ACTA CHIRURGIAE PLASTICAE

INTERNATIONAL JOURNAL
OF PLASTIC SURGERY

34 · 4

1992

CS ISSN - 0323-0414

KPK PRAHA • CZECH MEDICAL PRESS • PRAGUE

Exclusive Distributors for all Western Countries
KARGER-LIBRI AG, Petersgraben 31, CH-4000 Basel 11 (Switzerland)

Distributed by PNS. Information on subscription can be obtained from and orders are accepted by every administration of PNS, post-office, postman and PNS Central Expedition Prague. Orders for abroad are acepted by PNS Central Expedition and Press Import, administration of press export, H. Píky 26, 160 00 Praha 6.

Published four times (in 1959: two times) a year by KPK Praha — Czech Medical Press, Nádražní 116, Praha 5. Editor in Chief prof. M. Fára, M. D. DrSc. — Address of the Editorial Office: Acta Chirurgiae Plasticae, 100 34, Praha 10, Šrobárova 50, Czech Republic — Press: Tiskařské závody, provoz 33, Praha 2, Hálkova 2. Exclusive distributors for all countries with the exception of Albania, Bulgaria, China, Cuba, Czechoslovakia, Hungary, North Korea, Vietnam, Mongolia, Poland, Romania, the Commonwealth of Independent States and Yugoslavia:
KARGER LIBRI AG, Petersgraben 31, CH-4000 BASEL 11 (Switzerland)

Department of Plastic Surgery,
Charles University, Prague, Czech Republic
Head: Prof. MUDr. M. Fára, DrSc.

FRANCIS BURIAN — FOUNDER OF THE TREATMENT OF FACIAL CLEFTS IN CZECHOSLOVAKIA

M. FÁRA

Professor F. Burian, M. D., Sc. D. (1881—1965) belonged on the world-wide scale among the most prominent pioneers of plastic surgery. He excelled not only by his manifold professional expertness in the newly developing specialty, but also by his organisational ability which he demonstrated when he succeeded, already in the period between the two World Wars, to establish in Czechoslovakia the new specialty of plastic surgery and to attain its world-wide good reputation. He learned from his own experience and from visits abroad where methods of plastic surgery were already applied in practice from the end of World War I. There he acquired professional friends and subsequently exchanged with them their personal experience.

Burian devoted particular interest to the problems of facial clefts. He knew, from the beginning, that the treatment of clefts was associated with great difficulties and he had the experience that it yielded more disappointments than satisfactions.

The achievements of Prof. Burian in the field of plastic surgery were promoted by his artistic and creative imagination, manual skill and theoretic approach to the planned treatment, as well as his deep compassion and understanding of the mental state of the patients, which incited him to provide to the patient the maximum possible help, and at the same time, to attain the urgently required co-operation of the patient during the process of treatment.

His attitude to a child with an inborn malformation and to the next kin of the child is illustrated by his following statement:

The birth of a child with any type of malformation affects in the first place his family. The parents of the child suffer from a severe, painful disappointment. The maternal pride is severly hurt. The subconscious longing of mankind to give to the world and to transmit to posterity a human being who would be superior to themselves was not granted. Most distressing are congenital facial malformations which cannot be covered. Severe forms of clefts are associated with a disorder of facial harmony in sites which serve for the expression of mental powers and emotions. For nine months the mother imagined in her dreams the smiling face of her child and then suddenly she

had to look at a gaping monstrous mask. Later, when maternal love prevails over the feeling of horror and aversion, she suffers from persisting and increasing anxiety about the future life of her child. She is in great fear that the bodily and mental development of her child will be severly impeded, that the child will be a laughing-stock, that it will be pushed away with disgust, and will not be able to find a job, or a place in society.

In his harelip operations he used at first the Thompson technique which was described by Davis in his monography published in 1919. Burian was not in favour of the use of the Hagedorn operation from 1892 (primary raising of the height of the lip at the site of the suture with a flap including all components of the lateral side of the lip, which was turned round below the incised margin of the philtrum).

In the twenties Lexer in the 5th edition of his Handbuch der praktischen Chirurgie (1921) still included the statement, printed in large types, that it is not possible to recommend in all cases a preservation of the premaxilla since it is often markedly atrophic and therefore of no value even in cosmetic view, and according to Partsch in many cases the resection of the premaxilla does not result in conspicuous disfiguration in the presence of a relatively good dental articulation. Burian, already at this time, stated that the resection of the premaxilla is a humiliating product of an undignified effort to facilitate the repair of the lip, regardless of its consequences. In bilateral clefts he carried out at this time usually the established osteotomy of the vomer with a pushback of the premaxilla and a linear suture of the skin in an one--stage operation. He never adopted the rather attractive and at this time fashionable technique devised by Brophy, i. e. a closure of the palate with a wire.

In the twenties Burian got acquainted with Victor Veau and with his surgical techniques and a wide ranging research into facial clefts. He soon met him in person and established with him a close friendship which lasted up to the death of Veau. They exchanged their personal experience and on some problems shared the same opinion, while they disagreed in some other points. Their most important disagreement concerned the question whether a cleft represents an actual deficiency of tissues as argued Prof. Burian, or simply a splitting of tissues as it was believed by Veau.

Towards the end of the twenties Burian tested several procedures of lip suture, yet none of these techniques paid any need to the required satisfactory anatomic reconstruction of involved tissues and thus the results were by far not satisfactory.

In the early thirties Burian adopted the technique of Blair and Brown (US) aimed at a repair of deformations of the nostrils by dedublation and excision of crescent-shaped structures situated parallel to the lower margin of the ala. However, during the subsequent cicatrization the treshold of the nose sunk downwards and therefore Burian welcomed the technique devised by Veau and published at this time. Veau reconstructed cautiously the floor

of the nose and covered it with a mucoperiosteal palatal flap. However, since the oral palatal flap did not cover the whole bottom of the nasal suture in the floor of the nasal introitus and was followed by its break-down Burian started to supplement the oral covering with a mucosal flap from the lateral segment of the lip. Within a few years he adopted the procedure devised by Axhausen mainly by abandoning the use of a mucoperiosteal palatal flap for the covering of the sutured nasal floor, Burian also stopped to use a relaxation suture drawing together the edges of the orbicular muscle and replaced it by a meticulous suture of both stumps of the muscle with catgut stitches.

Towards the end of the thirties Burian tested also the Wassmund procedure. Wassmund operated in two stages: at first he reconstructed the nasal floor and performed the suture of the lip only during the second operation. In the forties Burian became an ardent advocate of the method devised by Brown and McDowell who used a small cutaneous flap connected with the vermilion which added the deficient substance to the lower margin of the philtrum facing the cleft. Unfortunately it led to a flattening of Cupid's bow.

The history of palate surgery at the Department for Plastic Surgery in Prague was characterized by the use of a variety of methods and documented the intense efforts of Burian in the search of a procedure which would promote a satisfactory healing and at the same time would not interfere with the subsequent growth of the maxilla.

In the twenties, during the first years of his surgical treatment of cleft palate Burian used the Langenbeck-Dieffenbach-Warren method. He believed that the survival of anteriorly based mucoperiosteal flaps depended, during the strain to which they were exposed, on their biologic value and he attempted to increase the latter by dividing the operation into two stages. During the first stage lateral incisions were made and mucoperiosteal flaps were raised from the bone. The operation was terminated after one week.

He was satisfied that the delay rendered the tissue of the flaps thicker, it increased their blood supply and after the final suture followed a more favourable healing. He attempted, also to relieve the tension in the suture by pulling a silver wire through muscles of the soft palate and through the periost of the hard palate, with knots made on each side over small lead plates, according to Brophy.

At this time Burian supplemented the operation of the palate by using a lower based musculomucosal flap raised from the posterior pharyngeal wall as suggested in 1876 by Trendelenburg and newly proposed and realized in 1924 by Rosenthal.

Burian was aware of the attempts of Passavant at the end of the 19th century to perform a secondary retroposition of the palate as a whole and when he got acquainted with the papers published by Lvov in 1920 and Halle in 1928 he began to carry out a pushback in two stages: at the first operation a suture of the palate and during the second stage a pushback.

When Burian got acquainted with Limberg's procedure from 1933 he performed an one-stage operation with an extension of incisions up to the

mandible and a fracturing of the hamulus pterygoideus. He was well aware of the drawbacks of all these procedures which consisted in cutting off the nasal layer from the posterior margin of palatal plates. This resulted in a defect which healed only per secundam, as well as in marked cicatrization of the nasal surface of the retropositioned palate. Therefore he started to use a primary velopharyngeoplasty with a longer lower based pharyngeal flap (Rosenthal) — or preferably — an upper based flap according to the procedure devised by Sanvenero-Roselli.

However, Burian was still aware of the fact that these and numerous other procedures proposed in the twenties paid little attention to the function of the reconstructed palate and therefore he was looking forward for an operation which in his terms "would not harm the already abnormally developed organs and which would use local tissues in a way consistent with their normal participation in the development of the pertinent structures".

This method was devised by Victor Veau and brought a fundamental change in the approach to palate surgery when it showed that it was possible to use for palatoplasty the mucoperiost from the nasal sides of palatal plates. The bloody surface of palatal oral flaps was from the nasal side completely covered with nasal periost without leaving an open wound which would be exposed to infection, granulation or shrinking. Veau recognized also the necessity to restore the musculature of the soft palate. This can be attained only by carefully suturing together the muscles of both halves of the velum. He did not use relaxation incisions on the side of the velum or any mobilization of muscles.

On the basis of this knowledge and on his own experience up to the fifties Burian performed palate repair at the patients' age of 5—6 years with the use of 2,3 or occasionally even 4 oral flaps. The retroposition of the palate was preceded by a mobilization of neurovascular bundles from the foramen palatinum maius which were carefully protected from any kind of injury, or even cutting. At the same time he primarily sutured into the velum an upper based pharyngeal flap.

In 1954 Burian summed-up his own experience by publishing an exellent monography on "Surgery of the Harelip and Cleft Palate".

Burian never neglected the scientific aspects of his surgical activities. He documented carefully his work by his own drawings made into medical records, by photos obtained in all phases of the treatment, by dental casts, X-ray films, and by setting-up a detailed scientific register. This documentation is still kept according to the principles laid down by Burian and after a period of 70 years it includes today almost 190 000 histories of patients, with more than 10 000 patients with cleft lip and palate.

In 1957 Burian created a scientific background for clinical practice when he established at his institute an affiliated well equipped laboratory for Congenital Malformations with a genetic, teratologic, histologic, and immunologic unit, an orthodontic department and with a centre for investigations into the

transplantation of tissues. Thus after his death in 1965 Burian bestowed upon us a heritage which allowed us to continue steadily in our work in his intentions aimed at a further improvement of therapy and care for the patients in general and for individuals with facial clefts in particular.

Prof. dr. M. Fára, DrSc.
Department of Plastic Surgery
Šrobárova 50, 100 34 Prague 10
Czech Republic

SUMMARY

Prof. F. Burian, the founder of Czechoslovak Plastic Surgery, belonged to the world-wide scale among the most prominent pioneers of this field. His main interest and professional concern was devoted to the problems of facial clefts. The present communication reviews the gradual development of surgical repair of cleft lip and palate from the early twenties to the late fifties at the Department for Plastic Surgery in Prague, headed by Prof. F. Burian.

Key words: Clefts, F. Burian

RÉSUMÉ

František Burian — fondateur du traitement de fentes faciales en Tchécoslovaquie

Fára, M.

Professeur F. Burian, fondateur de la chirurgie plastique en Tchécoslovaquie, appartient aux éminents pionniers de cette discipline du monde entier. Son intérêt principal et son amour professionnel se portait sur la problématique des fentes faciales. L'article apporte une vue récapitulative sur l'évolution du traitement chirurgical des fentes labiales et palatines, dès le commencement dans les années vingt à la fin des années cinquante à la Clinique de la chirurgie plastique de professeur Burian à Prague.

ZUSAMMENFASSUNG

František Burian — Gründer der Behandlung der Gesichtsspaltmissbildungen in Tschechoslowakia

Fára, M.

Prof. F. Burian, der Gründer der tschechoslowakischen plastischen Chirurgie, gehörte zu den weltbedeutendsten Pioneeren auf diesem Fachgebiet. Sein grösstes Interesse und wissenschaftliche Hingabe galt den Problemem der Gesichtsspalten. Die vorliegende Mitteilung liefert eine Übersicht der graduellen Entwicklung der chirurgischen Behandelung der Lippen- und Gaumenspalten auf der Prager Klinik für plastische Chirurgie unter der Leitung von Prof. F. Burian.

Czech Academy of Sciences, Prague (Czech Republic)
Institute of Experimental Medicine
Director Prof. R. Jelínek, M. D., DrSc
Charles University, 3rd Medical Faculty, Prague
Department of Plastic Surgery
Head Assoc. Prof. M. Tvrdek, M. D.

CONFIGURATION OF FACIAL PROFILE IN ADULTS WITH CLEFT LIP WITH OR WITHOUT CLEFT PALATE

Z. ŠMAHEL, H. POLÍVKOVÁ, B. ŠKVAŘILOVÁ, I. HORÁK

The aim of the study was a detailed analysis of deviations in the configuration of the soft and skeletal facial profile in adults with cleft lip and with cleft lip and palate. The deviations are due to the preceeding facial development, as well as to the long-term orthodontic and surgical treatment. Thus they characterize the final state of the malformation related to the effects of the applied treatment, which differs according to the type of cleft, to the practice at individual departments, as well as to the duration of the treatment and to the needs of the affected individual. In spite of these differences of the applied therapy the results obtained provide certain general information which allows to assess the global development in clefts and to draw conclusions on the need for the introduction of new therapeutic procedures.

In this study we continued our previous investigations into craniofacial morphology in the same series of patients (Šmahel and Brejcha, 1983; Šmahel, 1984a, b). However it was conceived as a comparative study dealing in more detail with the configuration of the facial profile. Detailed data on the composition of the series or on the applied therapeutic procedures were presented in the above quoted studies.

MATERIAL AND METHOD

The study is based on an assessment of measurements on X-ray films made in lateral projection in 114 males aged 20—42 years either with cleft lip or with cleft lip and palate. According to the type and extent of clefts they were subdivided into 4 groups: bilateral complete cleft lip and palate ($BCLP_c$), unilateral complete ($UCLP_c$) and incomplete ($UCLP_i$) cleft lip and palate and incomplete unilateral cleft lip alone (UCL_i). Other types of clefts were not included into the study. The numbers of patients in individual groups, their mean age at the time of examination, the age at the time of

surgery, and the frequency of surgical correction of the nose and lip, are presented in Table 1. There were no differences between the mean age in individual groups or in controls. The mean age at the time of surgery showed equally no significant differences, but for $BCLP_c$ where palatoplasty was performed at a more advanced age, since it was preceeded in 9 patients by premaxillary setback. However there are definite differences between individual groups of patients in the frequency of surgical correction of the lip and nose. In UCL_i they were carried out only in 12.9% of the patients, in $UCLP_i$ in 38.5%, in $UCLP_c$ in 90.6% and in $BCLP_c$ in 88.5%. There is also a difference between the two last groups, since in bilateral clefts there were on the average two surgical corrections per patient, and in unilateral clefts only 1.3 operations. These differences could exert significant effects on some parameters of the soft profile.

Tab. 1. Numbers of cases in individual groups, mean age at the time of examination and at the time of lip and palate surgery, numbers of patients without pharyngeal flap surgery and frequency of nose/lip revisions.

group	n	age years	lip surg. months	palate surg. years	without flap	nose/lip revisions (%)
Control	50	27.2	—	—	—	—
UCL_i	31	26.2	11.2	—	—	12.9
$UCLP_i$	26	26.1	8.9	5.3	2	38.5
$UCLP_c$	31	28.0	7.6	4.7	9	90.6
$BCLP_c$	26	27.7	8.2*	5.8	1	88.5

* on the right, on the left at 7.3 months

Cheiloplasty was carried out according to Veau, or Tennison, palatoplasty with a pushback and mostly with the use of pharyngeal flap surgery. The number of patients without pharyngeal flap surgery are also presented in Table 1 (in 4 patients with $BCLP_c$ pharyngeal flap surgery was performed as a secondary procedure). In the series were not included individuals with associated malformations, or patients after maxillofacial surgical procedures. Of the 26 examined individuals with incomplete cleft lip and palate 10 had a complete cleft of the alveolar process and a soft bridge in the threshold of the nostril, 16 had also an osseous bridge in the anterior pole of the maxilla. All patients were operated on at the Department of Plastic Surgery in Prague during the first two postwar decades. Therefore the therapeutic results are characteristic of this period. Since premaxillary pushback and a prolongation of the columella performed in bilateral cleft lip and palate could exert marked

effects on certain parameters of the upper face a further study will include an assessment of the effects of these procedures in the series of patients with $BCLP_c$.

The group of controls consisted of volunteers matched in age treated for minor injuries and of university students (n = 50). The probands were randomized and their mean age did not differ significantly from individual series of patients, inclusive of the distribution according to age (F-test). Body height (176.88 cm) and weight (77.22 kg) in the group of controls was consistent with the norm for our population.

X-ray films were made under standard conditions (magnification 8.1%) with the head of the patient fixed in a cephalostat during centric occlusion. Craniometric points and reference lines used for the interpretation of X-ray films are presented on Figures 1—2. In the case of double contours was marked the midpoint between both sides (in points Ar, Go, Pmp, Or, Zm). The perpendicular distance of a point from the reference line was marked Pmp-VL, an angle with an abreviation N-S-Ar, or as a fraction of reference lines forming

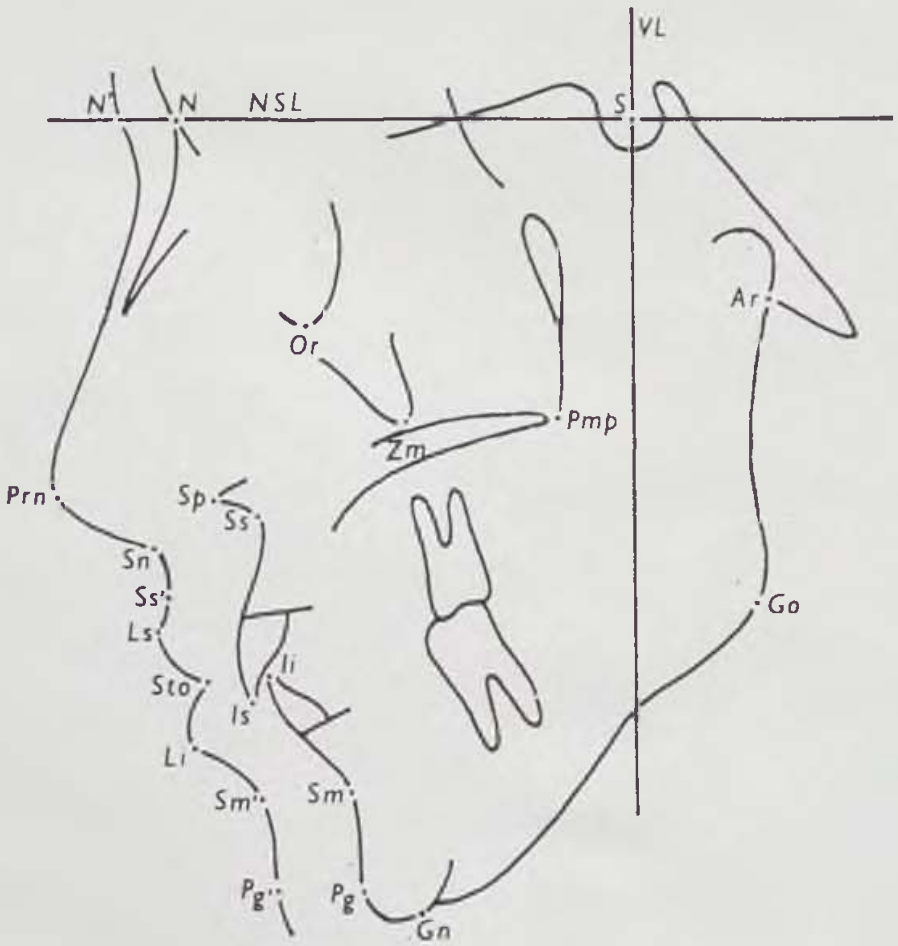


Fig. 1. Cephalometric points used for the assessment of lateral X-ray films.

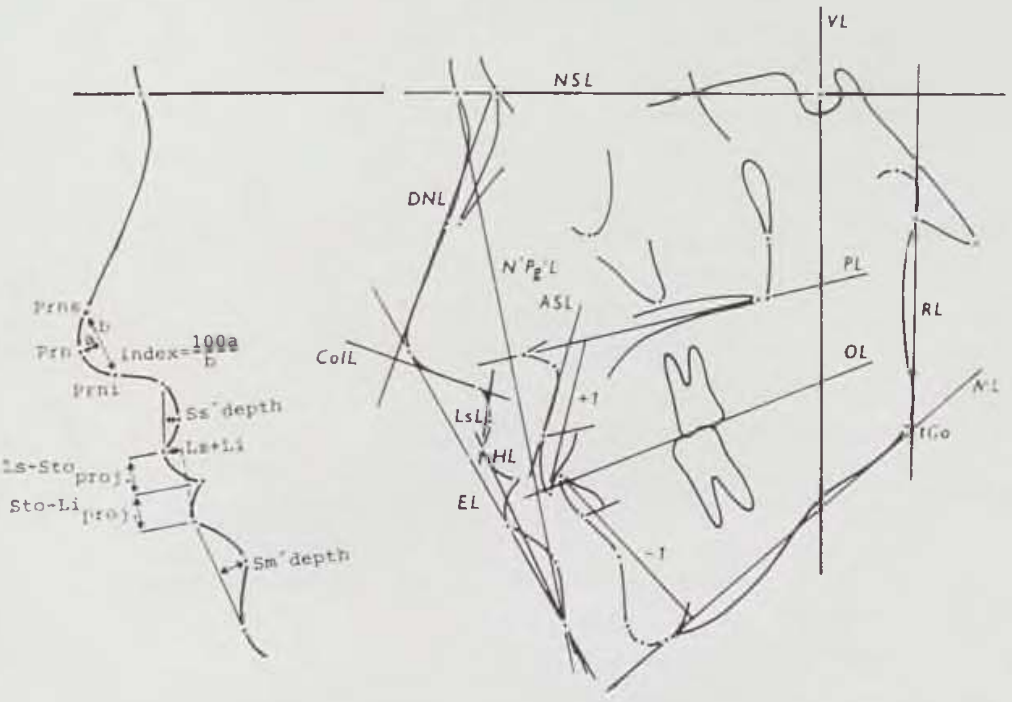


Fig. 2. Reference lines and special characteristics of the soft profile used in the study: NSL = line through N and S, VL = perpendicular to NSL through S, PL = line through Sp and most posterior point of the palatal proceses, OL = line through midpoint between tips of upper and lower central incisors and between cusps of the first upper and lower molars, ML = tangent to the mandibular body through Gn, RL = tangent to the mandibular ramus through Ar, ASL = tangent to the upper alveolar process through Pr, +1 = axis of the upper central incisors, −1 = axis of the lower central incisors, N′-Pg′L = line through N′ and Pg′, DNL = tangent to thedorsum nasi, ColL = tangent to the columella through Sn, LsL = line through Ls and midpoint between Sn and Ss′, EL = tangent to the soft chin and to the tip of the nose, HL = tangent to the soft chin through Ls, tGo = intersection of ML and RL, Prns and Prni = points of inflexion of the apex nasi contour, PrnsPrniL = line through Prns and Prni

the given angle, ColL/LsL (i. e. the nasolabial angle). Witts appraisal (the distance between points Ss and Sm after their perpendicular projection on the occlusal plane OL) is marked Ss+Sm. The overjet was measured between the tips of the upper and lower incisors parallel to the occlusal plane (Is-Ii) and the prominence of the upper lip over the lower lip as the projected distance between points Ls and Li measured perpendicularly to N′Pg′L (difference between the distance of Ls and Li from N′Pg′L, marked Ls+Li, Fig. 2). The height of the vermilion of the upper (Ls-Sto proj.) and lower (Sto-Li proj.) lip was determined as the projected distance parallel to N′Pg′L (Fig. 2). The thickness of the soft tissues of the facial profile was measured on the upper lip from points Ss′ and Pr parallel to the palatal plane, on the lower lip from points Id and Sm′ as the smallest thickness and on the chin from point Pg′ perpendicularly to N′Pg′L (marked Ss'_t, Pg'_t, etc.). The depths

of the concavities of the upper (Ss′ depth) and lower lip (Sm′ depth) were determined as the distance of points Ss′ and Sm′ from the connecting lines between points Sn and Ls, or Li and Pg′ (Fig. 2). A flattening of the tip of the nose was determined with the index 100 × Prn-PrnsPrniL : Prns-Prni (perpendicular distance of Prn from the line passing through points Prns and Prni in terms of per cent of the direct distance between Prns and Prni, Fig. 2).

The numbers of cases were reduced by individual data only in exceptional cases. However, because of prosthetic therapy they were reduced more markedly in cleft lip and palate in characteristics related to the tip of the upper incisors. Yet, it was mostly possible to determine the inclination of upper incisors on the basis of the course of their root channel and the reduction of the number of cases was smaller in these characteristics (+1/PL, +1/−1) than in the case of the overjet (Is-Ii). The pertinent data are presented in Table 2. For the reconstruction of craniograms of the profile (Fig. 3) was used a larger number of characteristics documented in previous studies (quoted above). The differences from the group of controls were determined with the t-test. The same procedure was used for the assessment of differences between individual series of patients. The craniograms were superimposed on NSL and registered at nasion point (N).

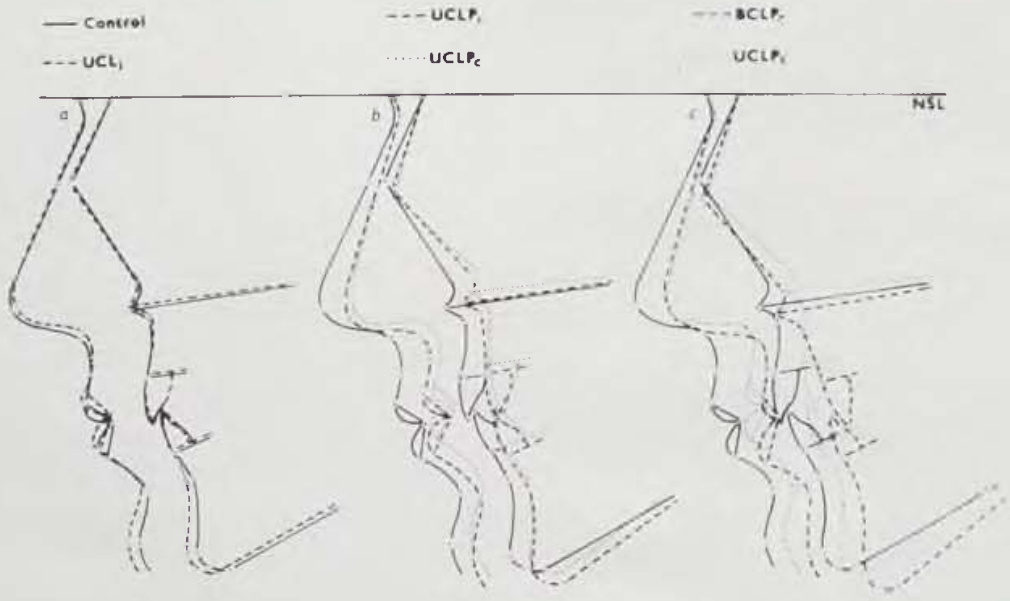


Fig. 3. Profilograms in individual types of clefts (explanatory notes above) as compared to controls (full line). UCL_i = incomplete unilateral cleft lip, $UCLP_i$ = incomplete unilateral cleft lip and palate, $UCLP_c$ = complete unilateral cleft lip and palate, $BCLP_c$ = = complete bilateral cleft lip and palate.

Tab.2. X-ray cephalometric characteristics: Mean values in controls and differences from controls individual types of clefts (in mm or degrees).

	Control	UCL_i	$UCLP_i$	$UCLP_c$	$BCLP_c$
Jaws position					
N-S-Ar	126.92	−0.92	−0.73	−1.70^{+}	2.12
N-S-Go	102.31	−2.33*$^{++}$	0.54	0.56	2.32*
Pmp-VL	13.84	0.43^{+++}	−2.46**	−2.69***$^{+}$	−4.61***
S-N-Ss	80.68	−0.65^{++}	−4.33***	−6.06***	−6.30***
S-N-Pg	79.84	1.22^{++}	−2.19*	−2.03*$^{+}$	−4.46***
PL/NSL	8.02	−0.63	0.17	−1.55^{++}	1.75
OL/NSL	13.02	0.43	1.86	1.45	3.38*
ML/NSL	30.06	0.33^{+++}	6.56***	6.91***	9.79***
Ar-tGo-N	48.85	1.65	0.30	0.87	0.15
N-tGo-Gn	70.27	3.28^{+++}	8.13***	8.60***	10.15***
Bony profile					
Ss-N-Or	26.32	−0.59	−2.13*	−3.35***	−0.99
Ss-N-Zm	27.63	−1.23	−1.55*	−2.58***	−0.71
Ss+Sm	3.00	−0.08	−1.30^{++}	−5.16***	−4.07**
Ss-N-Sm	2.48	−1.64*	−2.10**$^{+}$	−3.79***$^{+}$	−1.36
N-Ss-Pg	178.12	3.85*	3.80**$^{+}$	7.41***	3.53
ASL/PL	107.60	1.69	−8.60***	−12.04***	−17.31***
Incisors					
+1/PL	107.16	−0.34^{+}	−6.84*$^{+}$	−9.28***$^{++}$	−16.34***
−1/ML	95.83	−4.31*$^{++}$	−10.49***	−12.13***	−15.02***
−1/NSL	55.45	3.24	2.11	2.27*	3.34**
+1/−1	134.48	2.89^{+}	9.12**	12.41***$^{++}$	23.02***
Is-Ii	2.81	0.22^{++}	−2.48**	−3.79***	−3.45**
Soft profile					
DNL/NSL	117.76	−0.31^{+++}	−6.60***	−6.61***	−5.67***
DNL/N′Pg′L	36.56	−2.85*	−5.52***	−5.70***$^{+}$	−2.33
EL/N′Pg′L	16.97	−4.10******$^{+++}$	0.85	−1.07	−0.72
HL/N′Pg′L	12.34	−4.21**	−5.28*****$^{++}$	−9.22***	−8.62***
S-N′-Ss′	87.08	−0.92^{++}	−4.93***$^{+}$	−7.52***	−9.20***
S-N′-Pg′	82.34	1.05^{++}	−2.22*	−2.40*$^{+}$	−4.84***
Ss′-N′-Pg′	4.74	−1.97**	−2.70***$^{++}$	−5.12***	−4.36***
N′-Sn-Pg′	164.64	5.14**	7.55***$^{+}$	12.61***	12.82***
EL/DNL	124.11	3.60*	7.22***	7.28***	5.27**
N′-Prn-Pg′	134.00	3.68*	7.50***	10.75***	9.04***
Nose depth					
Prn-Sn	20.00	−0.35	−0.69	−0.38	2.12*
Prn-Sp	32.30	−1.82**	−3.11***	−2.49***	−4.18**
index	22.21	−1.37	−0.20	−1.62*	−2.18*
Lip height					
Sn-Sto	24.34	−1.50	−1.49*	−2.37***	−2.26*
Sn-Ls	17.66	−2.14**	−2.47***	−2.25***	−1.89*
Ls-Sto proj.	6.15	1.03*	1.25**$^{++}$	0.17	0.93
Sto-Li proj.	8.85	0.70	0.57	0.08^{++}	2.13***

	Control	UCL_i	$UCLP_i$	$UCLP_c$	$BCLP_c$
Lip protrusion					
Ls-EL	5.51	2.24	1.55^{++}	4.04***	4.79***
Li-EL	4.00	0.87	−1.38**	0.75^{+}	−1.80*
Li-HL	0.65	−1.79***	−2.86***	−3.73***	−5.34***
Ls+Li	5.08	−3.03**$^{+++}$	−6.41***	−7.99***	−9.29***
Lip thickness					
Ss'_t	14.80	0.39	−0.28	−1.13**	−1.84*
Pr_t	15.26	0.32	−0.41	−1.09*	−0.87
Id_t	11.60	−0.05	−0.22	−0.22	−0.10
Sm'_t	12.26	−0.40	−0.11	−0.35	−0.95**
Pg'_t	14.68	0.09	−0.03	−0.15	−1.06
Nasolabial region					
ColL/N′Pg′L	108.10	−3.94*	−5.79**$^{+}$	−11.36***$^{+++}$	−1.87
LsL/N′Pg′L	9.14	1.38	1.59	2.62	1.51
LsL/PL	100.21	1.53	−2.07	−2.21	−0.61
ColL/LsL	98.96	−5.31*	−7.38*$^{+}$	−14.02***$^{++}$	−3.38
Ss′ depth	2.63	−0.49*	−0.23	−0.42*	−0.61
Sm′ depth	6.75	0.64	0.50	0.09	0.82
Frequency	50	31	26	31	26
n in +1/PL	50	31	26	24	19
n in +1/−1	50	31	25	23	18
n in Is-Ii	50	30	18	14	14

* significant differences between clefts and controls at $p<0.05$, ** $p<0.01$, *** $p<0.001$
$^{+}$ significant differences between neighbouring columns i. e. UCL_i vs. $UCLP_i$, $UCLP_i$ vs $UCLP_c$ and $UCLP_c$ vs. $BCLP_c$ at $p<0.05$, $^{++}$ $p<0.01$, $^{+++}$ $p<0.001$

RESULTS

The results are summed up in Table 2 and documented on Figure 3. The orthodontic angle of cranial base (N-S-Ar) did not differ from controls, similarly as the earlier described actual angle of the cranial base (N-S-Ba). Thus the final configuration of the profile was not affected by the curvature of the cranial base. While a posterior position (displacement) of the maxilla (Pmp-VL) was present in all types of cleft lip and palate ($UCLP_i$, $UCLP_c$, $BCLP_c$) a posterior displacement of the mandible as a whole (N-S-Go) was recorded only in bilateral clefts. This was due to a more marked posterior rotation of the face in these clefts which is correlated equally with a significantly larger posterior displacement of the maxilla (Pmp-VL) as compared to unilateral

clefts. In cleft lip alone (UCL_i) it was possible to observe an anterior displacement of the mandible (N-S-Go).

Cleft lip alone: An anterior displacement of the mandible leads to an impairment of sagittal jaw relations (Ss-N-Sm), a flattening of the skeletal (N-Ss-Pg) and soft (N′-Sn-Pg′, N′-Prn-Pg′, EL/DNL, Ss′-N′-Pg′) facial profile, to a reduction of the inclination of lower incisors due to an adaptation to the maintained overjet (−1/ML) and to changes of some other parameters (EL/N′Pg′L, HL/N′Pg′L, DNL/N′Pg′L). Of independent characteristics cleft lip alone was associated with a reduction of the distance between the tip of the nose and the anterior spina (Prn-Sp), impaired prominence of the upper lip over the lower (Ls+Li, Li-HL), an inerease of the height of its vermilion (Ls-Sto proj.), a slighter concavity of the upper lip profile (Ss′ depth) and a more horizontal slope of the columella towards the profile (ColL/N′Pg′L), resulting in a reduction of the nasolabial angle (ColL/LsL). The craniogram of the profile (Fig. 3a) illustrates that in addition to the anterior displacement of the mandible there is a deeper nasolabial transition and a slightly flattened tip of the nose (index $p<0.1$).

Cleft lip and palate: In contrast to the cleft lip alone with only local deviations, changes in cleft lip and palate affect the face as a whole (Fig. 3b, c). The lower jaw (S-N-Pg) and especially the upper jaw (S-N-Ss) are retruded, mandibular body has a steep oblique slope (ML/NSL) which is reflected by the increase of the lower part of the gonial angle (N-tGo-Gn). The upper part of the angle is unchanged (Ar-tGo-N). The retrusion of the maxilla is less marked in incomplete ($UCLP_i$) than in complete clefts ($UCLP_c$). The retrusion of the mandible and the oblique slope of the mandibular body are more pronounced in bilateral clefts than in unilateral. The slope of the palate plane (PL/NSL) is unchanged, however there are significant differences between unilateral and bilateral clefts. In unilateral clefts the smaller height of the upper face is accompanied by a slight anteinclination of the palatal plane, while in bilateral clefts the oral inclination of the premaxilla leads to a slight retroinclination of the palatal plane. Higher posterior rotation of the face in $BCLP_c$ is reflected by a steeper slope of the occlusal plane (OL/NSL). A more conspicuous retrusion of the maxilla in complete than in incomplete unilateral clefts is reflected by a larger impairment of sagittal jaw relations (Ss-N-Sm, Ss+Sm) and a more marked flattening of the face (N-Ss-Pg, Ss′-N′-Pg′, N′-Sn′Pg′) in these clefts. The maxilla is retruded also in relation to the lateral parts of the face (Ss-N-Or, Ss-N-Zm), though in a lower degree than towards the cranial base (S-N-Ss). Retrusion of the lateral parts of the face (points Or and Zm) amounts to about one half of the retrusion at the central part of the maxilla (difference from S-N-Ss). In view of the persisting anterior displacement of the premaxilla neither this difference, nor the impairment of sagittal jaw relations and the flattening of facial profile attained the significance level in complete bilateral clefts. In the reduction of Witts appraisal (Ss+Sm) participates the steeper slope of the occlusal plane (OL/NSL).

Retroinclination of the upper alveolar process (ASL/PL) and of incisors (+1/PL) increased with the severity of the malformation in the following order: $UCLP_i$, $UCLP_c$ and $BCLP_c$. Retroinclination of lower incisors (−1/ML) was determined by the slope of the mandibular body, the inclination towards the cranial base showed only slight changes (−1/NSL). There was an enormous increase of the interincisal angle (+1/−1), especially in $BCLP_c$. The overjet of upper incisors (Is-Ii) was reduced, with the development of crossbite in complete clefts ($UCLP_c$, $BCLP_c$).

Retrusion of the soft profile of the face is determined by its skeletal framework (S-N′-Ss′, S-N′-Pg′). A similar posterior oblique slope of the dorsum nasi (DNL/NSL), occurred in $UCLP_i$, $UCLP_c$ and $BCLP_c$. The degree of obliquity corresponds to retrusion of the maxilla (S-N-Ss). Because of the retroposition of the chin the obliquity of the dorsum nasi in relation to the facial profile (DNL/N′Pg′L) is not significant in $BCLP_c$. The inclination of the so-called aesthetic line is not changed towards the facial profile (EL/N′Pg′L), the inclination of the harmony line (HL/N′Pg′L) is markedly reduced due to the retrusion of the upper lip, especially in complete clefts. Facial convexity, inclusive of the nose (EL/DNL, N′-Prn-Pg′) is reduced. A more marked flattening of the tip of the nose in complete clefts ($UCLP_c$ and $BCLP_c$) is documented by the index value. The distance between the tip of the nose and the anterior spina (Prn-Sp) is always reduced however the depth of the nose (Prn-Sn) measured after corrective surgery in unilateral clefts remained unchanged. In bilateral clefts it is on the contrary increased after the prolongation of the columella.

The upper lip is shortened in all types of cleft lip and palate (Sn-Sto, Sn-Ls), the height of the vermilion (Ls-Sto proj.) is increased in $UCLP_i$. In this type of cleft was performed the smallest number of surgical corrections. The increased height of the lower lip vermilion in $BCLP_c$ (Sto-Li proj.) is related to the sunken upper lip (Fig. 3c). A typical retrocheilia of the upper lip increases with the extent of cleft in the following order: UCL_i, $UCLP_i$, $UCLP_c$, and $BCLP_c$ (Ls+Li, Li−HL). The increased distance of the upper lip from the aesthetic line was observed only in complete unilateral and bilateral clefts (Ls-EL). In $BCLP_c$ was simultaneously reduced the distance of the lower lip vermilion from the aesthetic line (Li-EL) which confirmed a marked disproportion in the protrusion of both lips. The thickness of the upper lip was reduced only in unilateral and bilateral complete clefts (Ss_t, Pr_t). In $BCLP_c$ was reduced the thickness of soft tissues equally in the supramental groove (Sm'_t) and on the chin (Pg'_t, insig.), which might be related to the posterior displacement of the chin. In unilateral clefts, similarly as in UCL_i the slope of the columella is decreased (ColL/N′Pg′L), especially in complete clefts. This results in a reduction of the nasolabial angle (ColL/LsL), because of the unchanged inclination of the upper lip (LsL/N′Pg′L, LsL/PL). The natural concavity of the upper lip (Ss′ depth) is reduced in $UCLP_c$ and insignificantly (due to the high variability of this characteristic) also in $BCLP_c$. The concavity of the lower lip is unchanged (Sm′ depth).

DISCUSSION

Changes in the configuration of the skeletal facial profile in cleft lip and palate are related to the presence and extent of four main deviations of the face: deficient anterior growth and retrusion of both the upper and lower jaw, dentoalveolar retroinclination of the maxilla and a posterior displacement of the upper jaw. A deficient vertical growth of the upper face and an excessive growth of the lower face height can exert an unfavourable effect on vertical facial proportions and lead to a change in the inclination of the jaws within the skull. The configuration of the soft profile reflects skeletal changes with added deviations of soft tissues. In aesthetic view is most important the flattening of the tip of the nose and the reduction of the height and thickness of the upper lip. The above described deviations occur exclusively in cleft lip and palate, while cleft lip alone is nor associated with skeletal deviations or with a reduction of the upper lip thickness. The origin, importance and consequences of these deviations which provide the basis for the development of a great number of further changes were described in individual types of clefts in our previous studies (Šmahel and Brejcha, 1983; Šmahel, 1984a, b).

The anterior displacement of the lower jaw in cleft lip alone is due to the increased obliquity (anteinclination) of mandibular ramus (Šmahel, 1984b). Since we failed to disclose this deviation in any other type of clefts and because it attained only a low significance level, and it was not reported in the literature it was probably due to the composition of our series. But for this deviation and its consequences, all recorded changes were strictly local and affected solely the oronasal region. Surgical correction was carried out only in exceptional cases and thus in this type of cleft there was a persistence of a slightly flattened tip of the nose. The deviations of the upper lip included a shortening of its dermal part, an increase of vermilion and a smaller concavity which were all of them due to the primary malformation and to surgical treatment. The reduced prominence of the lip was related to the protrusion of the lower lip reflecting the protrusion of the mandible (Fig. 3a) rather than to the retrusion per se (S-N′-Ss′). A more horizontal slope of the columella leads to a reduction of the nasolabial angle and reflects the deeper nasolabial transition, which could be due to a primary tissue deficiency in incomplete clefts.

In cleft lip and palate the global character of deviations of the facial profile result mainly from the shortening and retrusion of both jaws and a maxillary dentoalveolar retroinclination. The retrusion of the maxilla is larger in complete than in incomplete unilateral clefts, mandibular retrusion and dentoalveolar retroinclination of the maxilla are more marked in bilateral than in unilateral clefts. Besides these changes the soft profile is altered also by the flattening of the nose (Prn-Sp) and by the smaller height and thickness of the upper lip. The latter characteristic results in complete clefts in a conspicuous retrocheilia, but it is not present in incomplete unilateral clefts where the situation is similar as in cleft lip alone. In spite of marked reduction

of the distance between the tip of the nose and the anterior spina, the depth of the nose is not reduced in cleft lip and palate. This is due to the sunken upper lip and in bilateral clefts also to the surgical prolongation of the columella. The configuration of the tip of the nose assessed with the proposed index remained unchanged in incomplete cleft lip and palate, similarly as in cleft lip alone. Exclusively in these two types of clefts there was an increased height of the vermilion of the upper lip. This could be due to the originally slighter deficiency of tissues, as well as to the smaller frequency of surgical corrections. The more horizontal slope of the columella in $UCLP_i$ was produced by the same factors as in UCL_i, as well as by the retrusion of the maxilla. In complete clefts this deviation is more conspicuous because of the smaller height of the upper face and of the nose. Because of the increased upper face height in bilateral clefts due to the oral inclination of the premaxilla, the slope of the columella is unchanged after its surgical prolongation. Initially it is excessively oblique. The above described deviations illustrate that in some details the parameters of the oronasal region in incomplete cleft lip and palate are similar to those observed in cleft lip alone. However the global deviations are consistent with those recorded in complete clefts.

During the assessment of the reported series were used Rickets aesthetic line and Holdaway's line of harmony which are commonly applied in clinical practice. The inclination of these lines towards the profile and the distance of the vermilion from the aesthetic line are influenced by a number of parameters, as: retrusion of the chin, flattening of the nose, upper lip height a. s. and therefore these methods are not convenient for the assessment of facial profile in clefts. The prominence of the upper lip can be assessed by our characteristic Ls+Li, while the characteristic Li—HL is less sensitive. The proposed index provides the possibility to evaluate the flattening of the nasal tip, but it is equally not very sensitive. For the assessment of the global flattening of the nose proved more useful the distance of the nasal tip from the anterior spina.

Relatively only a few studies devoted to the configuration of the facial profile in clefts were disclosed in the available literature. They were discussed in our previous studies (Šmahel and Brejcha, 1983; Šmahel, 1984a, b). Detailed and comparative studies are virtually missing in the pertinent literature. To conclude we would like to underline that our findings are characteristic for the postwar period and that they are not in agreement with the results attained at the present time in the treatment of clefts. Yet they show a trend towards the original deviations.

SUMMARY

X-ray cephalometric studies were carried out in 114 adult males with cleft lip and with or without cleft palate. According to the type and extent of the cleft they were subdivided into 4 groups and were compared with a control group of 50 normal males matched in age. Investigated were the parameters

of the skeletal and soft facial profile. The results showed that cleft lip alone is associated with deviations of local character concerning only soft tissues within the oronasal region. The ascertained deviations included a flattening of the nose, reduction of the height, concavity and prominence of the upper lip, increased height of the upper lip vermilion and a more horizontal slope of the columella leading to a reduction of the nasolabial angle.

Cleft lip and palate was associated with deviations of global character related predominantly to the extent of retrusion of the upper and lower jaw. The skeletal profile was altered and its deviations were reflected by changes of the soft profile. Of the deviations of soft tissues per se were most important the flattening of the nose and reduction of the height and thickness of the upper lip, which underlined the presence of retrocheilia. Maxillary retrusion was more marked in complete than in incomplete unilateral clefts, while mandibular retrusion and maxillary dentoalveolar retroinclination were more marked in bilateral than in unilateral clefts. Occlusion was always impaired. In unilateral involvement, especially in complete clefts the more horizontal slope of the columella resulted in a marked reduction of the nasolabial angle. Incomplete clefts, similarly as cleft lip alone were not associated with a reduction of thickness of the upper lip and showed an increase of the vermilion height. Because of the persisting protrusion of the premaxilla bilateral clefts were accompanied by only a slight flattening of the skeletal profile and by an excessive nasal depth after the prolongation of the columella. The nasolabial angle was unchanged. The concavity of the upper lip was reduced in complete unilateral and bilateral clefts. Certain characteristics of the oronasal region disclosed a similarity between incomplete cleft lip and palate (in unilateral involvement) and cleft lip alone, however global deviations (due to skeletal changes) were identical with those recorded in complete clefts.

RÉSUMÉ

Formation du profil facial chez les fentes labiales avec ou sans fente palatine à l'âge adulte

Smahel, Z., Polívková, H., Škvařilová, B., Horák, I.

Par les examens radiocéphalométriques, on a examiné 114 hommes adultes atteints de la fente labiale avec ou sans fente palatine. Selon le type et l'étendue de la fente, les patients ont été classés en 4 groupes et comparés avec un contrôle de 50 hommes sains adultes de l'âge équivalent. On a suivi des paramètres du profil facial squélettique et mou. Les examens ont mis en évidence que les déviations ayant relation à la propre fente labiale avaient un caractère local et ne touchaient que les tissus moux de la région oronasale. On a constaté l'applatissement nasal, diminution de la hauteur et de la proéminence de lèvre supérieure, augmentation de la hauteur du rouge de la lèvre supérieure et inclinaison columellaire plus horizontale ce qui causait une diminution de l'angle nasolabial. Chez les fentes labiopalatines, les déviations ont un caractère plus général et dépendent principalement du degré de retrusion du maxillaire supérieure et inférieure. De cette façon est altéré tout le profil squelettique et, en dépendance de celui, également

le profil mou. Quant aux déviations des tissus mous, les plus importantes sont applatissement du nez et diminution de la hauteur et de l'épaisseur de lèvre supérieure qui accentuent la rétrocheilie. La rétrusion du maxillaire supérieure est plus grande chez les fentes totales que chez les fentes unilatérales subtotales, la rétrusion du maxillaire inférieure et la rétroinclinaison dentoalvéolaire du maxillaire supérieure sont plus grandes chez les fentes bilatérales que chez les fentes unilatérales. L'occlusion est toujours altérée. Les fentes unilatérales, surtout totales, présentent l'angle nasolabial considérablement diminué conséquemment à l'inclinaison plus horizontale de la columelle. Chez les fentes subtotales ainsi que chez les simples fentes labiales, l'épaisseur de lèvre supérieure n'est pas diminuée, le niveau du rouge est élevé. Chez les fentes bilatérales, par rapport à la protrusion durable du prémaxillaire, l'applatissement du profil squélettique est petit et la profondeur nasale est — après prolongation de la columelle — excessive. L'angle nasolabial n'est pas changé. La concavité du maxillaire supérieure était diminuée chez les fentes totales uni- et bilatérales. En quelques paramètres détaillés de la région oronasale, les fentes labiopalatines subtotales (unilatérales) ressemblent aux propres fentes labiales mais, quant aux déviation de caractère général (conditionnées par changements squelettiques), elles correspondent aux fentes totales.

ZUSAMMENFASSUNG

Gestaltung des Gesichtsprofiles bei Erwachsenen mit Lippenspalten und mit bzw. ohne Gaumenspalten

Šmahel, Z., Polívková, H., Škvařilová, B., Horák, I.

Röntgenzephalometrische Untersuchungen erfolgten bei 114 erwachsenen Männern mit Lippenspalten, und mit bzw. ohne Gaumenspalten. Je nach dem Typ und Ausmass der Spaltmissbildung wurden die Untersuchten in 4 Gruppen unterteilt und mit einer Kontrollgruppe von 50 gesunden Männern, entsprechenden Alters verglichen. Es wurden die Parameter des Skelett- und Weichteilgesichtsprofiles bestimmt. Die Ergebnisse zeigten, dass bei alleinigen Lippenspalten nur lokale Abweichungen bestanden, die auf die Weichteile der oronasalen Gegend begränzt waren. Es bestand eine Verflachung der Nase, Herabsetzung der Höhe und Prominenz der Oberlippe, Vergrösserung der Vermilionhöhe an der Oberlippe und eine horizontalere Ebene der Columella bedingten eine Reduktion des nasolabialen Winkels.

Bei Lippen- und Gaumenspalten wurden globale Abweichungen überwiegend durch den Ausmass der Retrusion des Oberkiefers und des Unterkiefers bedingt. Es bestand eine Abweichung des gesamten Skelettgesichtsprofiles dadurch auch des Weichteilgesichtsprofiles. Von den eigentlichen Abweichungen der Weichteile waren am bedeutendsten die Verflachung der Nase, und die niedrigere Höhe und Dicke der Oberlippe, die eine Retrocheilie unterstrichen. Bei totalen Spaltmissbildungen bestand eine stärkere Retrusion des Oberkiefers als bei subtotalen Spalten. Die Retrusion des Unterkiefers und die dentoalveolare Retroinklination des Oberkiefers waren stärker bei bilaterales als bei unilateralen Spaltmissbildungen. Eine Störung der Okklusion war stets vorhanden. Bei einseitigen, insbesonders totalen Spalten war infolge der horizontaleren Neigung der Columella der nasolabiale Winkel strak herabgesetzt. Bei subtotalen Spalten, ähnlich wie bei alleinigen Lippenspalten, bestand eine niedrigere Dicke der Oberlippe und eine grössere Vermilionhöhe. Bei bilateralen Spalten war infolge der andauernden Protrusion der Premaxilla nur eine leichte Verflachung des Skelettgesichtsprofiles vorhanden, mit einer übermässigen Tiefe der Nase nach der Verlängerung der Columella.

Der nasolabiale Winkel war unverändert. Die Konkavität der Oberlippe war geringer bei totalen unilateralen und bilateralen Spalten. Gewisse Detaile der Parameter der oronasalen Gegend wiesen bei subtotalen (einseitigen) Lippen- und Gaumenspalten eine Ähnlichkeit mit denjenigen bei alleinigen Lippenspalten, auf. Die, durch skelettale Veränderungen bedingten Globalen Abweichungen glichen jedoch den bei totalen Spaltmissbildungen verzeichneten Änderungen.

REFERENCES

1. **Šmahel, Z.**: Craniofacial morphology in adults with bilateral complete cleft lip and palate. Cleft Palate J., 21: 159, 1984a.

2. **Šmahel, Z.**: Craniofacial changes in unilateral cleft lip in adults. Acta Chir. Plast., 26: 129, 1984b.

3. **Šmahel, Z., Brejcha, M.**: Differences in craniofacial morphology between complete and incomplete unilateral cleft lip and palate in adults. Cleft Palate J., 20: 113, 1983.

Dr. Z. Šmahel,
Šrobárova 50, 100 34 Prague 10,
Czech Republic

Czech Academy of Sciences, Prague (Czech Republic)
Institute of Experimental Medicine
Director Prof. R. Jelínek, M. D., DrSc
Charles University, 3rd Medical Faculty, Prague
Department of Plastic Surgery
Head Assoc. Prof. M. Tvrdek, M. D.

CONFIGURATION OF FACIAL PROFILE IN ADULTS WITH ISOLATED CLEFT PALATE

Z. ŠMAHEL, I. HORÁK, H. POLIVKOVÁ, B. ŠKVAŘILOVÁ

Our earlier study was devoted to a detailed description of deviations in the configuration of the skeletal and soft facial profile in cleft lip and palate (Šmahel et al., 1992). The present communication deals with the same problems in isolated cleft palate. In contrast to the former types of clefts facial soft tissues are not affected in isolated cleft palate and therefore they do not require any surgical treatment. Just on the contrary, they conceal skeletal defects. However, in spite of this fact certain deviations in the configuration of facial soft tissues occur and represent mainly the sequelae of changes of the skeletal framework. The purpose of the present study was to provide a detailed description of these deviations, to illustrate their relationship to skeletal changes and to the extent and severity of clefts, as well as to ascertain whether certain changes in the configuration of soft tissues of the facial profile per se can develop independently on skeletal alterations. For this purpose was used an earlier examined series of adult males subjected to an analysis of the main features of craniofacial morphology (Šmahel, 1984).

MATERIAL AND METHOD

Similarly as in the previous study (Šmahel et al., 1992) were assessed measurements carried out on 81 X-ray films made in males ranging in age from 20 to 42 years. All probands had an isolated cleft palate without any associated malformations. They were subdivided into three groups, according to the extent of the cleft: 1. with a complete cleft up to the for. incisivum (CP_c), 2. with an incomplete cleft extending at least to one third of the hard palate (CP_i) and 3. with a cleft of the soft palate alone (CP_s). Patients with cleft soft palate and a notch into the hard palate (up to one third of its length) and with submucous clefts were not included into the present study. The numbers of patients in individual groups and their mean age at the time of examination and of primary surgical repair are presented in Table 1. There

are no differences in the mean age of patients in individual groups at the time of examination or as compared to the pertinent data in controls. There were equally no significant differences between their age at the time of primary surgical repair. These characteristics did not differ from those assessed earlier in series with cleft lip and palate (Šmahel et al., 1992).

Palatoplasty consisted of a pushback, mostly with the use of pharyngeal flap surgery (Tab. 1). All patients were operated on at the Department for Plastic Surgery in Prague during the first two decades after The Second World War. The group of controls included volunteers matched in age and treated because of slight injuries, as well as students (n = 50). They were described in more detail in our previous study (Šmahel et al., 1992).

Tab. 1. Numbers of cases in individual groups, mean age at the time of examination and at the time of palate surgery and numbers of patients without pharyngeal flap surgery.

group	n	age years	surg. years	without flap
Control	50	27.2	—	—
CP_c	32	29.7	4.5	9
CP_i	32	27.8	5.1	5
CP_s	17	30.1	5.2	4

X-ray films were obtained under standard conditions (magnification 8.1%) with the head of the patients fixed with a cephalostat during centric occlusion. Craniometric points and reference lines used during the measurements of X-ray films are presented on Figures 1—2. In the case of double contours was marked the midpoint between both sides (in points Ar, Go, Pmp, Or, Zm). The perpendicular distance of a given point from the reference line is marked Pmp-VL, an angle with an abbreviation N-S-Ar, or in terms of a fraction of reference lines forming a given angle, ColL/LsL (i. e. the naso-labial angle). Witts appraisal (the distance of points Ss and Sm after their perpendicular projection to the occlusal plane OL) is marked Ss+Sm. The overjet was measured between the tips of upper and lower incisors parallel to the occlusal plane (marked Is-Ii) and the prominence of the upper lip over the lower lip as the projected distance between points Ls and Li measured perpendicularly to N′Pg′L (difference of the distance Ls and Li from N′Pg′L, marked Ls+Li, Fig. 2). The heights of the vermilion of the upper (Ls-Sto proj.) and lower (Sto-Li proj.) lip were determined as the projected distances parallel to N′Pg′L (Fig. 2). Soft tissue thickness of the facial profile was measured on the upper lip from points Ss′ and Pr parallel to the palatal plane, on the lower lip from the points Id and Sm′ as the smallest thickness,

and on the chin from point Pg′ perpendicular to N′Pg′L (marked Ss′$_t$, Pg′$_t$ etc.). The depths of the concavity of the upper (Ss′ depth) and of the lower (Sm′ depth) lip were determined as the distances of points Ss′ and Sm′ from the connecting lines between points Sn and Ls, or Li and Pg′ (Fig. 2). A flattening of the tip of the nose was determined with the index 100× Prn-Prns PrniL : Prns-Prni (perpendicular distance of Prn from the line passing through points Prns and Prni expressed in percent of the direct distance between Prns and Prni, Fig. 2).

The results were analyzed with routine statistical methods. The number of cases was reduced by 1—3 data only in characteristics including the tips of upper incisors (+1/PL, +1/—1, Is-Ii) because of their changes due to prosthetic therapy. The differences between individual groups of patients and as compared to controls were tested with the t-test. Profile craniograms were superimposed on NSL and registered at nasion point N (Fig. 3). For their construction was used a larger number of characteristics which were described in our previous study (Šmahel, 1984).

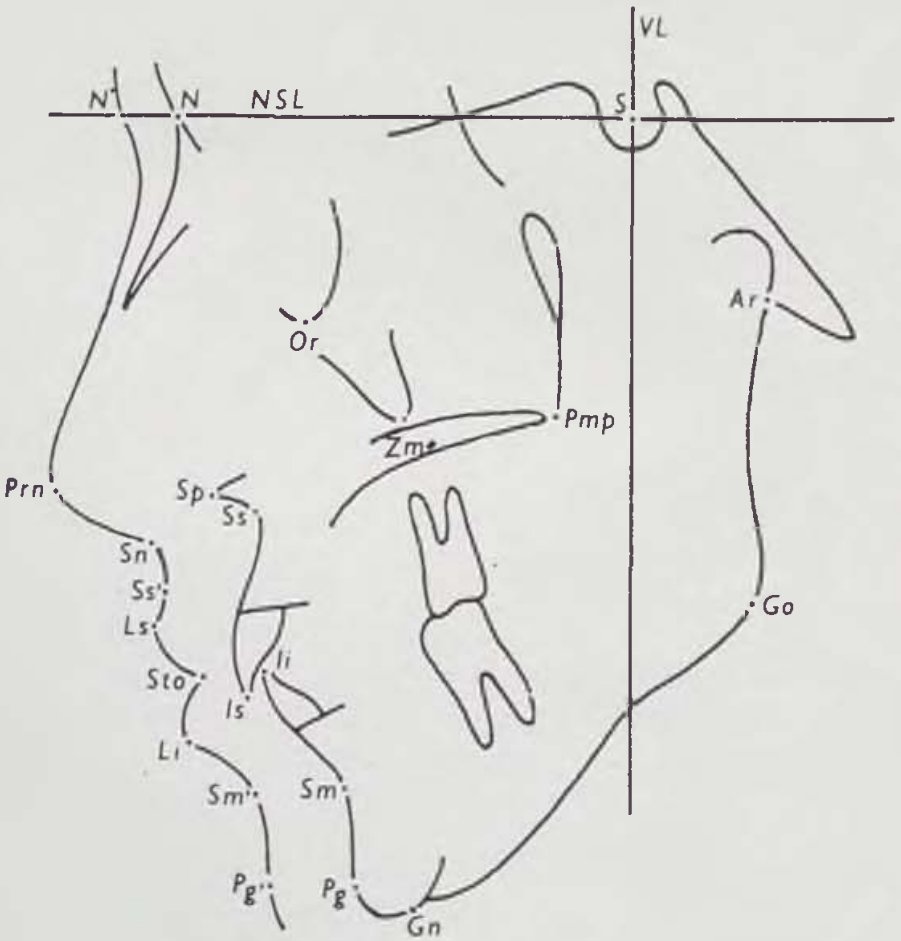


Fig. 1. Cephalometric points used for the assessment of lateral X-ray films.

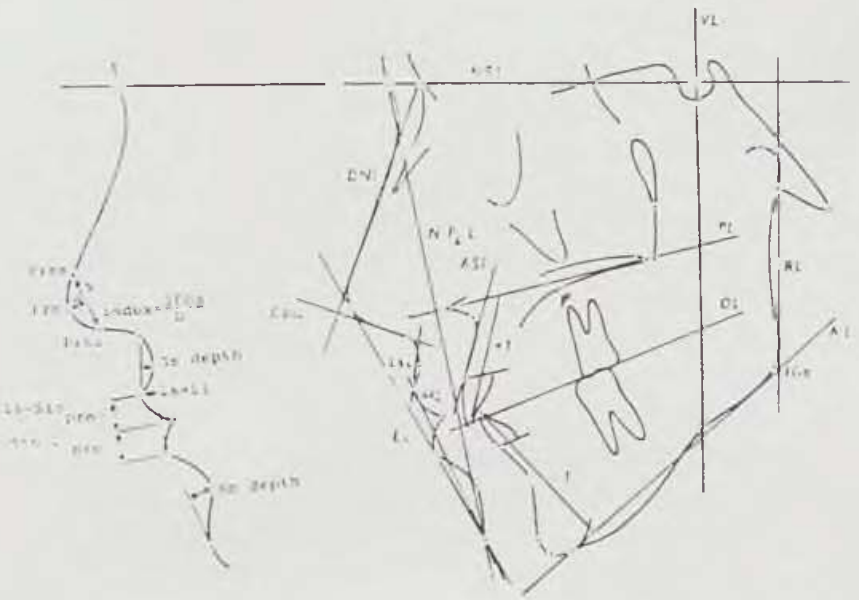


Fig. 2. Reference lines and special characteristics of the soft profile used in the study: NSL = line through N and S, VL = perpendicular to NSL through S, PL = line through Sp and most posterior point of the palatal processes, OL = line through midpoint between tips of upper and lower central incisors and between cusps of the first upper and lower molars, ML = tangent to the mandibular body through Gn, RL = tangent to the mandibular ramus through Ar, ASL = tangent to the upper alveolar process through Pr, +1 = axis of the upper central incisors, −1 = axis of the lower central incisors, N′ Pg′L = line through N′ and Pg′, DNL = tangent to the dorsum nasi, ColL = tangent to the columella through Sn, LsL = line through Ls and midpoint between Sn and Ss′, EL = tangent to the soft chin and to the tip of the nose, HL = tangent to the soft chin through Ls, tGo = intersection of ML and RL, Prns and Prni — points of inflexion of the apex nasi contour, PrnsPrniL = line through Prns and Prni.

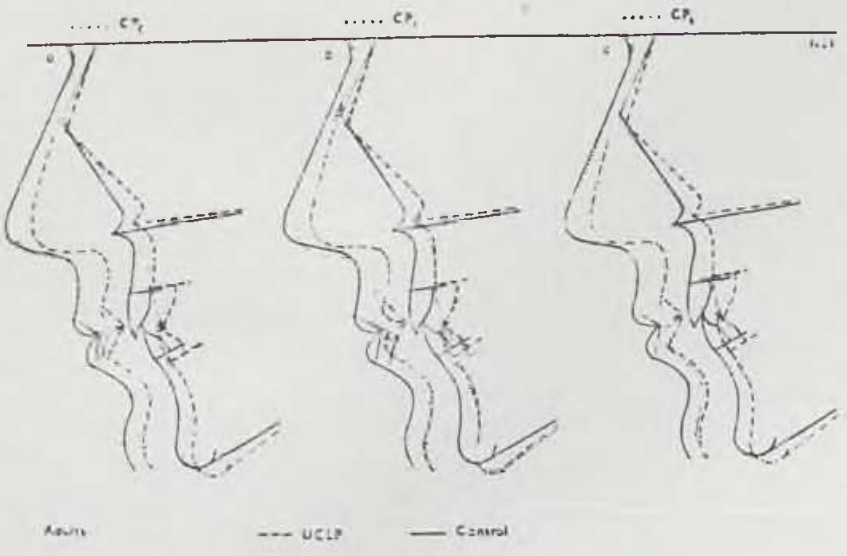


Fig. 3. Profilograms in individual types of isolated cleft palate (dotted line; a = complete clefts, b = incomplete clefts, c = clefts of the soft palate alone) as compared to controls (full line) and to individuals with unilateral cleft lip and palate (dashed line).

The results are summed up in Table 2 and on Figure 3 are compared with the situation in unilateral cleft lip and palate (both complete and incomplete) described in our earlier study (Šmahel et al., 1991). The orthodontic angle of the cranial base (N-S-Ar) was reduced at a low significance level in complete clefts and in clefts of the soft palate alone (CP_c and CP_s). Identical deviations of the angle of the cranial base (N-S-Ba) were described earlier (Šmahel, 1984). However the anteroposterior position of the upper (Pmp-VL) and lower (N-S-Go) jaw remained unchanged. Thus the final configuration of the profile was not markedly affected by the flexion of the cranial base.

The main features of the configuration of skeletal facial profile are identical with those in unilateral cleft lip and palate. This is most clearly evident in incomplete cleft palate where the contour of the skeletal profile almost merges with the contour of unilateral clefts (Fig. 3b). Identical with UCLP are: the retrusion of both jaws (S-N-Ss, S-N-Pg), the steepness of the mandibular body (ML/NSL, N-tGo-Gn), maxillary retrusion towards the lateral parts of the face (Ss-N-Or, Ss-N-Zm), impairment of sagittal jaw relations (Ss-N-Sm) and the flattening of the facial skeletal framework (N-Ss-Pg). This type of cleft was the only one of isolated clefts of the palate which was associated with retroinclination of the occlusal plane (OL/NSL). Therefore the assessment of sagittal jaw relations with Witts appraisal (Ss+Sm) yielded a larger deviation. The described characteristics differed in complete cleft palate from incomplete clefts only by the absence of mandibular retrusion (S-N-Pg, Fig. 3a), which was again reflected by a larger deviation of Witts appraisal. Clefts of the soft palate alone differ by a smaller retrusion of the maxilla (S-N-Ss, Fig. 3c) and by a less steep mandibular body (ML/NSL). Thus, they are not associated with an impairment of sagittal jaw relations (Ss-N-Sm, Ss+Sm) or with a flattening of the skeletal facial profile (N-Ss-Pg).

The inclination of the upper alveolar process (ASL/PL) and of incisors (+1/PL) are unchanged in isolated cleft palate and almost unchanged is also the overjet (Is-Ii). In incomplete and "soft" cleft palate the retroinclination of lower incisors (−1/ML) represent an adaptation to the steeper slope of the mandibular body, with no changes in the inclination of incisors towards the cranial base (−1/NSL). Therefore remains also unchanged the interincisal angle (+1/−1). In complete cleft palate due to the relatively larger protrusion of the chin (as compared to CP_i and CP_s) the retroinclination of lower incisors is more marked (adaptation to a positive overjet). It is also evident towards the cranial base (−1/NSL) and leads to an increase of the interincisal angle.

The configuration of the soft profile in isolated cleft palate masks in a large degree the retrusion of the middle face. The deviation from the norm is much smaller than in cleft lip and palate (S-N′-Ss′) and there is also a slighter change in the slope of the dorsum nasi (DNL/NSL, DNL/N′Pg′L), which is insignificant in cleft soft palate. The soft profile of the lower jaw (S-N′-Pg′) is determined by the skeletal profile (S-N-Pg), the sagittal relation

Tab. 2. X-ray cephalometric characteristics: Mean values in controls and differences from controls in individual types of clefts (in mm or degrees).

	Control	CP_c	CP_i	CP_s
Jaws position				
N-S-Ar	126.92	−2.34*	−1.71	−3.57*
N-S-Go	102.31	−0.51	−0.43	−0.40
Pmp-VL	13.84	0.41	−1.37	−1.10
S-N-Ss	80.68	−3.49**	−3.96***	−1.95
S-N-Pg	79.84	−0.62	−2.00*	−1.31
PL/NSL	8.02	0.32	1.48	0.65
OL/NSL	13.02	0.90	3.87***+	0.74
ML/NSL	30.06	5.16**	7.07***	3.40
Ar-tGo-N	48.85	1.46	1.20	0.53
N-tGo-Gn	70.27	7.03***	8.96***	6.83**
Bony profile				
Ss-N-Or	26.32	−2.04	−2.62*	−2.09
Ss-N-Zm	27.63	−2.54***	−1.86	−2.22**
Ss+Sm	3.00	−5.87***	−5.78***++	−2.09++
Ss-N-Sm	2.48	−2.29***	−1.67**	−0.35+
N-Ss-Pg	178.12	5.85***	4.16**	1.08+
ASL/PL	107.60	−2.76	−2.04	−2.47
Incisors				
+1/PL	107.16	0.46	−0.36	1.19
−1/ML	95.83	−13.00***+	−7.52***	−7.52*
−1/NSL	55.45	6.96**	2.22	2.74
+1/−1	134.48	10.24***+	2.66	4.77
Is-Ii	2.81	−0.71*	−0.76	0.30
Soft profile				
DNL/NSL	117.76	−2.52	−4.07***	−1.32
DNL/N′Pg′L	36.56	−3.92**	−3.25***+	−0.94+
EL/N′Pg′L	16.97	−2.94**++	3.11***	2.79+
HL/N′Pg′L	12.34	−2.80*	−0.62	−2.90*
S-N′-Ss′	87.08	−2.17*	−2.58*	−2.75*
S-N′-Pg′	82.34	−0.53	−2.31*	−1.74
Ss′-N′-Pg′	4.74	−1.65*	−0.27	−1.01
N′-Sn-Pg′	164.64	3.36*	1.20	−0.31
EL/DNL	124.11	3.84**	2.07	−1.36++
N′-Prn-Pg′	134.00	3.72**	2.53*	0.80
Nose depth				
Prn-Sn	20.00	−0.81	−0.69	−0.40
Prn-Sp	32.30	0.26	−0.05	−1.50*+
index	22.21	0.53	0.64	0.25
Lip height				
Sn-Sto	24.34	−1.12+	0.38	−0.14
Sn-Ls	17.66	−0.25	0.28	0.07
Ls-Sto proj.	6.15	0.51	0.53	−0.53
Sto-Li proj.	8.85	−1.26*	−0.57	−1.23

	Control	CP_c	CP_i	CP_s
Lip protrusion				
Ls-EL	5.51	2.24**	0.93^{+}	2.95**
Li-EL	4.00	1.87**	0.36	2.85*
Li-HL	0.65	−0.38	−0.87	0.35
Ls+Li	5.08	−2.81*	−2.37*	−2.38*
Lip thickness				
Ss'_t	14.80	2.68***	2.98***$^{++}$	0.47^{+++}
Pr_t	15.26	3.08***	2.62***$^{++}$	0.67^{+++}
Id_t	11.60	1.31***	0.71	0.07^{++}
Sm'_t	12.26	1.40***	0.80*$^{+}$	−0.19^{+++}
Pg'_t	14.68	0.60	−0.18	−0.61
Nasolabial region				
ColL/N′Pg′L	108.10	−6.01***	−3.51	−4.51*
LsL/N′Pg′L	9.14	−0.92	1.58	−5.20*$^{+}$
LsL/PL	100.21	−0.10	−0.83^{+}	−6.54**$^{+}$
ColL/LsL	98.96	−5.08*	−5.08*	0.69
Ss′ depth	2.63	0.01	0.21	−0.16
Sm′ depth	6.75	−0.03	0.40	−0.05
Frequency	50	32	32	17

* significant differences between clefts and controls at $p<0.05$, ** $p<0.01$, *** $p<0.001$
$^{+}$ significant differences between CP_c vs. CP_i (marked under CP_c), CP_i vs CP_s (under CP_i) and CP_s vs. CP_c (under CP_s) at $p<0.05$, $^{++}$ $p<0.01$, $^{+++}$ $p<0.001$

between the middle and the lower face is impaired only in complete clefts (Ss′-N′-Pg′). The inclination of the aesthetic line towards the facial profile (EL/N′Pg′L) is reduced in complete clefts because of the protrusion of the chin, while in other types of cleft palate it is increased because of the retrusion of the chin and of the more marked prominence of the nose than it is the case in cleft lip and palate. The inclination of the line of facial harmony (HL/N′Pg′L) is decreased in CP_c because of the protrusion of the chin and in CP_s because of the retrusion of the upper lip (LsL/N′Pg′L, Fig. 3a, c). Facial soft profile is flattened only in complete cleft palate (N′-Sn-Pg′, EL/DNL, N′-Prn-Pg′), however much less than in cleft lip and palate.

Nasal depth (Prn-Sn, Prn-Sp), configuration of the nasal tip (index), upper lip height (Sn-Sto, Sn-Ls) vermilion height of both lips (Ls-Sto proj., Sto-Li proj.) and the concavity of the lips (Ss′ depth, Sm′ depth) are unchanged in isolated cleft palate. Occasional exceptions attain only low significance levels and thus are not of great importance. All types of cleft palate are accompanied by a slightly inferior prominence of the upper lip over the lower (Ls+li, $p<0.05$). The Li-HL parameter failed to document this re-

duction. The distance between the vermilion of both lips and the aesthetic line (Ls-EL, Li-EL) is increased in CP_c because of the prominence of the chin and in CP_s because of a satisfactory prominence of the nose (Fig. 3a, c). Complete cleft palate is associated with an increased thickness of both lips (Ss'_t, Pr_t, Id_t and Sm'_t) while in incomplete clefts only of the upper lip (Ss'_t and Pr_t). In clefts of the soft palate the thickness of the lips is not changed. Thus in complete clefts the retrusion of the maxilla and of the denoalveolar component of the lower jaw is masked (Fig. 3a). In incomplete clefts is masked only the retrusion of the maxilla, the dentoalveolar component of the mandible is not inclined backwards (Fig. 3b). In cleft soft palate alone maxillary retrusion is insignificant (S-N-Ss) and a masking effect is not required (Fig. 3c). This type of cleft is characterized by a particular steeper slope of the contour of the upper lip (LsL/N'Pg'L, LsL/PL), representing probably an adaptation to the retruded lower lip (Fig. 3c). Therefore in spite of the more horizontal slope of the columella (ColL/N'Pg'L) the nasolabial angle (ColL/LsL) is not changed, as it is the case in other types of isolated cleft palate. In these types of clefts, similarly as in unilateral cleft lip and palate a reduction of the nasoabial angle is due to the decreased slope of the columella (ColL/N'Pg'L).

DISCUSSION

Changes in the configuration of facial skeletal profile in isolated cleft palate are related to the extent of the retrusion of both jaws. Maxillary retrusion is predominantly a secondary sequelae of palate surgery, while smaller mandible could represent a primary change and the cause of the development of isolated cleft palate (Šmahel, 1984). Both show a varying degree of relationship to the extent of the cleft. However, in contrast to cleft lip and palate isolated cleft palate is not associated with other basic skeletal changes, as maxillary dentoalveolar retroinclination, posterior displacement of the maxilla and deficient vertical growth of the upper face. These deviations, however, are less important than the retrusion of both jaws and therefore the contour of the skeletal profile is very much like in unilateral cleft lip and palate, especially in an incomplete isolated cleft palate. Yet, the absence of maxillary dentoalveolar retroinclination proves sufficient for the restoration of a positive overjet.

In an isolated cleft palate the soft tissues of the facial profile show no obvious changes, deviations in the configuration of the soft profile are produced by skeletal changes. Retrusion of both jaws is fully expressed in incomplete clefts, while in complete clefts the mandible is not retruded and in clefts of the soft palate the retrusion of the upper jaw is only slight. The retrusion of the middle face is to a high degree masked by the increased thickness of the upper, or even of both lips, as described in the preceeding text. This is not due to a hypertrophy of soft tissues but rather to an extension of an intact lip into the vestibular area increased by the retrusion of the middle face. Thus the soft profile poses no therapeutic problems.

The inclination of the dorsum nasi shows substantially slighter changes than in cleft lip and palate, since it is affected solely by the retrusion of the maxilla and not by a flattening of the nose (the distance between the tip of the nose and the anterior spina is unchanged). Yet, in spite of these favourable conditions the facial soft profile tends to be slightly retrusive in isolated cleft palate. However since the deviations are identical in the upper and lower face the profile is not flattened, but for a slight flattening in complete clefts. The retrusive character is not visible on inspection and it can be compensated by postural changes of the head.

The more horizontal slope of the columella leads to a reduction of the nasolabial angle. The extent of the deviation is related to the situation in cleft lip and in incomplete unilateral cleft lip and palate (Šmahel et al., 1992) as it was verified by repeated measurements. Since the height of the upper face was not reduced, it was most probably due to the retrusion of the maxilla and thus equally of the nasolabial transition. It was rather improbable that the deviation could be due to a bias produced by the composition of the series of controls which included 50 examined probands. This series was equally repeatedly measured with identical results.

Thus the results showed that the soft profile can show in isolated cleft palate some changes. Changes within the oronasal region, as a reduced slope of the columella and of the upper lip, as well as a reduced nasolabial angle and upper lip protrusion together with earlier demonstrated smaller width of the oral slot, of the nose and of the nostril tresholds (Šmahel, 1983) could be suggestive of certain physiognomic differences of the face in patients with isolated cleft palate. Specialists mention often that the face of a child with this type of cleft is characterized by gracility, conspicuous especially within the oronasal region, which has been sometimes explained by the frequent oral breathing. The deviations may persist up to adult age and may not be necessarily related to skeletal changes.

We failed to disclose in the available literature any report dealing with an assessment of the configuration of the soft and skeletal facial profile in isolated cleft palate and its relation to the extent of the cleft. Therefore there are no data which could be used for a comparison with our findings. However, attention should be paid to certain, especially skeletal deviations. It is therefore indispensable to carry out further studies which would be concerned with developmental and growth problems.

SUMMARY

X-ray cephalometry was used for the assessment of the configuration of the skeletal and soft tissue profile in 81 adult males with isolated cleft palate. They were assessed in three subgroups, i. e. with complete and incomplete clefts and with clefts of the soft palate alone and were compared with a matched group of controls consisting of 50 normal males, as well as with the situation in the earlier examined series with unilateral cleft lip and palate. In isolated

cleft palate both the upper and lower jaws were retruded. The maxilla was most markedly retruded in incomplete clefts and most slightly in clefts of the soft palate alone, while the mandible showed the smallest degree of retrusion in complete clefts. The configuration of the skeletal profile was similar as in unilateral cleft lip and palate, yet positive overjet was on the average restored in all types of isolated cleft palate. A more favourable configuration of the profile was present in patients with cleft soft palate alone, in the absence of an impairment of sagittal jaw relations. Changes in the configuration of the soft profile were due mainly to skeletal deviations. The retrusion of skeletal framework of the middle face was to a large degree masked by the larger thickness of the upper lip, in complete clefts also of the lower lip. Therefore the prominence of the upper lip was only slightly impaired and slight flattening of the face occurred only in complete clefts. The more horizontal slope of the columella resulted in a reduction of the nasolabial angle. Some deviations from the described pattern occurred in clefts of the soft palate alone (steeper slope of the upper lip with an unchanged nasolabial angle, normal thickness of the upper lip a. o.). The findings are suggestive of a differing facial physiognomy in isolated cleft palate.

RÉSUMÉ

Formation du profil facial chez les fentes palatines isolées à l'âge adulte

Šmahel, Z., Polívková, H., Škvařilová, B., Horák, I.

On a évalué, par les examens radiocéphalométriques, la formation du profil squelettique et du profil mou de la face chez 81 hommes adultes avec la fente palatine isolée. L'évaluation a été effectuée en trois groupes avec la fente totale et subtotale et avec la simple fente du voile qui étaient comparés avec un groupe adéquat de 50 hommes sains et avec la situation d'un ensemble examiné antérieurement et comportent la fente labio-palatine unilatérale. Le maxillaire supérieur et inférieur sont retrusés chez les fentes palatines isolées, le maxillaire supérieur le plus souvent chez les fentes subtotales et le moins souvent chez les simples fentes du voile, le maxillaire inférieur le moins souvent chez les fentes totales. La formation du profil squelettique est très proche à la situation des fentes labiales et palatines unilatérales mais l'antérocclusion est toujours formée. Le profil est plus favorablement formé chez la simple fente du voile, sans défaut en relations intermaxillaires sagittales. Les déviations de formation du profil mou résultent principalement des changements squelettiques, les propres tissus moux ne sont pas déviés. La rétrusion de l'étage moyen du squelette facial est masquée dans une mesure considérable par une plus grande épaisseur de la lèvre supérieure, éventuellement de la lèvre inférieure, donc la proéminence de la lèvre supérieure n'est que légèrement aggravée et la face est légèrement applatie seulement chez les fentes totales. Le profil mou est généralement retrué, la columelle a une inclinaison plus horizontale causant la diminution de l'angle nasolabial. Quelques différences du schéma décrit n'apparaissent que chez la fente du voile (inclinaison plus abrupte de la lèvre supérieure avec l'angle nasolabial sans changements, épaisseur normale de la lèvre supérieure e. a.). Les examens témoignent d'une certaine différence physiognomique de la face avec la fente palatine isolée.

ZUSAMMENFASSUNG

Gestaltung des Gesichtsprofiles bei Erwachsenen mit isolierten Gaumenspalten

Šmahel, Z., Horák, I., Polívková, H., Škvařilová, B.

Roentgenzephalometrische Bewertungen der Gestaltung des skeletalen und Weichteil-Gesichtsprofiles bei 81 erwachsenen Männern mit isolierter Gaumenspalte. Die Bewertung erfolgte in drei Gruppen: totale und subtotale Spaltmissbildungen und Spaltmissbildung begränzt auf den weichen Gaumen, mit dem Vergleich mit einer Kontrollgruppe von 50 gesunden Männern, und ferner auch mit der Situation bei einem früher untersuchten Krankengut mit einseitiger Lippen- und Gaumenspalte. Bei isolierten Gaumenspalten bestand eine Retrusion des Ober- und Unterkiefers, bei der Maxilla war sie am stärksten bei subtotalen Spaltmissbildungen, und am geringsten bei Spalten des weichen Gaumens, die Retrusion des Unterkiefers war am gerungsten bei totalen Spalten. Die Gestaltung des skeletalen Gesichtsprofiles ähnelt der Situation bei einseitigen Lippen- und Gaumenspalten, es besteht jedoch stets ein Überbiss. Günstiger ist die Gestaltung des Profils bei der Begrenzung der Spaltmissbildung auf den weichen Gaumen, ohne eine Störung der sagittalen Beziehungen zwischen beiden Kiefern. Abweichungen in der Gestaltung der Weichteil-Gesichtsprofiles werden überwiegend durch die skeletalen Änderungen bedingt. Die Retrusion des skeletalen mittleren Gesichtsteiles ist in hohem Grade durch die grössere Dicke der Oberlippe, ev. auch der Unterlippe, maskiert. Die Prominenz der Oberlippe ist nur leicht vermindert und eine leichte Verflachung des Gesichtes besteht nur bei totalen Spalten. Die verstärkt horizontale Neigung der Columella bedingt eine Reduktion des nasolabialen Winkels. Gewisse Abweichungen von diesem Schema werden nur bei den auf den weichen Gaumen begrenzten Spalten beobachtet (steilere Neigung der Oberlippe bei unverändertem nasolabialen Winkel, normale Dicke der Oberlippe u. a.). Die Befunde bieten einen Hinweis auf ein physiognomisch unterschiedliches Gesicht bei isolierten Gaumenspalten.

REFERENCES

1. **Šmahel, Z.:** Cephalometric and morphologic changes in adult males with isolated cleft palate. Acta Chir. Plast., 25: 113, 1983.

2. **Šmahel, Z.:** Variations in craniofacial morphology with severity of isolated cleft palate. Cleft Palate J., 21: 140, 1984.

3. **Šmahel, Z., Brejcha, M., Müllerová, Ž.:** Craniofacial morphology in unilateral cleft lip and palate in adults. Acta Chir. Plast., 33: 224, 1991.

4. **Šmahel, Z., Polívková, H., Škvařilová, B., Horák, I.:** Configuration of facial profile in adults with cleft lip with or without cleft palate. Acta Chir. Plast., 34: No 4, 1992.

Dr. Z. Šmahel.

Šrobárova 50, 100 34 Prague 10.
Czech Republic

Department of Plastic Surgery,
Center for Postgraduate Medical Education, Warsaw (Poland)
Head: Prof. M. Krauss, M. D.

LATE RESULTS OF THE SURGICAL TREATMENT IN UNILATERAL COMPLETE CLEFT LIP AND PALATE

Occlusal and craniofacial characteristics

T. POLACZEK

INTRODUCTION

An analysis of late results of the cleft lip and palate surgery is the only way to assess the value of the surgical method used and to determine its effect on the development of jaws and craniofacial skeleton after the period of an intense growth of the patient. The literature pertinent to the late results of cleft lip and palate surgery is however rather scarce. It describes usually small, often inhomogeneous groups, what limits the generalization and comparison possibilities. The papers published by Dahl (1970), Heiner et al. (1982), Ross (1987), Horswell and Levant (1988) and Paulin and Thilander (1991) can be used for comparison purposes in some extent.

Aim of this study was to evaluate the development of dental occlusion and craniofacial morphology in a group of adult patients operated on previously in their childhood for unilateral complete cleft lip and palate (UCLP).

MATERIAL AND METHODS

Sixty-one UCLP patients, aged 17—20 years (mean age 18 years and 5 months) were included in this study. They were operated on in the Hospital for Plastic Surgery in Polanica Zdroj between the years 1960—1970 by the same surgeon (M. Krauss). Cleft lip was repaired at the age of 6—9 months, using the modified Le Mesurier technique; cleft palate was repaired at the age of 3—4 years using the modified Veau technique (Krauss and Polaczek, 1992). The studied group was described previously in detail (Polaczek, 1991; Polaczek, 1992).

The UCLP patients had usually subsequent orthodontic treatment (mean time: 6.5 years, standard deviation: 5 years and 7 months). Malocclusion was treated using the upper Schwarz plate, the block apparatus and an elastic band for the mandible.

Dental study casts of the maxilla and mandible were prepared for all patients. They were used to measure the length and width of dental arches

according to the measure points proposed by Moorrees (1959). The casts were also used to measure the degree of development of crossbites using numerical classification of Huddart and Bodenham (1972), separately for the anterior and lateral segments. A healthy population without clefts described by Moorrees (1959) served as a control group, and populations of adult UCLP patients described by Heiner et al. (1982) and Dahl (1970) served as a comparison group.

Standard cephalometric radiograms have been made for 45 UCLP patients and used to measure the basic skeletal linear and angular variables (anterior cranial base, upper, lower and total facial heigths, maxillary horizontal and mandibular lengths, prognathism of mandible, maxillary protrusion, inclinations of upper and lower incisors). Vertical proportion of the midface to the total face height was also calculated. Healthy adult populations without clefts described by Solow (1966) and Szlachetko (1970) served as control groups, and populations of adult UCLP patients described by Dahl (1970), Heiner et al. (1982), Paulin and Thilander (1991) and Ross (1987) were used as comparison groups.

The Student test was used for statistical analysis.

RESULTS AND DISCUSSION

The basic results on dental occlusion and craniofacial cephalometry have been collected in Tables 1—7 and compared with the available literature data. The complete documentation of the study was published elsewhere (Polaczek, 1991; Polaczek, 1992).

Table 1. Comparison of the dental arch width and length in the cleft and noncleft patients

Variable (means)	Males			Females		
	present study[a])	non-clefts[b])	difference p	present study[c])	non-clefts[b])	difference p
Maxillary arch, mm						
width 13—23	29.99	33.74	<0.001	27.92	32.00	<0.001
16—26	39.94	41.72	<0.05	38.05	39.24	NS
length	26.40	28.40	<0.001	25.23	27.20	<0.001
Mandibular arch, mm						
width 33—43	26.62	25.59	<0.05	25.46	24.81	NS
36—46	37.15	35.43	<0.05	37.35	34.81	<0.01
length	23.23	23.61	NS	22.50	22.73	NS

[a]) N = 31—40
[b]) Moorrees (1959), age 17—19 years, N = 27—48
[c]) N = 17—21
NS — no significance

There were observed some occlusal differences between the studied group and the control and comparison groups described in the literature. The upper dental arches were narrower and shorter in the studied group, as compared to the control group without clefts (Table 1). The biggest difference was marked in the anterior width of the arch, which was 4 mm smaller, both in men and in women. This difference was highly significant statistically. The difference in the length of upper arches was also highly significant statistically. These results were compared with the data of Heiner et al. (1982) who also studied adult patients with unilateral cleft lip and palate (Table 2). No statistically significant differences were found between these two groups.

Table 2. Comparison of the maxillary arch dimensions in the studied group and in the cleft group described by Heiner et al. (1982)

Variable (mean)	Present study	Comparison group[a])	Difference
Maxillary arch width, mm			
14—24	32.78	33.30	NS
16—26	45.25	45.90	NS
Maxillary arch length, mm	17.97	17.00	NS

[a]) age 18—20 years, N = 42—43
NS — *no significance*

Table 3. Frequency of crossbites

Crossbite	Number of cases (frequency in paranthesis)
no crossbite	13 (21 %)
anterior only	4 (7 %)
lateral on the cleft side only	18 (30 %)
bilateral	16 (26 %)
all segments	10 (16 %)

The lower dental arches were wider in the studied group, both in men and women, than in the control group without clefts. This was mostly expressed in the posterior width of the arch (Table 1). The length of the lower arch did not differr significantly between the studied and control groups.

Clinical evaluation of the crossbite (Table 3) showed normal occlusion in 13 patients (21 %). The most frequent deformity of occlusion observed in other patients was the lateral crossbite on the cleft side, involving several or all lateral teeth. Lateral crossbites, unilateral and bilateral, were often complicated by the crossbite or edge-to-edge occlusion of the incisor on the cleft side. Ten patients (16 %) had a crossbite in all segments.

The degree of development of crossbites in the studied group of patients was confirmed by the results of numerical assessment of the occlusion (Table 4). The anterior and lateral segments on the cleft side were most affected. These data could be compared only with those of Dahl (1970) in central incisor region due to the lack of other comparable group in the same age. No statistically significant difference was found.

Table 4. Numerical classification of occlusion in the studied group and in the group of cleft subjects described by Dahl (1970)

Segment	Present study		Dahl	Difference
	males N = 40	females N = 21	males[a]) N = 59	
anterior	−2.13	−1.95	n. a.	
lateral				
cleft side	−2.10	−2.10	n. a.	
non-cleft side	−1.10	−1.66	n. a.	
total score	−5.33	−5.71	n. a.	
central incisor on the cleft side	−1.27	n. a.	−1.07	NS

[a]) age 18—33 years
n. a. — not available
NS — no significance

The linear variables from cephalometric measurements obtained for men and women differed significantly and therefore had to be treated separately (Tables 5 and 6).

In men (Table 5), the anterior cranial base and upper facial height in the studied group did not differ significantly from those found in the control groups but were significantly longer than in the comparison group. Similarly, prognatism of mandible, maxillary protrusion and upper incisor inclination angles as well as mandibular length were in the studied group nearer to the conrol group than to the respective variables of the comparison groups.

Table 5. Comparison of the linear and angular angular variales for men in the studied group and non-cleft subjects as well as cleft patient groups

Variable	present study	control group I[a]		control group II[b]		comparison group I[c]		comparison group II[d]	
		mean	difference	mean	difference	mean	difference	mean	difference
distance, mm									
N-Se	77.43	73.67	NS	73.76	NS	71.28	<0.01	n. a.	
N-Gn	133.19	125.63	<0.05	126.49	<0.05	129.46	NS	n. a.	
N-ANS	56.67	57.57	NS	55.96	NS	53.85	<0.05	n. a.	
ANS-Me	76.67	n. a.		72.26	<0.01	76.52	NS	72.3	<0.05
ANS-PNS	51.43	58.18	<0.001	58.46	<0.001	52.85	NS	n. a.	
Go-Pg'	79.52	81.14	<0.05	82.47	<0.001	77.73	<0.01	n. a.	
angle, degree									
SNPg	79.78	83.49	<0.01	79.27	NS	75.78	<0.001	80.0	NS
SNA	78.11	83.80	<0.001	81.66	<0.01	74.28	<0.01	77.2	NS
IL_s/NL	101.28	112.05	<0.01	109.83	<0.01	103.91	NS	111.9	<0.05
IL_i/ML	84.65	95.48	<0.01	97.87	<0.001	82.56	NS	86.8	NS

[a] Szlachetko (1970), age 20 – 25 years, N = 50
[b] Solow (1966), age 20 – 30 years, N = 102
[c] Dahl (1970), mean age 20.2 years, N = 30
[d] Paulin and Thilander (1991), mean age 20.4 years, N = 23

Table 6. Comparison of the linear and angular variables for women in the studied group and non-cleft subjects as well as cleft patient groups

Variable	present study	control group[a])		comparison group[b])	
		mean	difference	mean	difference
distance, mm					
N-Se	70.22	68.41	<0.05	n. a.	
N-Gn	123.78	115.41	<0.01	n. a.	
N-ANS	52.71	52.09	NS	n. a.	
ANS-Me	72.06	n. a.		65.3	<0.05
ANS-PNS	47.56	54.39	<0.001	n. a.	
Go-Pg'	76.33	74.06	<0.01	n. a.	
angle, degree					
SNPg	77.94	81.90	<0.01	76.8	NS
SNA	75.53	82.71	<0.001	78.3	NS
IL_s/NL	103.50	111.39	NS	111.9	NS
IL_i/ML	84.03	93.78	NS	89.1	NS

[a]) Szlachetko (1970), age 20—25 years, N = 50
[b]) Paulin and Thilander (1991), mean age 20.4 years, N = 7
n. a. — non available
NS — no significance

Table 7. Vertical proportions of the midface to the total face height

$$\frac{N - ANS}{N - GN} \cdot 100\ \%$$

Group	Males	Females
present study	42.5	42.6
control groups:		
Szlachetko (1970)[a])	45.8	45.1
Solow (1966)[b])	44.2	—
Ross (1987)[c])	44.4	—
comparison groups:		
Horswell and Levant (1988)[d])	43.0	43.0
Paulin and Thilander (1991)[e])	42.9	44.6
Heiner et al. (1982)[f])	41.6	—
Ross (1987)[g])	40.9	—
Ross (1987)[h])	42.9	—

[a]) age 20—25 years, N = 100
[b]) age 20—30 years, N = 102
[c]) mean age 20,2 year, N = 30
[d]) age 18 years, N = 16
[e]) mean age 20,4 year, N = 30
[f]) mean age 19,8 year, N = 50
[g]) mean age 18,1 year, N = 35
[h]) mean age 19,1 year, N = 57

In contrary, the maxillary horizontal length, total and lower facial heights as well as lower incisor inclination angle in the studied group differed more from the control group than from the comparison group but the differences were statistically insignificant.

Table 6 provides a comparison of the studied women group and respective published control (non-cleft) and UCLP patient groups. The differences were quite similar as in the men populations. Only the mandibular length was significantly higher than in the control group, while in the men group a diverse relation was observed.

The midface constituted in men 42.5 % and in women 42.6 % of the total face height (Table 7), similarly as in the UCLP populations described in the literature.

CONCLUSIONS

The statistical data presented in this study allows to assess objectively the dental occlusion and craniofacial morphology in a homogenous, relatively large group of grown-up patients treated previously for the complete unilateral cleft lip and palate.

It was difficult to compare the data obtained with the literature ones due to the lack of unified testing methods and criteria as well as of differences in regard to the patient age and type of cleft. However, bearing this limitations in mind, our findings on the upper dental arch, development of crossbite as well as linear and angular variables of the midfacial skeleton do not differ significantly with that of other authors.

Use of the modified Le Mesurier and Veau methods for surgical repair of the UCLP resulted indeed in a midfacial growth inhibition but the vertical growth of the maxilla and related proportions remained only slightly effected.

SUMMARY

Sixty-one UCLP patients at 17—20 years of age treated surgically in childhood by M. Krauss were invited for check-up examination to evaluate their occlusal and craniofacial characteristics. Dental study casts were used to determine the dental arch widths and lengths according to Moorrees points and to classify the occlusion according the descriptive and numerical methods. Conventional distances and angles were measured on 45 radiographs. The maxillary canine arch width was smaller by 4 mm than those of the control group, while the maxillary molar arch width did not differ significantly from the normal value. In contrary, the mandibular molar arch width was considerably greater in the studied group than in the control one. The frequency of anterior crossbite was 7%, the lateral crossbite on the cleft side 30%, bilateral crossbite 26% and the crossbite in all segments 16%. In 21% of cases, no crossbite was observed. These results were confirmed by occlusal scoring. The cephalometric analysis showed a decreased maxillary horizontal

lenght and maxillary protrusion angle when compared with the control group, while the anterior upper facial height and incisor inclination angles did not difier significantly. The midface constituted in men 42.5% and in women 42.6% of the total face height.

RÉSUMÉ

Derniers résultats du traitement chirurgical de la fente labiopalatine unilatérale totale — caractéristiques occlusales et craniofaciales

Polaczek, T.

Soixante et un patients avec la fente labiopalatine unilatérale totale, opérés dans leur enfance par M. Krauss, furent invités, à l'âge de 17—20 ans, à l'examen de contrôle, pour évaluer les caractéristiques occlusales et craniofaciales. Afin de déterminer la largeur et la longueur de l'arc dental selon les points de Moorees et afin de classer l'occlusion, se basant sur les méthodes descriptives et numériques, on a utilisé d'empreintes dentaires. Les distances et les angles habituels étaient mesurés sur 45 skiagrammes. La largeur d'arc du maxillaire supérieur entre les canines fut de 4 mm plus petite que chez le groupe de contrôle, tandis que la largeur d'arc molaire ne se distingait pas considérablement du taux normal. Au contraire, la largeur d'arc molaire du maxillaire inférieur fut essentiellement plus élevée dans le groupe étudié que dans le groupe de contrôle. La fréquence de l'occlusion croisée antérieure était de 7 %, de l'occlusion croisée latérale du côté atteint de la fente faisait 30 % de cas, l'occlusion croisée bilatérale 26 % et l'occlusion croisée dans tous les segments faisait 16 %. Dans 21 % de cas, on n'a pas observé d'occlusion croisée. Les résultats furent confirmés par le score d'occlusion. L'analyse céphalométrique a montré une diminution de la longueur horizontale du maxillaire supérieur et de l'angle protruse en comparaison avec le groupe de contrôle, tandis que la hauteur faciale antéro-supérieure et l'angle d'inclinaison des incisives ne se distingaient pas considérablement. Le centre du visage représentait 42,5 % chez les hommes et 42,6 % chez les femmes de la hauteur totale du visage.

ZUSAMMENFASSUNG

Letzte Ergebnisse der chirurgischen Behandlung einer einseitigen vollständigen Lippen- und Gaumenspaltung — Okklusive und kraniofaziale Charakteristiken

Polaczek, T.

Einundsechzig Patienten mit einer vollständigen einseitigen Lippen- und Gaumenspaltung, die in ihrer Kindheit von M. Krauss operiert worden waren, wurden im Alter von 17 bis 20 Jahren zu einer Kontrolluntersuchung und Bewertung ihrer okklusiven und kraniofazialen Charakteristiken eingeladen. Zur Feststellung der Breite und Länge des Zahnbogens laut der Punkte von Moorrees sowie zwecks Klassifizierung der Okklusion auf Grund deskriptiver und numerischer Methoden wurden Zahnabdrücke verwendet. Die üblichen Entfernungen und Winkel wurden auf 45 Radiographen gemessen. Die Bogenbreite des Oberkiefers zwischen den Eckzähnen war um 4 mm geringer als bei der Kontrollgruppe, während sich die molare Bogenbreite nicht wesentlich vom normalen Wert unterschied. Im Gegenteil war die mandibulare molare Bogenbreite wesentlich grösser bei der studierten Gruppe als bei der Kontrollgruppe. Die Frequenz des vorderen überkreuzenden Bisses betrug 7 %, ein seitlicher überkreuzender Biss an der

Seite der Spaltung erschien in 30 % der Fälle, ein bilateraler überkreuzender Biss in 26 % der Fälle und ein überkreuzender Biss in allen Segmenten in 16 % der Fälle. Bei 21 % der Fälle wurde kein überkreuzender Biss festgestellt. Die Ergebnisse wurden mittels skorierter Okklusuin bestätigt. Die zephalometrische Analysis zeigte eine Verkleinerung der horizontalen Länge des Oberkiefers und des Protusionswinkels im Vergleich zur Kontrollgruppe, während die vordere obere faziale Höhe und der Winkelder Neigung der Schneidezähne sich nicht wesentlich unterschieden. Die Mitte des Gesichts bildete bei den Männern 42,5 % und bei den Frauen 42,6 % der Gesamthöhe des Gesichts.

REFERENCES

1. **Dahl, E.**: Cranial morphology in congenital clefts of the lip and palate. Acta Odontol. Scand. Suppl. 57, Copenhagen 1970.

2. **Heiner, H., Schumann, D., Erler, V., Karl, P.**: Kontrolle der Lippenplastik 18 Jahre nach modifizierter Le Mesurier-Technik. In: Lippen-Kiefer-Gaumen-Spalten (ed. G. Pfeifer), Thieme Verlag, Stuttgart 1982, p. 30.

3. **Horswell, B. B., Levant, B. A.**: Craniofacial growth in unilateral cleft lip and palate: Skeletal growth from eight to eighteen years. Cleft Palate J., 25: 114, 1988.

4. **Huddart, A. G., Bodenham, R. S.**: The evaluation of arch form and occlusion in unilateral cleft palate subjects, Cleft Palate J. 9: 194, 1972.

5. **Krauss, M., Polaczek, T.**: Late results of the surgical treatment of complete unilateral cleft lip and palate. Acta Chir. Plast. (Prague), in press, 1992.

6. **Moorrees, C. F. A.**: The dentition of the growing child., Harvard Univ. Press, Cambridge 1959.

7. **Paulin, G., Thilander, B.**: Dentofacial relations in young adults with unilateral complete cleft lip and palate. Scand. J. Plastic Reconstr. Hand Surg., 25: 63, 1991.

8. **Polaczek, T.**: Late results of surgical treatment in complete unilateral cleft lip and palate cases. Evaluation of occlusion (in Polish). Czas. Stomat. (Warsaw), XLIV: 658, 1991.

9. **Polaczek, T.**: Late results of surgical treatment in complete unilateral cleft lip and palate cases. X-Ray cephalometric evaluation of facial morphology (in Polish). Czas. Stomat. (Warsaw), XLV: 155, 1992.

10. **Ross, R. B.**: Treatment variables affecting facial growth in complete unilateral cleft lip and palate. Parts 1—7, Cleft Palate J. 24: 5, 1987.

11. **Solow, B.**: The pattern of craniofacial associations. Acta Odont. Scand. Suppl. 46, Copenhagen 1966.

12. **Szlachetko, K.**: Craniofacial development of the 10—13 year old children. Habilitation Thesis (in Polish)., Medical Academy, Warsaw 1970.

Adress for correspondence:
Teresa Polaczek, M. D.
Klinika Chirurgii Plastycznej CMKP
00—416 Warszawa, ul. Czerniakowska 231
Poland

Academisch Ziekenhuis Nijmegen, Plastische- en Reconstructieve Chirurgie, Niederland

SKIN NECROSIS, A RARE COMPLICATION OF COUMARIN THERAPY

E. H. M. HARTMAN, J. A. R. COOSEMANS, P. TAN

E. H. M. Hartman, at that time resident general surgery at the St. Joannes de Deo Hospital in Haarlem, at the moment resident Plastic & Reconstructive Surgery at the St. Radboud Academic Hospital in Nijmegen

J. A. R. Coosemans, vascular surgeon at the St. Joannes de Deo Hospital in Haarlem

P. Tan, specialist in internal diseases at the St. Joannes de Deo Hospital in Haarlem

INTRODUCTION

Coumarin congeners have been used as a anti-coagulant therapy since 1940. The action of coumarin congeners depends on a decrease of the vitamin K dependant coagulation factors II, VII, IX and X. The most important complication and the complication that is seen the most frequently, is haemorrhage based on a overdose of the drug. Necrosis of skin and soft tissues are seen less frequently: only in 0.01% to 0.10% of the cases (1).

CASUS

Patient P, an eighty-seven year old woman, was seen at the out-patient ward for a recurrent ulcer of the right lower leg. Three years before, the patient had suffered from a myocardial infarction and had undergone an endarteriectomy of the aorta abdominalis with an amputation of the left lower leg. Acenocoumarol had been prescribed to the patient since that time. Adverse effects had not occurred.

Treatment of the ulcer consisted of primary excision. The acenocoumarol was stopped for the duration of the operation. After the operation anti-coagulant therapy was continued with fenprocoumon. Noteworthy was the occurrence of an allergic reaction on nifedipine: patient developed a skin rash.

Rheumatic factors were determined at that time and found to be negative. No other problems arised.

Three months after this operation a recurrence of the ulcer of the right lower leg occurred. A revascularisation of the right leg was performed by

anastomosing an in-situ vena saphena magna autograft proximally to the arteria femoralis communis and distally to the arteria poplitea. Post-operative medication was given according to the protocol peripheral vascular reconstructions in our hospital: cefuroxim was given three times a day 1500 mg for 48 hours, dipyridamol, an inhibitor of thrombocytic aggregation, was given three times a day 75 mg and fenprocoumon was started. No other medication was given.

The seventeenth postoperative day the patient complained of painful, blue coloured spots. Examination showed large purpurae at the stump of the left leg, the right upper leg, the right upper arm, the right breast and the face (Fig. 1 and 2).

Laboratory investigation showed a well adjusted anti-coagulant therapy: the thrombo test (TT) was 96 seconds (optimal between 100 and 130 seconds); activated partial thromboplastin time, thrombocyt count, and bleeding time were normal. Because there was no overdose of anti-coagulant therapy, fenprocoumon was continued. After three more days, on the twentieth post-operative day the diagnosis coumarin necrosis was made. At this time the TT was found to be high (253 seconds). Fenprocoumon and dipirydamol were stopped, vitamin K and heparin were given intravenously. Later it was possible to administer heparin subcutaneously.

All purpurae developed into full-thickness necrosis. Surgical treatment consisted of excision of necrosis. Later on amputation of the left upper leg was necessary.

Laboratory investigation showed normal values for protein C, protein S and antithrombin III (respectively 114%, 136%, and 97%; normal values 100%). No assessment of free protein C was made. Determination of rheumatic factors (ANF, dsDNA, ENF and AST) showed negative results, making an immunological disease very unlikely.

After the secondary healing of all wounds the patient was transferred to a nursery home. During and after the hospital stay the vascular bypass of the right leg functioned without problems.

DISCUSSION

In 1943 a case of coumarin necrosis was described for the first time by Flood and others. This was a case of necrosis of the breast (2). Verhagen described 13 cases in 1952. He was the first to consider coumarin as the cause of necrosis (3).

Coumarin necrosis consists of very painful skin laesions which ultimately form gangrenous necrosis. Often surgical treatment is indicated; debridement, skin transplantation or even amputation or mastectomy may be necessary. Coumarin necrosis has been described for all coumarin congeners. These laesions develop three to six days after the onset of coumarin therapy; this varies from four days to seventeen months (1). The laesions develop most

Fig. 1. A large area of necrosis of the left lower extremity stump, later resulting in an upper leg amputation.

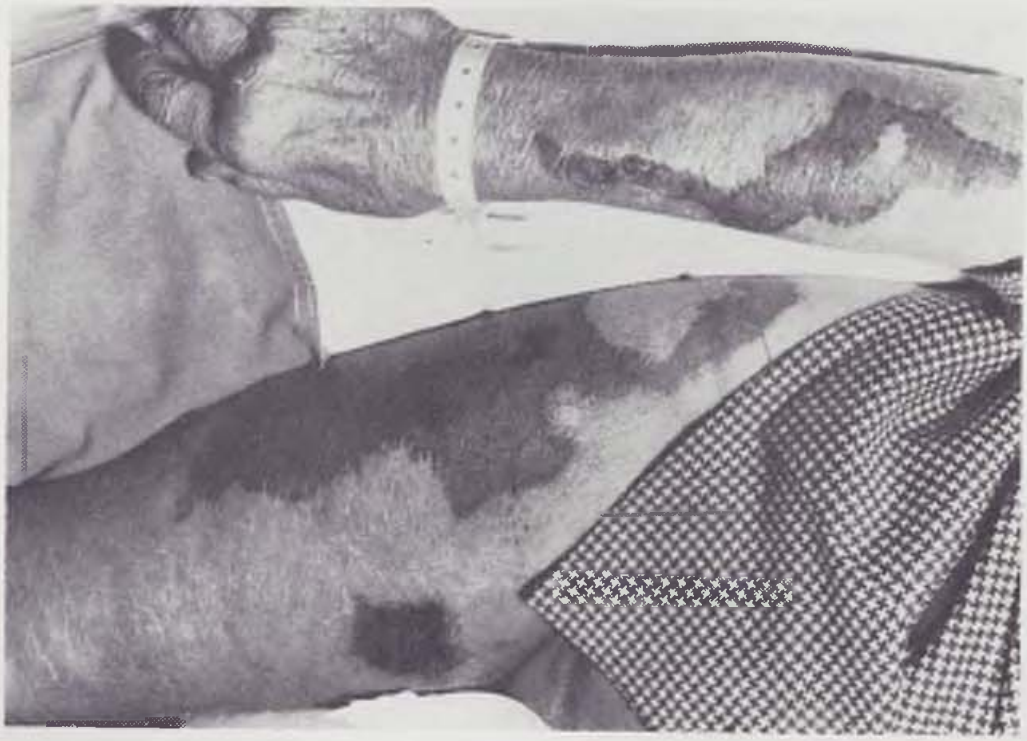


Fig. 2. Necrosis of the right upper leg

often at sites with a thick subcutaneous layer of fat. like the upper legs, the abdomen and the breasts.

It is important to differentiate between coumarin necrosis and haemorrhage, which is a much more frequently seen complication. If there is a haemorrhage, based on an overdose of coumarins, the TT is elevated, treatment should consist of discontinuing coumarin therapy, and prescribing vitamin K. Heparin is contraindicated. continuing coumarin leads to progression of the symptoms. Frank necrosis of the skin is hardly ever seen.

However, if there is a coumarin necrosis, no haemorrhage occurs, continuing coumarin therapy would not lead to progression of the symptoms, and treatment should consist of prescribing vitamin K and heparin intravenously. Frank necrosis often occurs.

The etiology of coumarin necrosis is unclear: the most likely theory is a deficiency of protein C (1). At the beginning of coumarin therapy a quick decrease in the concentrations of factor VII and protein C occurs. Their biological half-lives are about the same. Protein C is a vitamin K-dependant protein, important in the regulation of fibrin formation. When activated it inhibits the fibrin formation by inhibiting factors Va and VIIIa. It also enhances the fibrinolytic capacity of the circulating blood. A heritable protein C-deficiency predisposes for thrombosis. A temporary decrease in the level of protein C while starting coumarin therapy, can be a cause of thrombosis of the small vessels of the skin, resulting in skin necrosis. This is even more so when fibrin formation takes place via the intrinsic (factor VII-independant) route.

This risk of thrombosis is even higher in patients with an already lowered level of protein C, because of an inherited deficiency or an acquired deficiency, in case of malnutrition, parenchymateous liver disease, the use of broad spectrum antibiotics or diffuse intravascular coagulation. An important observation is that thrombosis, occurring while coumarins are being administered, is seen in the microcirculation. This is exactly the place where protein C is being activated, namely the surface of the endothelium (4) (5) (6) (7).

Grimaudo et al (8) describe a case of coumarin necrosis with a protein S-deficiency (protein S acts as a co-factor for activated protein C). Kiehl et al (7) describe a case of coumarin necrosis in a patient with an antithrombin III-deficiency. Antithrombin III is a plasma inhibitor of thrombin: a deficiency is associated with thrombosis (9).

TREATMENT

To prevent coumarin necrosis it is advisable to start coumarin therapy in a moderate dose and prescribe heparin intravenously as long as is necessary to achieve a sufficiently low level of vitamin K-dependant coagulant factors. In this way there will be no relative shortage of protein C with subsequent chance for thrombosis.

There is no consensus about the need to stop the administration of coumarin. Some authors observe that continuation of the coumarin therapy does not aggravate the skin laesions (10), and that starting coumarin therapy at a later time does not produce a repeated occurrence of these laesions (3) (11) (12) (13). Other authors on the contrary do observe an aggravation of the laesions or repeated occurrence of this laesions with restarting coumarin therapy (14).

In practice, most surgeons do not dare to continue coumarin therapy, after necrosis has evolved. Vitamin K is started to antagonate possible coagulation and heparin is given intravenously, on the one hand to prevent progression of the necrosis, on the other hand to treat the disease that formed the indication for the anticoagulant therapy, e. g. a deep vein thrombosis (6). A practical matter: after discontinuation of heparin intravenously, one can treat the coagulant disorder by supplying the heparin subcutaneously; this produces no problems in hospital nor at home.

Other treatments for skin necrosis, as corticosteroids, vasodilatators, sympathic nerve block and hypothermia were not found to be useful (5).

CONCLUSION

In our patient more than one factor has played a role in the development of coumarin necrosis. A protein C-deficiency could not be diagnosed, although our patient was in a state of malnutrition, and she was given broad spectrum antibiotics perioperatively, namely cefuroxim 3 times 1500 mg a day for 48 hours. However, these antibiotics were given two weeks prior to the development of the skin necrosis. Apart from the dipirydamol, our patient did not recieve any other drugs. A necrosis following prescription of dipirydamol has never been observed (15). It is possible that an overdose of the coumarin therapy has played a role in the development of skin necrosis: it might be that a relative deficiency of protein C develops, comparable to the mechanism of a high dosage at the start of coumarin therapy.

Necrosis of skin and subcutis is a rare, acutely developing and potentially lethal complication of coumarin therapy. It is hard to predict which patient will be inflicted and which patient will not. The etiology is not clear, but a relationship with protein C deficiency is likely. Early treatment with heparin can prevent necrosis or prevent progression of the necrosis. After necrosis has developed, surgical therapy is most often needed. Because of the frequent use of coumarin congeners and because of the high morbidity and even mortality, it is essential for the clinician to know and to recognise this important complication.

SUMMARY

Coumarin congeners are frequently being prescribed in vascular surgery. The complication most often seen is haemorrhage. A less known complication is necrosis of skin and soft tissues. This rare complication is potentially lethal.

The etiology is unclear, a relation with protein C deficiency seems likely. Early treatment with vitamin K and heparin may prevent the skin necrosis. After necrosis has occurred. surgical intervention is usually necessary.

Key-words: skin necrosis, coumarins, adverse effects of drugs, protein C-deficiency.

RÉSUMÉ

Nécrose cutanée — complication rare de thérapeutique à coumarine

Hartman, E. H. M., Coosemans, J. A. R., Tan, P.

Les analogues de coumarine sont souvent proscrits en chirurgie vasculaire. Les plus fréquentes complications représentent les hémorragies. La nécrose de la peau et de tissus moux appartient aux complications moins connues. Ces rares complications sont potentiellement létales. Leur étiologie n'est pas claire, probablement, il existe un rapport avec la carence de protéine C. Un traitement précoce par la vitamine K et par l'héparine peut prévenir la survenue de nécrose cutanée. Après manifestation de la nécrose, l'intervention chirurgicale est, d'habitude, nécessaire.

ZUSAMMENFASSUNG

Hautnekrose — eine seltene Komplikation der Kumarintherapie

Hartman E. H. M., Coosemans J. A. R.,, Tan P.

Kumarinanaloge werden häufig bei vaskulärer Chirurgie vorgeschrieben. Die häufigsten Komplikationen sind Haemorrhagien. Weniger bekannte Komplikationen sind Hautnekrose und weiche Gewebe. Diese seltenen Komplikationen sind potential letal. Ihre Ätiologie ist unklar, und ein Zusammenhang mit einem Mangel an Protein C scheint wahrscheinlich zu sein. Eine rechtzeitige Behandlung mit Vitamin K und Heparin kann einer Hautnekrose vorbeugen. Falls jedoch eine Nekrose erscheint, ist der chirurgische Eingriff gewöhnlich unerlässlich.

1. **Cole MS, Minifee PK, Wolma FJ.**: Coumarin necrosis: a review. Surgery, 3: 271—7, 1988.

2. **Flood EP, Redish MH, Bociek SJ et al.**: Thrombophlebitis migrans disseminata: report of a case in which gangrene of the breast occurred. NY State J Med, 43: 1121—4, 1943.

3. **Verhagen H, Wiersema MU.**: Huidbloeding en huidnecrose bij patiënten met thrombose, behandeld met dicumol of dicumyl. Ned Tijdschr Geneesk, 96: 1578—85, 1952.

4. **Michiels JJ, Bertina RM.**: Thrombohaemorrhagic skin necrosis due to rapid development of severe vitamin K deficiency associated with cholestasis. Thromb and hemost, 58: 412, 1987.

5. **Caldwell EH, Stewart S.**: Skin necrosis as a consequence of coumarin therapy. Plastic reconstr Surg, 72: 231—3, 1983.

6. **McGehee WG, Klotz TA, Epstein DJ et al.**: Coumarin necrosis associated with hereditary protein deficiency. Ann Intern Med, 100; 1: 59—60, 1984.

7. **Kiehl R, Hellstern P, Wenzel E.**: Hereditary antithrombin III deficiency and atypical localization of a coumarin necrosis. Thrombosis Research, 45: 191—3, 1987.

8. **Grimaudo V., Gueissaz F., Hauert J. et al.**: Necrosis of skin induced by coumarin in a patient deficient in protein S. Br Med. J, 298: 233—4, 1989.

9. **Wessler S. and Gitel S.**: Warfarin, from bedside to bench. N Engl J Med, 311: 645, 1984.

10. **Amstel v WJ, Boekhout-Mussert MJ, Loeliger EA.**: Successful prevention of coumarin-induced hemorrhagic skin necrosis by timely administration of vitamin K. Blut, 36: 89—93, 1978.

11. **Kiehl R, Hellstern P, Wenzel E.**: Hereditary antithrombin III deficiency and atypical localization of a coumarin necrosis. Thrombosis Research, 45:191—3, 1987.

12. **Kahn S, Stern HD, Rhodes GA.**: Cutaneous and subcutaneous necrosis as a complication of coumarin-congener therapy. Plast reconstr Surg, 48: 160, 1971

13. **Empel v CH, Smeenk G.**: Haemorrhagic necrosis of the skin as a complication of anticoagulant therapy. Arch Chir Neerl, 24: 353—9, 1972.

14. **Hofmann V, Frick PG.**: Repeated occurence of skin necrosis twice following coumarrin intake and subsequently during decrease of vitamin K dependant coagulation factors associated with cholestasis. Thromb Haemostas, 48: 245, 1982.

15. *personal communication Boehringer* Ingelheim.

Address:
E. H. M. Hartman
Academisch Ziekenhuis Nijmegen
Plastische- en Reconstructieve Chirurgie
Reinier Postlaan 4, Postbus 9101, 6500 HB Nijmegen
Niederland

3rd School of Medicine, Charles University, Prague
Department of Plastic Surgery
(Head., Doc. MUDr. M. Tvrdek)

MULTIPLE USES OF THE FREE RADIAL FOREARM FLAP

M. TVRDEK, A. NEJEDLÝ, S. SVOBODA

The free radial forearm flap, providing a thin, pliable and flexible skin cover, is most commonly employed to cover intraoral defects and those of the palmar aspect of the hand (Figs 1, 2). The length of the vascular pedicle, and the calibre of its vessels make transfer of these flaps a fairly safe procedure. Transfer of the flap as a sensory flap markedly enhances its resistance against load.

This advantage is made use of when managing defects in the area of the planta pedis as one of the body areas bearing maximum load. In our experience, the resistance of this flap is superior to that of other types of flaps. Similarly, sensory flaps are employed in thumb reconstruction en-

Fig. 1. Contracting scar on the palm

Fig. 2. Status after reconstruction

capsulating the thumb skeleton made up of a bone graft removed from the iliac crest. It is just the pliability, thinness, and flexibility of the skin that make it possible to obtain a flap of a shape and size not requiring subsequent modelling.

The free radial forearm flap can also be used for pharyngoesophageal reconstruction where its use, in indicated cases, is simpler and safer compared with reconstruction by part of the intestine.

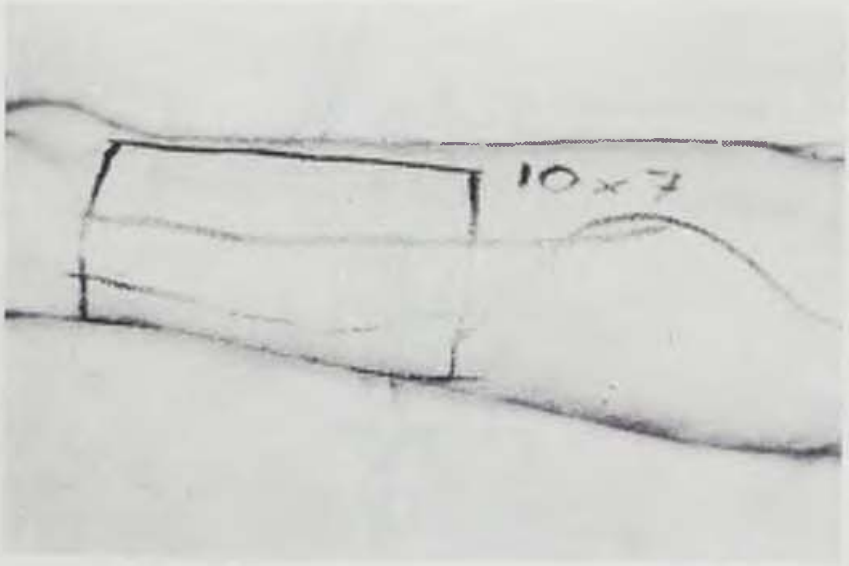


Fig. 3. Unstable scar of the heel — Fig. 4. A schematic drawing of the flap

Last but not least, the flap proved useful in penile reconstruction allowing to form the urethra and outer cover of the penis.

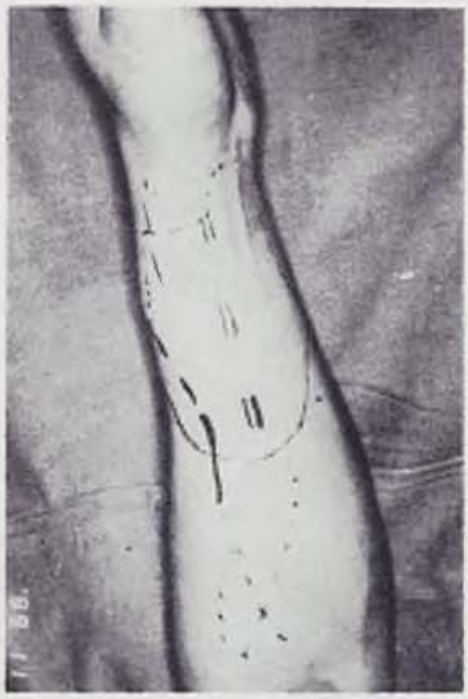
CLINICAL CASES

1. A 42-year-old patient suffered scalping of the left heel, the defect was primarily treated with a dermoepidermal skin graft. An unstable scar was excised. The defect was then covered with a 10 by 7 cm sensory flap from the radial aspect of the left forearm. Vessels of the flap's pedicle were anastomosed to the posterior tibial vessels (arteries end-to-side, veins end-to-end). The flap's sensory nerve was sutured to n. suralis (Figs 3—5).

2. A 21-year-old patient suffered avulsion amputation of the right thumb. The thumb was replanted but, despite revision of arterial anastomosis and bypassing of the thrombosed segment with a venous graft, the procedure failed. Four days after removal of the replant, thumb reconstruction was carried out using a bone graft from the iliac crest covered with a free sensory flap (Figs 6—9).

3. A 64-year-old female patient had laryngectomy and hypopharyngectomy for a carcinoma. Cervical oesophagus was replaced by free transfer of a part of the jejunum; however, the procedure failed resulting in intestinal necrosis. After an interval of several months, the oesophagus was reconstructed using a free flap from the radial aspect of the forearm; the vessels were anastomosed to facial ones. A tiny fistula formed postoperatively in the median

Fig. 5. Status at 3 months postoperatively



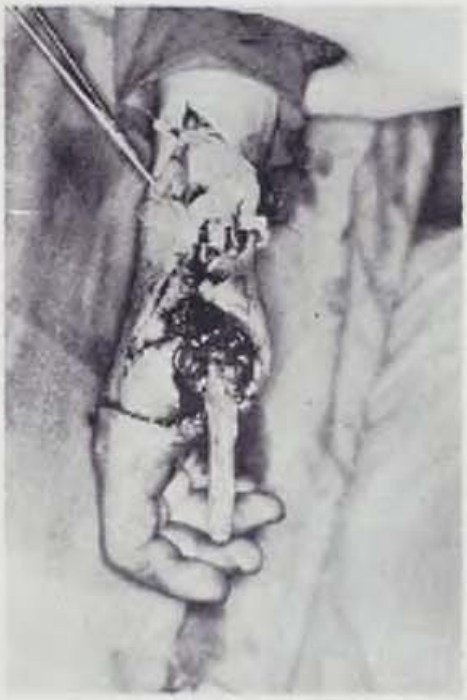


Fig. 6. Status before reconstruction — Fig. 7. A schematic drawing of the flap — Fig. 8. Bone graft — Fig. 9. Status at 2 months postoperatively

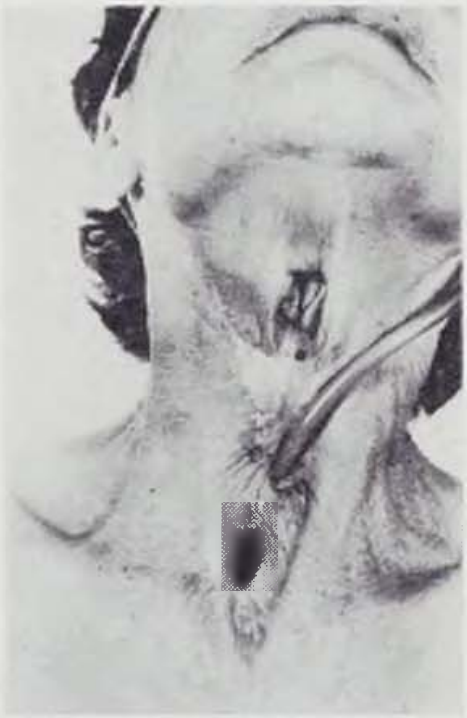


Fig. 10. Status before oesophageal reconstruction

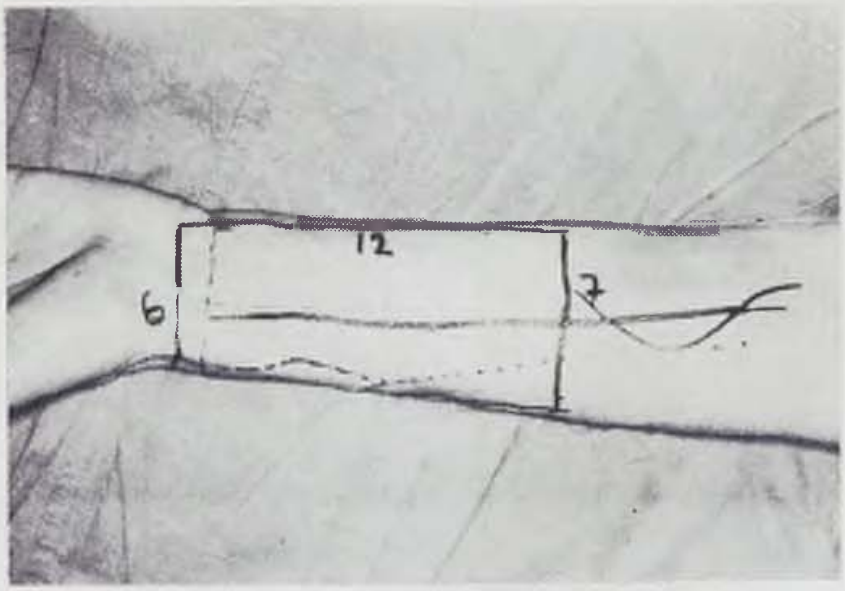
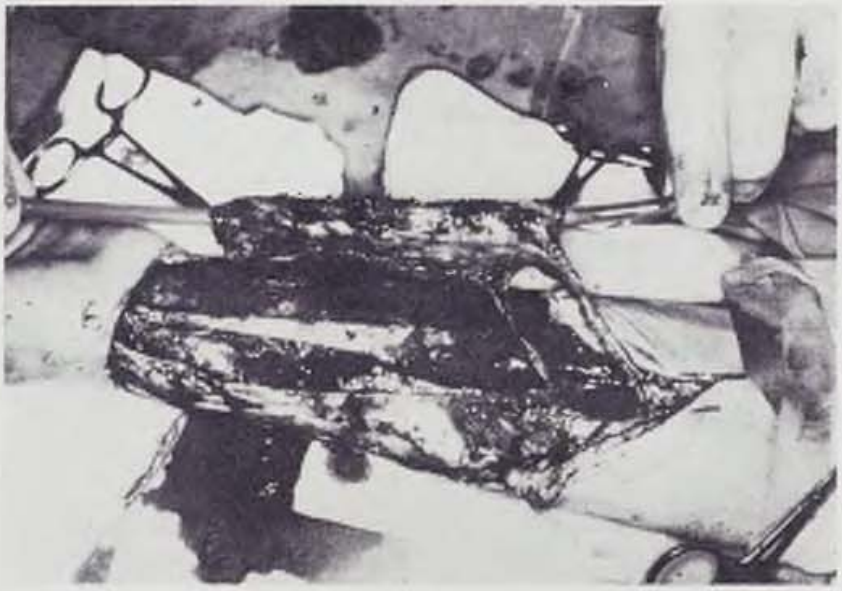


Fig. 11. A schematic drawing of the flap



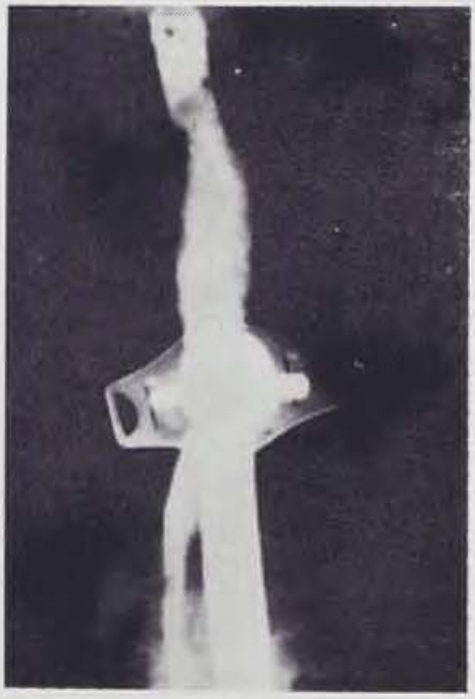


Fig. 12. A mobilized and tubulized flap — Fig. 13. Passage through the oesophagus at 2 months postoperatively — Fig. 14. Status after healing

Fig. 15. Status before surgery

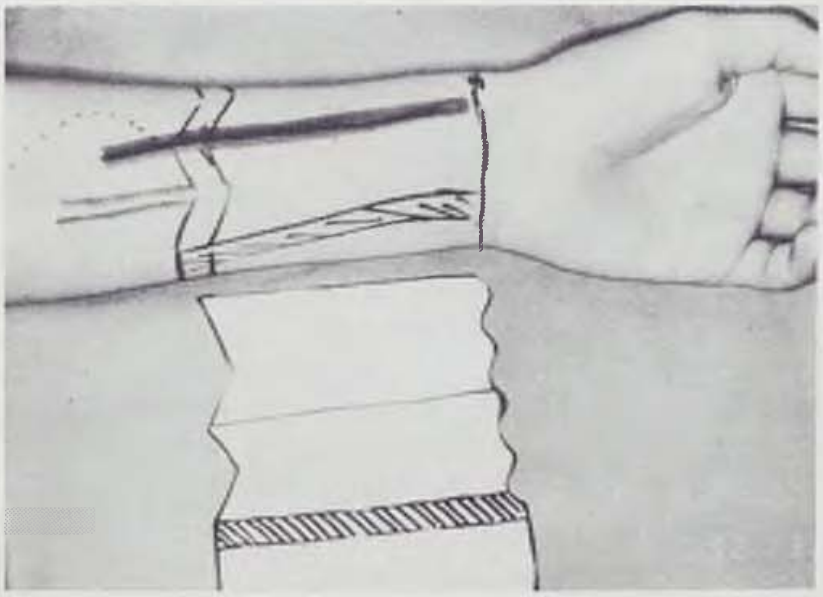


Fig. 16. A schematic drawing of the flap and its model

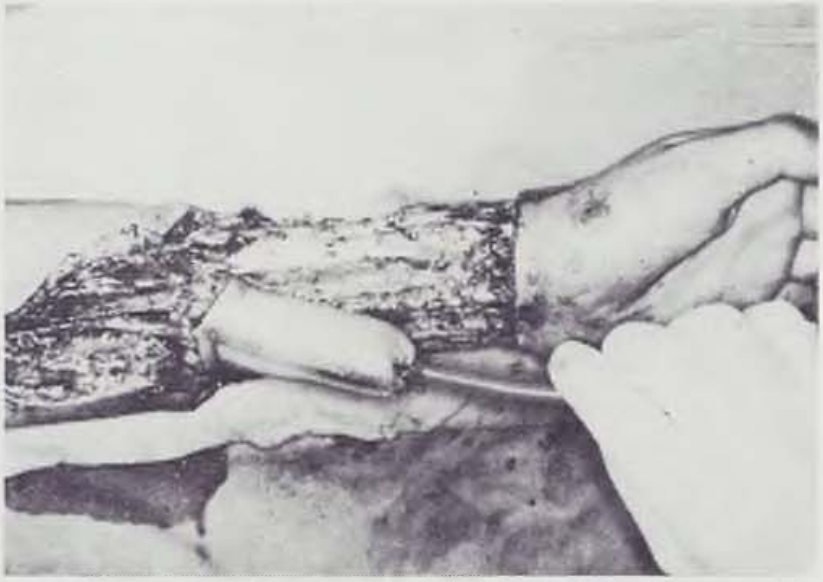


Fig. 17. A mobilized and tubulized flap

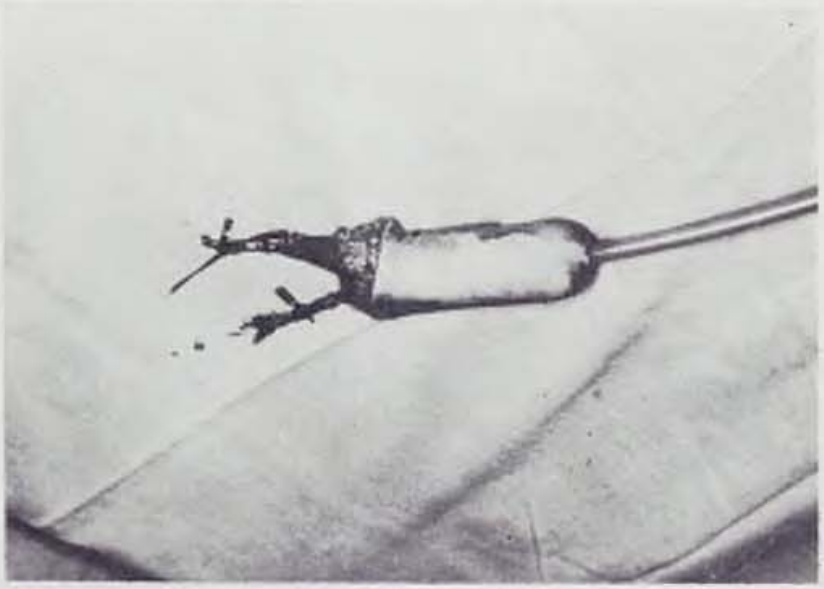


Fig. 18. Flap after mobilization

Fig. 19. Status at 4 months postoperatively

part of the reconstructed oesophagus closed by multiple-layer suture. There were no complications, and the patient was able to receive enteral nutrition six weeks after surgery (Figs 10—14).

4. A 14-year-old boy sustained, in a traffic accident, scalping of the abdominal wall with penile and scrotal amputation. The urethra was passed out into the peritoneum. At an interval of six months since the accident, penile reconstruction was undertaken using a free 10 by 12-cm flap removed from the radial aspect of the left forearm. While part of the flap was used to form the urethra, the remainder was employed to mould the outer cover. The radial artery was anastomosed to the deep inferior epigastric artery whereas veins to those of the saphenous bulb (Figs 15—19).

The above clinical cases demonstrate the multiple uses, in the most varied locations, of a skin flap obtained from the radial aspect of the forearm. While the conspicuous scar left after flap removal can be considered a minor disadvantage, this drawback will be outbalanced by the excellent outcome at the reconstruction site.

SUMMARY

Presenting clinical cases, the authors show the variety of possible uses of the free radial forearm flap. They employ this sensory flap at sites of increased load such as the area of the planta pedis and in thumb reconstruction. Other potential uses include oesophageal and penile reconstruction.

RÉSUMÉ

Usage multiple de lambeau libre prélevé au côté radial de l'avant-bras

Tvrdek, M., Nejedlý, A., Svoboda, S.

Sur les cas cliniques, les auteurs démontrent la multiplicité d'usage du lambeau libre, prélevé sur le côté radial de l'avant-bras. Ils utilisent ce lambeau sensitif dans les endroits exposés à la charge élevée, comme par exemple dans la région plantaire et dans les reconstructions du pouce. D'autres possibilités de son utilisation sont montrées sur les cas de reconstruction de l'oesophage et du pénis.

ZUSAMMENFASSUNG

Vielseitige Ausnützung des freien Lappens aus der radialen Seite des Unterarms

Tvrdek, M., Nejedlý, A., Svoboda, S.

Die Autoren zeigen an klinischen Fällen die Vielseitigkeit einer Ausnützung des freien Lappens aus der radialen Seite des Unterarms. Dieser sensitive Lappen wird an Stellen einer höheren Belastung ausgenützt, wie es die Region der Planta ist, oder bei einer Rekonstruktion des Daumens. Weitere Möglichkeiten der Ausnützung werden an Hand von Fällen einer Rekonstruktion des Rachens und der Penis demonstriert.

REFERENCES

1. **Chang T. S., Hwang W. Y.**: Forearm flap in one stage reconstruction of the penis. Plast. reconstr. Surg. 74: 251.
2. **Fatah, M. F., Davies D. M.**: The radial forearm island flap in upper limb reconstruction. J. Hand Surg. 98: 234.
3. **Boorman J. G., Green M. F.**: A split Chinese forearm flap for simultaneous oral lining and skin cover. Br. J. Plast. Surg. 39: 179.
4. **Harii K., Ebihara S., Ono I.**: Pharyngo-esophageal reconstruction using a fabricated forearm free flap. Plast. reconstr. Surg. 75: 463.
5. **Tvrdek M.**: Covering skin defects of the planta pedis by transfer of free sensory flap. Acta Chir. Plast. 31, 4, 1989.
6. **Nejedlý A., Tvrdek M.**: Thumb reconstruction using free flap transfer. Acta Chir. Plast. 32, 4, 1990.

Doc. M. Tvrdek
Department of Plastic Surgery
Šrobárova 50, 100 34 Prague 10
Czech Republic

3rd Medical Faculty of Charles University
Orthopaedic Clinic (Head: Prof. MUDr. O. Čech, DrSc.)
Clinic of Plastic Surgery (Head: Doc. MUDr. M. Tvrdek)

THE TECHNIQUE OF OSTEOSYNTHESIS IN REPLANTATIONS OF THE UPPER LIMB

J. STEHLÍK, M. TVRDEK, J. BARTONÍČEK

Replantation of limbs represents a new, highly progressive method of musculoskeletal trauma management avoiding amputation which in the past was the only possible way of the treatment of these injuries. At the same time it can serve as an example of interdisciplinary cooperation since one of the prerequisites of a successful microsurgery is the stable osteosynthesis of both parts of the affected limb. With regard to its complex nature the injury requires treatment by skilled orthopaedic and plastic surgeons.

Since its establishment in 1984 our Clinic has been developing close cooperation with the Clinic of Plastic Surgery, taking part in almost all replantations requiring stable osteosynthesis. Dominating among these replantations are injuries of the wrist. Osteosynthesis in this area has certain specificities from the viewpoint of subsequent microsurgery and our article reports on our experience gained in this respect.

METHOD AND MATERIAL

Method: The patient with the proper indication is operated on immediately after his/her admission to the clinic and the necessary pre-surgery management. The operation is performed under total anesthesia or brachial plexus block anesthesia. We use a two-team approach, where one team explores the recipient proximal stump and the other team commences exploration and debridement of the amputated stump. After the teams change surgical gowns and after redraping, the actual stabilization is begun first by the resection of both bone ends. This resection has proved very important as it helps:

- to remove comminuted and contaminated parts of the fractured bones
- simplify the performance of osteosynthesis (straight line of fracture) resulting in the reduction of the time necessary for fixation and making it moreover more stable
- to reduce the time interval eliminating the necessity to apply grafts in suturing vessels and nerves and to permit a tension-free anastomosis
- to shift the actual "fracture zone" proximally so that it is covered by intact and well-vascularised soft tissues.

The stabilization of the amputated part and the stump in the proper position is followed by temporary transfixation by K-wires. In this, the basic axial position of the limb should be respected and any rotational deviation entirely eliminated which might result in problems in the microsurgical anastomosis of vessels and nerves. Vascular clamps placed on either end of the transsected vessels provide clues on the proper position of individual vessels.

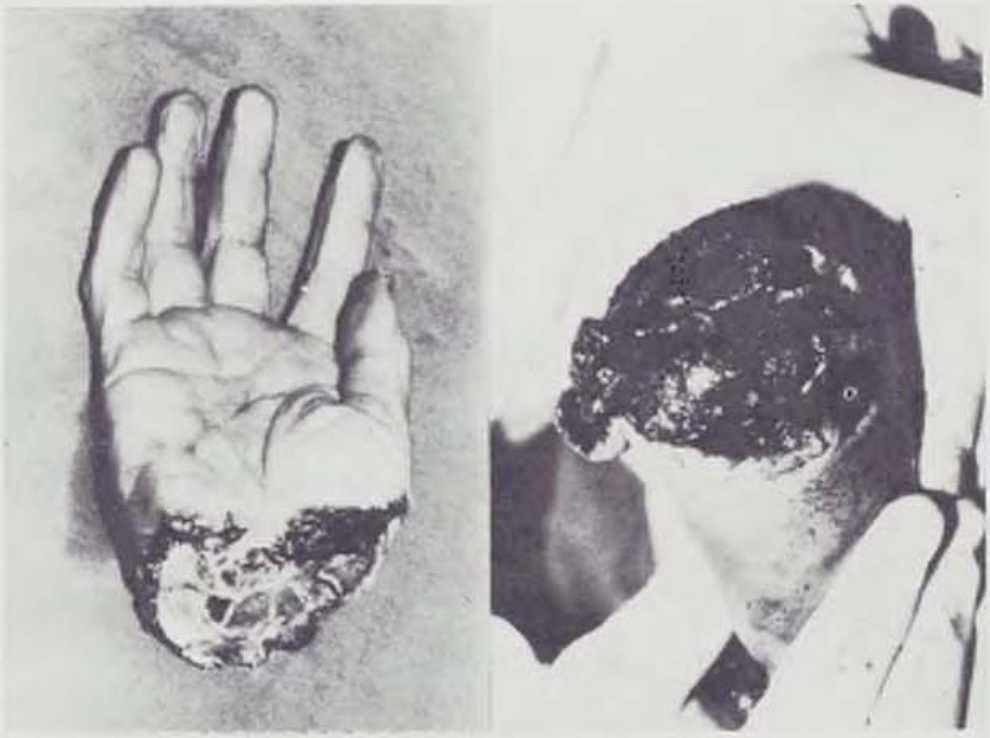
For the actual osteosynthesis we use external fixation device from the Poldi 7 set. The only exception was our first patient in which we applied an older type of device from the Poldi 4 set. Stabilization is performed by means of a unilateral half frame which we apply on the radial aspect of the forearm and the hand. Schanz screws are inserted to the radius, i. e. 2nd or 3rd metacarpal bone, two to each. Three screws originally inserted in the radius have proven unnecessary. Two screws can fully stabilize the fracture over the whole period of the treatment. The first screw is inserted approximately to the midportion of the radius diaphysis, the second one 3—5 cm from the fracture zone, other screws are then inserted into the basis and distal half of one of the mentioned metacarpal bones. The unilateral half frame is placed approximately 5 cm from the skin surface. As concerns clamps most frequently are used simple or joined clamps.

Other associated minor bones and joints injuries are treated only later. After the accomplishment of stabilization it is the plastic surgeon who is in charge of the rest of the operation completing it always by an extensive fasciotomy, and namely from the elbow up to lig. carpi transversum incl., performing usually short skin incisions by scissors in 6—8 cm intervals.

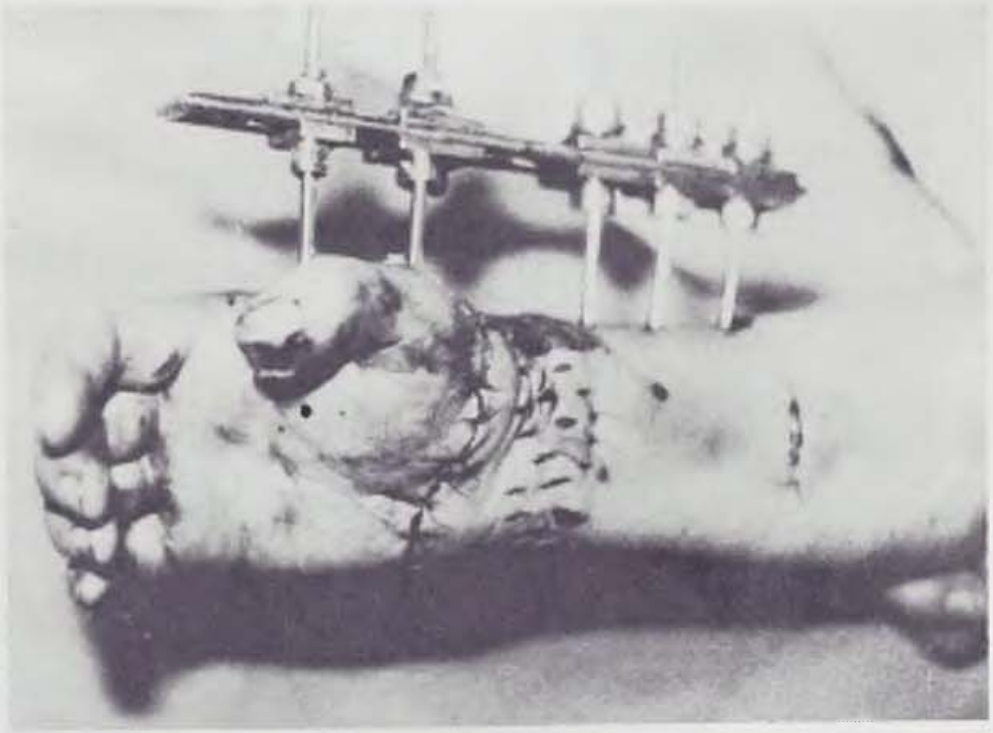
It is our policy to follow patients postoperatively, together with the plastic surgeon. In case of favourable position shown by radiograph Schanz screws are cut right above the frame to allow the patient to resume everyday activities. The external fixation device is removed 3 to 5 months after the operation and plaster of Paris is applied thereafter, if necessary. In cases where folllow-up reveals a potential danger of the development of a pseudo-arthrosis bone grafting is performed, always in the presence of a plastic surgeon (localization of vascular and nervous anastomoses). Other operations not having a direct impact on the stability of the fixation are performed only later, i. e. after the primary healing of the fracture.

Material: Between March 1984 and March 1992 we participated in 21 replantations of the upper limb, out of which 19 were in the area of the wrist (there were 16 men and 3 women). The ages ranged from eighteen to fifty-eight years, the average age being thirty-seven and a half years.

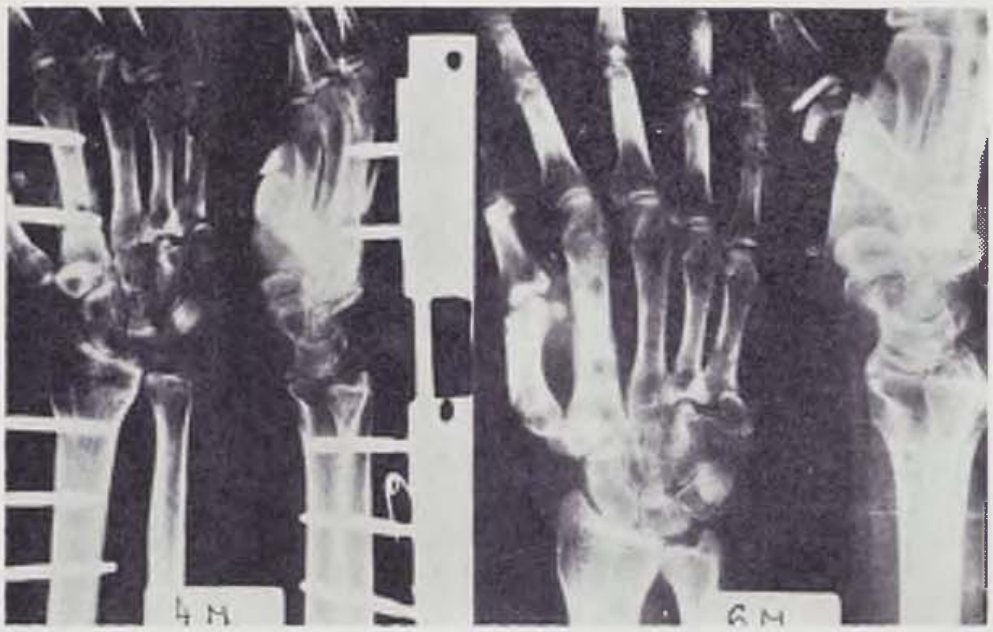
We evaluated the mean period of healing, the incidence of infection, the need for the secondary operations on the bones and the complications of osteosynthesis, if any (Fig. 1). The evaluation of our own functional results was not the subject of this article.



1 — A male, 50-year-old, suffered amputation when operating a circular saw



2 — Situation after replantation (the external fixation device type Poldi 7 has been used)



3 — Situation after healing of the fracture and removal of external fixation

4 — Outcome rated as excellent

RESULTS

Mean bone healing:	27,5 weeks
Mean duration of external fixation:	20,5 weeks
Deep infection (osteitis):	0
Pin track infection:	2
Secondary operations on the bones and joints:	6
— bone grafting	3
— desis between 1st and 2nd metacarpal bones	1
— external fixation adjustment	2
Interruption of replantation:	1 (wrong indication)
Fatigue fracture of radius:	2

DISCUSSION

Osteosynthesis in replantations should meet the following requirements:

- short duration of performance — any prolongation of ischaemia can considerably influence the final result
- elimination of the risk of the development of a potential subsequent infection
- creation of optimal conditions for the subsequent microsurgical procedure, i. e. ensuring of the stabilization of both parts without complicating the approach to the treated structures for the plastic surgeon.

All these conditions are closely interrelated. In theory three modalities are available: The first one is the above mentioned external fixation, another one is adaptation osteosynthesis by K-wires transfixation and the third one is internal fixation by plate.

The transfixation by K-wires is a relatively quick method which, however, cannot guarantee a stable osteosynthesis. It may threaten sutures of neurovascular structures (vessels!) and moreover requires fixation by plaster of Paris complicating considerably the aftertreatment.

Pho (3) uses for the stabilization in replantation in the wrist area two intramedullary inserted K-wires or Steinman pins. The first one passes through the medullary cavity of 3rd metacarpal bone into the medullary cavity of radius, and, similarly, the second pin or a K-wire through 4th metacarpal bone into ulna. Fixation is combined with by compression wire-sling over these two K-wires or S-pins. In our view this type of osteosynthesis does not offer sufficient stability and moreover there is an increased danger of potential infection.

Fixation by plate is entirely inappropriate for these types of injury as it does not ensure sufficient stability with regard to the nature of the injury and, most importantly, it significantly raises the risk of infection, not to mention its time consuming character.

On our view, the ideal procedure for this type of injury is external fixation (2, 4, 5). While the risk of infection is minimal, the stability is sufficient both for immediate aftertreatment without the need for the application of plaster

of Paris, and for final healing. The placement of the frame from the dorso-radial aspect does not entail any limitation for the subsequent microsurgical procedure, on the contrary. Time is not a limiting factor for the application of the device either, as the application of this type of external fixation is for a skilled surgeon a matter of 20 to 30 minutes. This has been proved also by our experience in the treatment of unstable fractures of distal radius by external fixation (5).

Once again the importance should be pointed out in this respect of the resection of the bones in the zone of the primary fracture (1, 3). and of the absolute inevitability of an extensive fasciotomy which is performed by a plastic surgeon, prior to the beginning of the actual operation. Neglect of these principles may have catastrophic consequences for the final outcome of the operation.

The absence of a deep infection (osteitis) in our group of patients is rather surprising when considering the type of injuries, their mechanism as well as the setting in which they occurred. However, it may be explained by the above mentioned facts, by faultless microsurgery and, last but not least, by observing the exact indication for the operation. It means to undertake the operation only in cases where the fundamental prerequisites are met. Other complications such as synostosis or the need for bone grafting should not be ascribed to the technique of treatment but rather to the extent and type of injury.

Unfortunately we have no comparison with other authors as we have not found a work in the literature dealing in details with the issues of external fixation in replantations in the area of the wrist.

CONCLUSION

External fixation is one of the key factors for a successful replantation in the area of the wrist. However, it must be performed by a skilled surgeon who is aware of all potential complications and ways how to avoid them. The resection of fractured bones ends and fasciotomy are conditions sine qua non as is a good interdisciplinary cooperation.

SUMMARY

The authors present their experience in osteosynthesis in replantations in the area of the wrist in 19 patients.

For osteosynthesis they use external fixation device, type Poldi 7, which guarantees the stability not only during the microsurgical procedure but also over the whole period of healing.

They point out the importance of the resection of both bones ends, i. e. the resection of the comminuted zone, as well as the importance of an extensive fasciotomy.

In all patients but one healing was achieved without infection.

The authors consider external fixation for the method of choice in the replantation in the wrist area.

Key words: replantation — wrist — osteosynthesis — external fixation

RÉSUMÉ

Rôle d'orthopédiste dans réimplantations du membre supérieur

Stehlík, J., Tvrdek, M., Bartoníček, J.

Les auteurs étendent leurs expériences avec l'ostéosynthèse, acquises au cours de 21 réimplantations de membres supérieurs.

Afin d'obtenir une jonction stable des deux bouts, les auteurs appliquent la méthode d'ostéosynthèse extérieure qui permet, grâce à sa stabilitě et à sa localisation, un travail opératoire tranquille et ininterrompu au chirurgien plastique, avec l'accès de microscope tout au long de la circonférence de membre.

Ils accentuent l'importance d'une indication juste à la réimplantation, la nécessité du raccourcissement des deux bouts osseux et la fasciotomie étendue, nécessaire et précoce.

Le matériel utilisé pour l'ostéosynthèse était de type POLDI qui a complètement fait ses preuves et satisfait les exigeances à une fixation stable dans les réimplantations de membres.

ZUSAMMENFASSUNG

Die Aufgabe des Orthopäden bei einer Replantation des oberen Gliedmasses

Stehlík, J., Tvrdek, M., Bartoníček, J.

Die Autoren führen ihre Erfahrungen bei einer Osteosynthese bei einer Replantation der oberen Gliedmasse an, die sie bei 21 Patienten gewannen.

Zur stabilen Verbindung beider Teile benutzen sie die Methode einer äusseren Osteosynthese, die durch ihre Stabilität und Plazierung dem Chirurgen eine ruhige und ungestörte Operation gestattet unter Anwendung des Mikroskops entlang des ganzen Umfangs des Gliedmasses.

Sie betonen die Wichtigkeit einer korrekten Indikation zur Replantation, einer notwendigen Verkürzung beider Knochenenden und einer rechtzeitigen, unerlässlichen und ausgedehnten Fasciotomie.

Der angewendete Apparat zur äusseren Osteosynthese war vom Typ POLDI, der sich vollkommen bewährte und die Anforderungen an eine stabile Fixierung bei der Replantation der Gliedmasse erfüllte.

REFERENCES

1. **Berger, A.**: Replantation Surgery: Indication and Limitations. In: Tscherne, H., Gotzen, (eds.): Fractures with Soft Tissues Injuries. Berlin-Heidelberg-New York-Tokyo, Springer 1984.

2. **Jupiter, J. B.**: Fractures of the Distal

End of the Radius. Current Concepts Review. J. Bone Jt Surg., 73-A: 461—469, 1991.

3. **Pho, R: W. H.:** Microsurgical Technique in Orthopaedics. London-Boston-Durban-Singapore-Sydney-Toronto-Wellington, Butterworths 1988.

4. **Rogge, D.:** External Articular Transfixation for Joint Injuries with Severe Soft Tissue Damage. In: Tscherne, H., Gotzen, L. (eds.): Fractures with Soft Tissues Injuries. Berlin-Heidelberg-New York-Tokyo, Springer 1984.

5. **Váchal, J., Stehlík, J., Jiřička, J.:** Treatment of Fractures of the Distal End of the Radius by External Fixation. (In Czech). Acta Chir. orthop. Traum. čech. 56: 473—483, 1989.

MUDr. J. Stehlík
Orthopaedic Clinic,
Šrobárova 50.
100 34 Praha 10
Czech Republic

3rd School of Medicine, Charles University, Prague
Department of Plastic Surgery; Head: Prof. MUDr. M. Fára, DrSc.

USE OF BECKER'S PROSTHESIS IN BREAST RECONSTRUCTION

M. DUŠKOVÁ

A successful reconstruction will give the woman, diagnosed to have breast carcinoma, satisfaction derived from the feeling of full health and self-confidence in her appearance.

One of the modalities available is the use of a tissue expander replaced, after the skin cover has stretched sufficiently, by a breast prosthesis. A simplification of this approach is the permanent tissue expander. This type of implant was proposed, and the operative procedure described, by Hilton Becker. The prosthesis consists of an outer textured low-permeability silastic shell placed over an outer chamber containing silicone gel. This is separated, by another membrane, from an inner chamber which can be filled with saline via a standard dome or microport. The dome is connected to the prosthesis by a filllng tube entering the implant via a twin-valve system. Upon completion of expansion, the tube is pulled out sealing the system tightly; the device then serves as a permanent prosthesis. (Fig. 1.)

Becker's implant can be used in delayed and emergency breast reconstruction as well as for breast augmentation.

The recommended operative procedure in delayed reconstruction consists in creating a pocket under m. pectoralis from an inframammary incison. The pocket should extend as far as 4 cm under the natural submammary groove. Intraoperatively, the implant is to be filled to a maximum of one third of its total volume. During expansion, the single dose should not exceed 10 % of total volume. The areomammilary complex will start to form approximately within 3 months after the end of expansion.

TWO CASE RECORDS OF OUR PATIENTS:

D. V., a 47-year-old patient, 3 years after subcutaneous mastectomy for fibrotic cystic mastopathy; her medical history showed three bouts of bronchopneumonia, APE, TE, pelvic bottom reconstruction; a heavy smoker (20—30

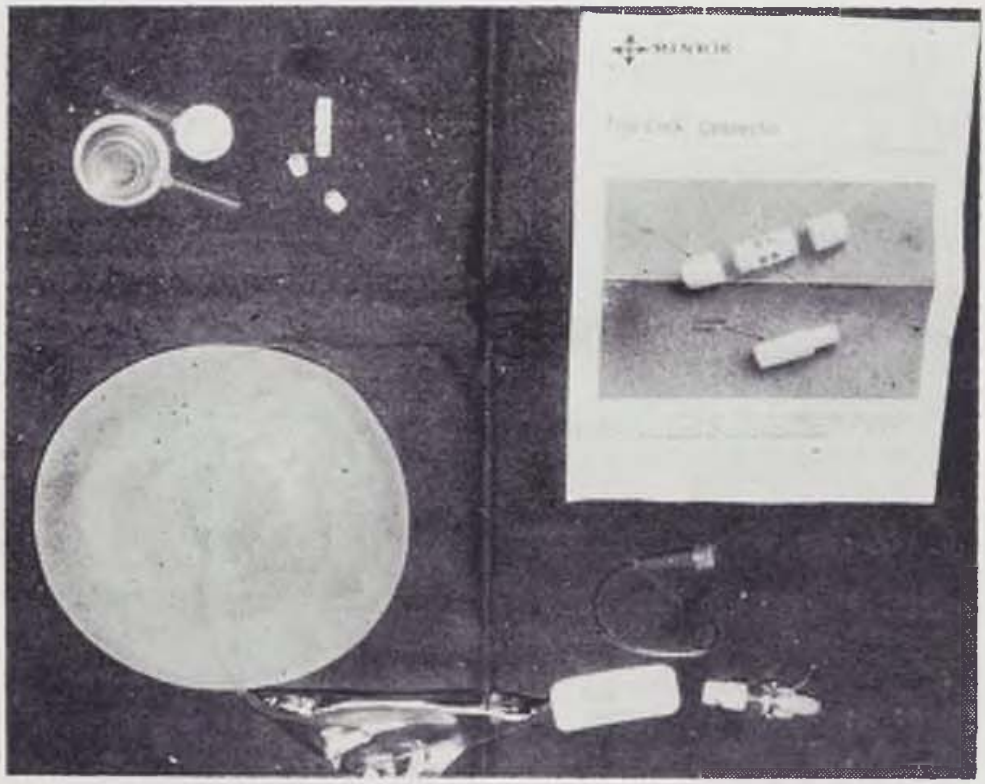


Fig. 1

Fig. 2

Fig. 3

Fig. 4

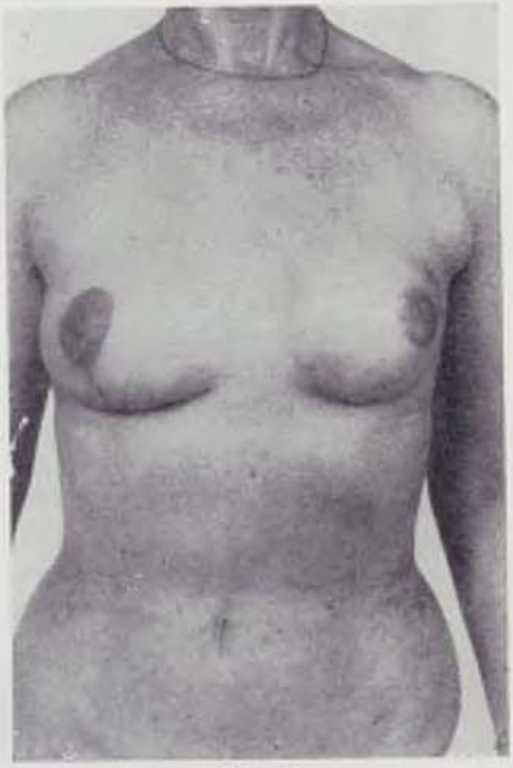


Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Fig. 13

Fig. 1. A Sitex Mentor^{R} implant (upper left) standard-size filler and microport connecting tubes to syringe and port

Figs 2—4. Patient D. V. before surgery

Figs 5—7. Patient D. V. upon completion of reconstruction

Figs 8—10. Patient E. K. before surgery

Figs 11—13. Patient E. K. upon completion of reconstruction

cigarettes a day).(Figs 2—4.) A 200ml prosthesis was inserted under the breast muscle from the upper outer part of the original scar. Since overexpansion (attained in two sessions on postop Day 10) was possible, the prosthesis was intraoperatively filled to 140 ml. Suction drainage was retained for a period of 5 days; antibiotics were administered for a total of 7 days. Duration of surgery was 40 minutes, general anaesthesia lasted 55 minutes, the patient was hospitalized for 8 days. Uneventful ccurse. When reconstructing the AM complex, extensive probatory excision was made, based on oncological indication, from the contralateral breast whose remainder was to be modelled. Duration of reconstruction was 6 months. (Figs 5—7).

E. K., a 55-year-old patient, 5 months after radical mastectomy for breast carcinoma (T1, NO, MO) with subsequent Thamoxiphen chemotherapy; her medical history revealed pulmonary tuberculosis, recurrent

thrombophlebitis, type-A hepatitis, nephrolithiasis, hypertension, polyvalent allergy (PNC, Ketason), two bouts of hemorrhoids, HE for myomatosis. (Figs 8—10). A 300ml prosthesis was inserted under the breast muscle from the upper outer part of the original scar. The prosthesis was intraoperatively filled to 160 ml; making use of the possibility of overexpansion attained in 4 sessions on postop Day 40. A suction drain was retained for 4 days, total duration of antibiotic administration was 7 days. Duration of surgery was 30 minutes, duration of general anaesthesia 40 minutes, hospital stay 8 days. Uneventful course. While good shape and size of the breasts were obtained, the position did not correspond to contralateral ptosis. As a result, to meet the patients' wishes, the drooping was corrected during reconstruction of the AM complex. Duration of reconstruction was 6 months. Figs (11—13).

The key problem of delayed reconstruction is to attain symmetry in size, shape and position.

Exact measurement of the volume of the removed breast (1) was not possible, since the mastectomies had been performed elsewhere without previous consultation. Overestimate of the prosthesis size will commonly result in a wrinkled surface, if filled inadequately. To determine exactly the volume, the patients were asked to bend forward immersing their healthy breasts into a vessel containing water. Addition of the liquid expelled showed exactly the missing volume. An additional approx. 50 ml was deducted for the existing skin cover of the affected side.

The recommended surgical technique was modified by placing the expander in a symmetrically proposed inframammary groove. While a prosthesis placed in a somewhat lower position mimics ptosis well, its position cannot be corrected by garments making it necessary to retain also the attire in a ptotic position, an arrangement incompatible with Central European aesthetic standards. Detaching of the lower part of the sternal origin of m. pectoralis made it possible to place the prosthesis well without a tendency to upward luxation. Access from the upper and outer parts of the original scar allowed immediate rehabilitation of ambulation and early expansion without straining the operative scar. Using temporary overexpansion, a good inframammary groove was formed. The recommended procedure to create genuine ptosis by inserting the prosthesis into subcutaneous tissue was considered rather risky and technically almost unfeasible due to the extensive superficial scarring between the muscle and the skin.

A suction drain, preventive administration of antibiotics, early massages and use of textured surface prostheses, all minimize the development of a capsule capable of destroying the whole cosmetic benefit of the procedure. Moreover, the gel filling, while providing a more physiological feel, significantly decreases capsule formation.

The two-step reconstruction procedure takes a long time to complete — 6 months — however, it is indispensable for safe maturation of the expanded tissue.

In view of the not yet clear response of the body to long-term implantation of man-made prostheses, it is critical to follow up the patients recommending removal of the prosthesis should adverse reactions develop

There are two main current trends in breast reconstruction, seeking either perfection as a result of free transplantation of a bulky musculocutaneous flap (TRAM), or simplicity using a permanent tissue expander. Distinct advantages of the implant include its simplicity and shortness of surgery, relatively low costs, fairly low stress on the patient, short hospitalization and minimal postoperative medication. It is the method of choice of breast reconstruction especially in cases of bilateral involvement and in all patients with a concomitant disease or another factor making it impossible to perform an extensive surgical procedure.

SUMMARY

The method of breast reconstruction using a submuscular permanent expander is rapid and simple. imposing minimal stress on the patient. Using it, it is possible to obtain good shape and size of the reconstructed breast; the ptotic position remains to pose a problem.

This modality is useful especially in bilateral involvement and in all patients with a concomitant disease or another risk factor.

Key words: breast reconstruction — permanent expander

RÉSUMÉ

Utilisation de prothèse de Becker dans reconstruction mammaire

Dušková, M.

La méthode de reconstruction du sein par un exapandeur constant sousmusculaire est rapide et simple. Le gêne qu'elle représente pour la patiente est le moindre. La méthode permet d'obtenir une forme et un volume convenable du sein à reconstruire, la position ptosée est problématique. La méthode est avantageuse notamment chez l'atteinte bilatérale et chez toutes les malades avec une maladie intercurrente ou avec une autre charge.

ZUSAMMENFASSUNG

Die Anwendung der Becker'schen Prothese bei einer Rekonstruktion der Brust

Dušková, M.

Die Methode einer Rekonstruktion der Brust mittels eines submuskulär gelagerten ständigen Expanders ist schnell und einfach. Sie beschwert den Patienten minimal.

Man kann dadurch eine gute Form und Grösse der rekonstructierten Brust erzielen, das Problem ist nur die ptotische Stellung. Die Methode ist vorteilhaft vor allem bei einer beiderseitigen Betroffenheit sowie bei einen Patienten mit interkurrenten Erkrankungen oder einer anderen Belastung.

M. Dušková,
Department of Plastic Surgery,
Šrobárova 50,
100 34 Praha 10
Czech Republic

CONTENTS