaient l'oedème du cerveau. L'E.E.G. était semblable chez tous les enfants, avec dominance de hauts et lents graphoéléments 1—2 c/s. Un enfant a décédé. L'autopsie a confirmé l'oedème du cerveau. Parce que dans la survenue pathogénétique de l'oedème du cerveau c'est surtout le choc de brûlure comme cause la plus importante, il faut assurer la meilleure prévention possible par un traitement antichoc immédiat.

Les auteurs montrent qu'une coopération des équipes de spécialistes, y compris des examens électroencéphalographiques et une thérapie antioedématisante complexe, est nécessaire pour obtenir à temps la diagnose de l'oedème du cerveau et pour prévention des séquelles neurologiques persistantes.

## Z U S A M M E N F A S S U N G

### **Ein Hirnödem bei Kindern mit Verbrennungen.**

Prekop, R., Bárdošová, G., Šimko, Š., Várady, L.

Vom Zentrum zur Behandlung von Verbrennungen des Städtischen Instituts für Volksgesundheit und des Landesinstitut für Volksgesundheit in Košice-Šaca beschreiben die Autoren das Auftreten schwerer neurologischer Störungen bei 5 Kindern von 72 hospitalisierten, im ersten Halbjahr 1983, d. h. bei 6,9 %. Der gesamte Zustand und die neurologischen sowie die EEG-Befund wiesen auf ein Hirnödem hin. Der EEG-Befund war bei jedem Kind ein ähnlicher, mit Übergewicht hoher und langsamer Grafoelemente 1—2 c/s. Ein Kind verstarb. Der pathologisch-anatomische Befund bestätigte das Hirnödem. Da in der Pathogenese der Entstehung eines Hirnödems am bedeutsamsten der Schock bei Verbrennungen zur Geltung kommt, bildet auch eine korrekte und rechtzeitige Antischockbehandlung die wirksamste Prävention.

Die Autoren weisen auf die Notwendigkeit einer Teamarbeit zur rechtzeitigen Diagnose des Hirnödems hin, einschliesslich einer EEG-Untersuchung und der Notwendigkeit einer komplexen Antiödembehandlung, damit möglichen neurologischen Folgen vorgebeugt werden kann.

## R E S U M E N

### **Edema del cerebro de los niños quemados.**

Prekop, R., Bárdošová, G., Šimko, Š., Várady, L.

Los autores — del Centro para el tratamiento de las quemaduras en Košice-Šaca, describen graves trastornos neurológicos en 5 niños de los 72 ingresados en la primera mitad del año 1983, es decir un 6.9 %. El estado general, los diagnósticos neurológicos y EEG fueron similares a los del edema del cerebro. El diagnóstico EEG resultaba parecido en los cinco niños, con preponderancia de grafoelementos altos y lentos 1—2 c/s. Un niño murió. El diagnóstico patológico-anatómico corroboró el edema del cerebro. Como en la patogenesis del edema del cerebro el papel principal lo juega la

conmoción producto de quemaduras, se logra la prevención más eficaz con un oportuno y correcto tratamiento de las conmociones.

Los autores señalan lo importante que resulta una cooperación en "team" para que oportunamente se diagnostique el edema del cerebro, incluyendo la necesidad del examen EEG junto con un tratamiento global neurológico para evitar los eventuales trastornos neurológicos permanentes.

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#### Symposium on Problems of Organization in Burned Patients Care

The Prague Department of Plastic Surgery Burns Unit commemorated its 30th anniversary by holding a working symposium with international participation. The celebrations of the anniversary of what is the oldest burns unit in the continent of Europe proved a success, both professionally and socially.

In spite of a marked drop in, especially, foreign participation in a number of last year's conferences and symposia, the Symposium on Problems of Organization in Burned Patients Care held in the Prague Intercontinental Hotel on Sept. 25—27, 1983 was attended by guests from 18 countries, some of them as remote as Australia, North America and Africa. The agenda covered general problems of organization faced by specialized burns centres, problems of physical and psychic rehabilitation, infection and nutrition in extensive burns, treatment in the initial phase of severe burns, specific problems of burned children care, the choice of temporary skin cover replacement, computer techniques in the treatment of burns, etc. All the papers presented there featured a high professional standard. What we appreciated in particular were the unusually fruitful informal discussions that followed each session. The Prague Symposium held under the auspices of the International Society for the Treatment of Burns and the European Burns Association provided a welcome opportunity for meetings between workers from the socialist countries and specialists from the rest of the world. It was encouraging to see the western participants' respect for the socialist countries' health care systems and the standard of burned patients care in our countries rising appreciably after the exchange of experience at the Prague gathering. There is little doubt that events such as the Prague Symposium on Problems of Organization in Burned Patients Care contribute not only to the participants' professional knowledge but also to friendship and understanding among specialists who are confronted with the same kind of problems regardless of which part of the world they come from.

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