Bi8352 Metody antropologie II
jaro 2023
Mgr. Mikoláš Jurda, Ph.D.

MUNI SCI Ústav antropologie

Odhad dožitého věku

Základní východiska


Cell

Leading Edge
Review

The Hallmarks of Aging

Carlos López-Otín,[1] Maria A. Blasco,[2] Linda Partridge,[3,4] Manuel Serrano,[5,*] and Guido Kroemer[6,7,8,9,10]
[1]Departamento de Bioquímica y Biología Molecular, Instituto Universitario de Oncología (IUOPA), Universidad de Oviedo, Oviedo, Spain
[2]Telomeres and Telomerase Group, Molecular Oncology Program, Spanish National Cancer Research Centre (CNIO), Madrid, Spain
[3]Max Planck Institute for Biology of Ageing, Cologne, Germany
[4]Institute of Healthy Ageing, Department of Genetics, Evolution and Environment, University College London, London, UK
[5]Tumor Suppression Group, Molecular Oncology Program, Spanish National Cancer Research Centre (CNIO), Madrid, Spain
[6]INSERM, U848, Villejuif, France
[7]Metabolomics and Cell Biology Platforms, Institut Gustave Roussy, Villejuif, France
[8]Centre de Recherche des Cordeliers, Paris, France
[9]Pôle de Biologie, Hôpital Européen Georges Pompidou, AP-HP, Paris, France
[10]Université Paris Descartes, Sorbonne Paris Cité, Paris, France
*Correspondence: mserrano@cnio.es
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chronologický věk – čas od narození

Posuzování znaků, které se mění s věkem.

biologický věk – popis aktuální podoby (fenotypu) kosterní soustavy/vytipovaných struktur

vývinový věk

kosterní věk

estimation vs. determination

fyziologický věk

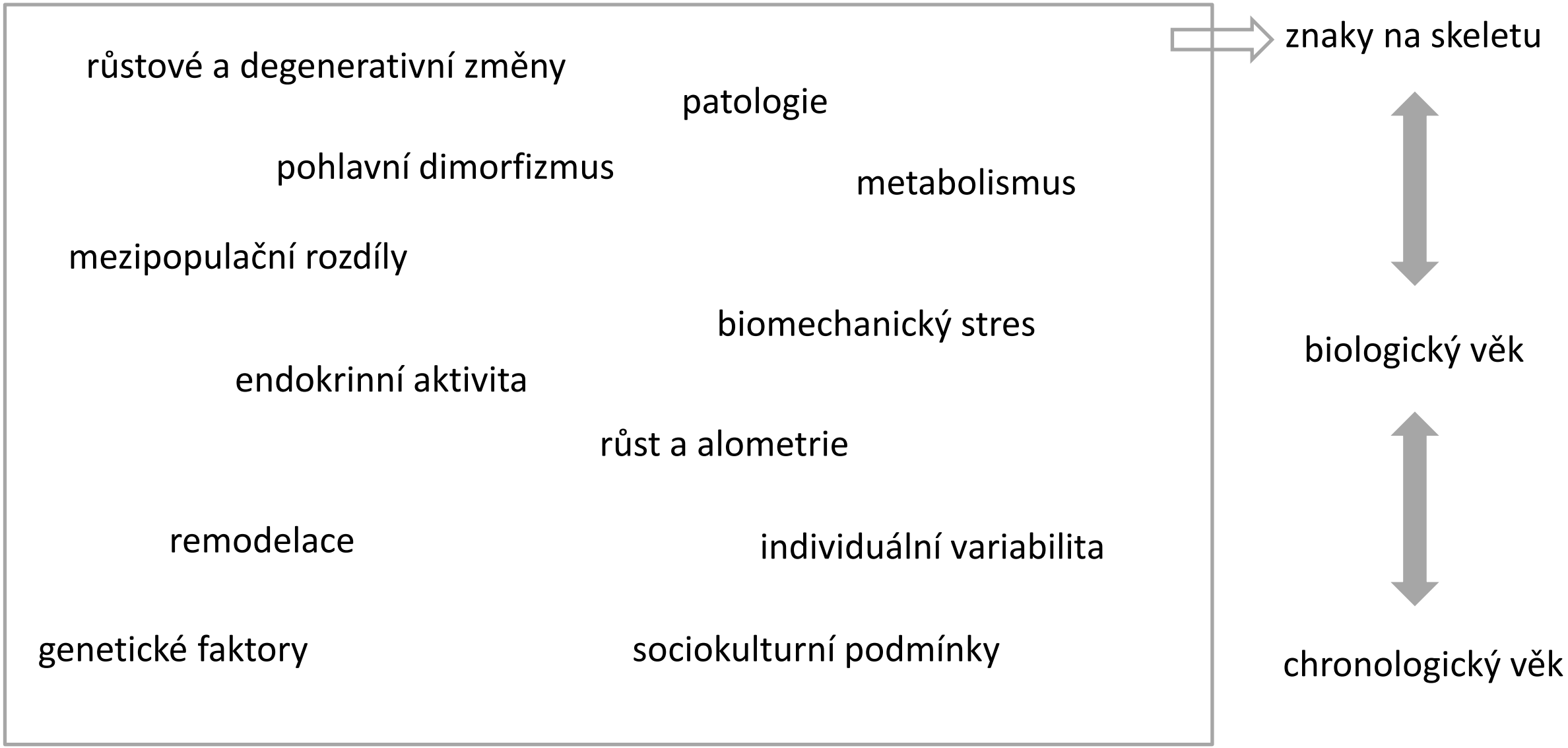
morfologický věk

zubní věk

proporční věk

dožitý věk

Základní východiska



Základní východiska

znaky na skeletu

biologický věk

pro účely populačních studií například historických populací (pohřebiště apod.) není vždy potřeba převádět na chronologický věk

chronologický věk

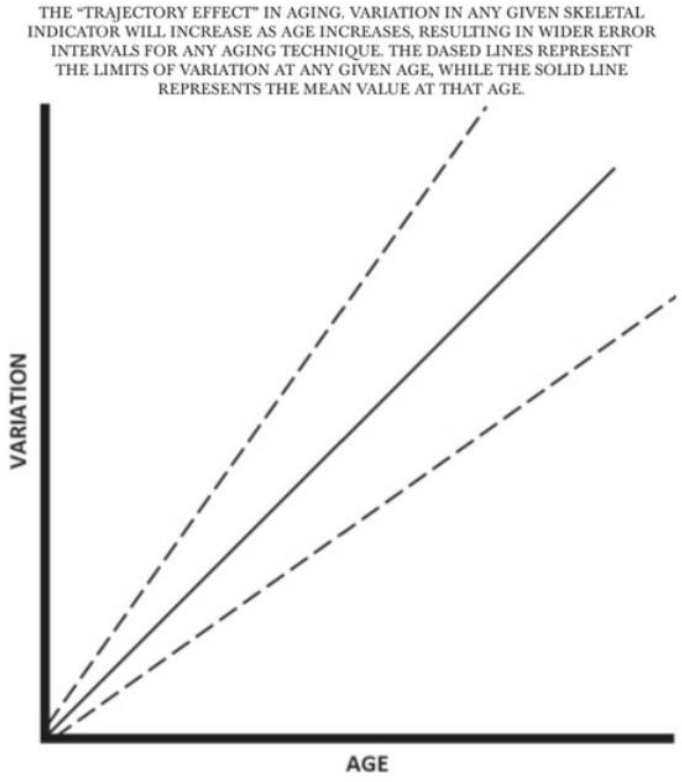
podstatný, pokud jde o specifického jedince – například jako odhad skupinových vlastností pozůstatků neznámého původu; nebo pokud má význam z hlediska práva

Základní východiska

nemetrické nedospělí
intervaly obecně 3–5 let

nemetrické dospělí
správně zkonstruované intervaly ca 15–20 let na jednu fázi; někdy ale i 50

metrické
obvykle přesnější – neomezují se na pár kategorií pokrývajících celý život



Základní problémy – znalost materiálu

Je dobré provést více metod a zamyslet se nad výsledky.

Průměrování **je problematické**. Méně přesné metody mohou zhoršit odhady těch přesných a přijdeme o intervaly. Využije se ale víc znaků, ale efekt na přesnost nemusí být významný.

Přesnost se s věkem snižuje.

Obecně se nadhodnocují mladší a podhodnocují starší.

plod/novorozenec

dospělý/nedospělý

historický/recentní

populační příslušnost

invazivní/neinvazivní

The anthropologist can save himself a lot of time by not trying to make more precise estimates of age than are warranted by the nature of the material.

S. L. WASHBURN

Pro hlubší vhled

nedospělí

vznik, vývoj a srůst osifikačních center

vývoj a erupce zubů

délka diafýz

rozměry lebečních kostí

dospělí

degenerarityní změny kloubních ploch

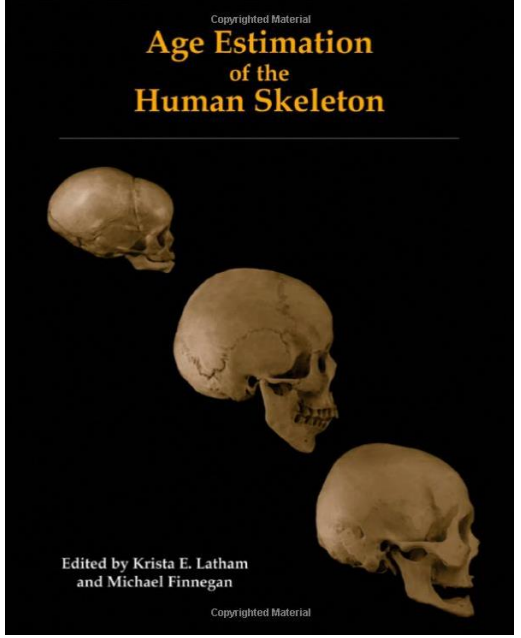
obliterace švů

morfologie osteonů

změny zubů

Pro hlubší vhled

BUIKSTRA, Jane E.; RHINE, Stanley. Age estimation of the human skeleton. Charles C Thomas Publisher, 2010.
Kapitola 6
THE NATURE AND SOURCES OF ERROR IN THE ESTIMATION OF AGE AT DEATH FROM THE SKELETON



MAYS, Simon, 2015. The effect of factors other than age upon skeletal age indicators in the adult. *Annals of Human Biology*. **42**(4), 332–341. ISSN 0301-4460, 1464-5033. doi:10.3109/03014460.2015.1044470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informa healthcare

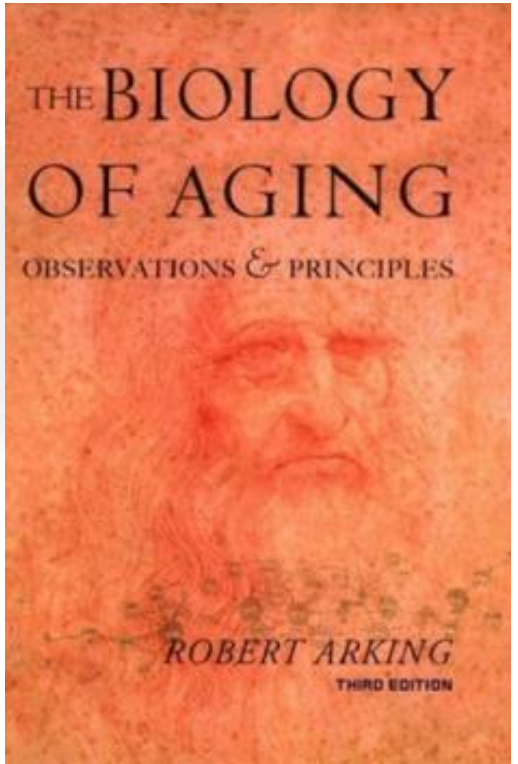
REVIEW

The effect of factors other than age upon skeletal age indicators in the adult

Simon Mays

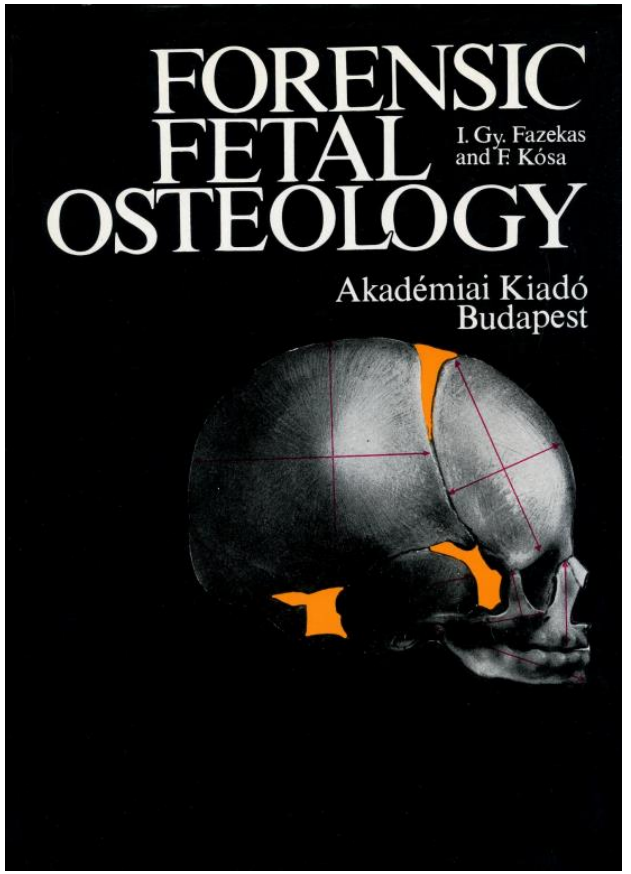
Historic England, Fort Cumberland, Eastney, Portsmouth, UK

ARKING, Robert, 2006. *The biology of aging: observations and principles*. 3rd ed. Oxford ; New York: Oxford University Press. ISBN 978-0-19-516739-9.



Odhad věku plodu

FAZEKAS, István Gyula a F. KÓSA, 1978. *Forensic fetal osteology*. Budapest: Akadémiai Kiadó. ISBN 978-963-05-1491-0.



Délka dlouhých kostí plodu v závislosti na věku (Fazekas a Kósa 1978)

věk	délka těla	Humerus délka	Humerus šířka	Radius	Ulna	Femur délka	Femur šířka	Tibia	Fibula
3	95	8.8	1.9	6.7	7.2	8.5	1.9	6.0	6.0
3 1/2	123	12.4	2.2	10.1	11.2	12.4	2.2	10.2	9.9
4	173	19.5	4.7	17.2	19.0	20.7	4.7	17.4	16.7
4 1/2	220	25.8	6.1	21.5	23.9	26.4	6.2	23.4	22.6
5	256	31.8	7.8	26.2	29.4	32.6	8.02	28.5	27.8
5 1/2	275	34.5	8.3	28.9	31.6	35.7	8.8	32.6	31.1
6	306	37.6	9.3	31.6	35.1	40.3	9.8	35.8	34.3
6 1/2	326	39.9	9.9	33.4	37.1	41.9	10.6	37.9	36.5
7	354	44.2	10.9	35.6	40.2	47.0	11.8	42.0	40.0
7 1/2	375	45.8	11.9	38.2	42.8	48.7	12.3	43.9	42.8
8	400	50.4	12.9	40.8	46.7	55.5	14.3	48.2	46.8
8 1/2	424	53.1	13.6	43.3	49.1	59.8	15.3	52.7	50.5
9	455	55.5	14.4	45.7	51.0	62.5	16.4	54.8	51.6
9 1/2	480	61.3	15.7	48.8	55.9	68.9	18.7	59.9	57.6
10	516	64.9	16.8	51.8	59.3	74.3	19.9	65.1	62.3

Věk je udáván v lunárních měsících, délka kostí a těla v mm.

(Stloukal 1999)

Odhad věku plodu

FAZEKAS, I. Gy. a F. KÓSA, 1966. Neuere Beiträge und vergleichende Untersuchungen von Feten zur Bestimmung der Körperlänge auf Grund der Diaphysenmasse der Extremitätenknochen. *Deutsche Zeitschrift für die Gesamte Gerichtliche Medizin*. **58**(2), 142–160. ISSN 0937-9827, 1437-1596.

Körperlänge (cm) =	Humeruslänge (cm) ×	7,524	+2,4717
Körperlänge (cm) =	Humerusbreite (cm) ×	28,304	+3,9504
Körperlänge (cm) =	Radiuslänge (cm) ×	10,614	—2,1125
Körperlänge (cm) =	Ulnalänge (cm) ×	8,196	+2,3779
Körperlänge (cm) =	Femurlänge (cm) ×	6,444	+4,5082
Körperlänge (cm) =	Femurbreite (cm) ×	22,629	+7,5659
Körperlänge (cm) =	Tibialänge (cm) ×	7,236	+4,9031
Körperlänge (cm) =	Fibulalänge (cm) ×	7,592	+4,6841

výpočet délky těla

Haaseho pravidlo

1.–5. měsíc intrauterinního vývoje – druhá odmocnina délky plodu určí jeho stáří

6.–7. měsíc intrauterinního vývoje – délka plodu v cm dělená 5 určí jeho stáří v měsících

Odhad věku plodu

SCHEUER, J.L., J.H. MUSGRAVE a S.P. EVANS, 1980. The estimation of late fetal and perinatal age from limb bone length by linear and logarithmic regression. *Annals of Human Biology*. **7**(3), 257–265. ISSN 0301-4460, 1464-5033. doi:10.1080/03014468000004301

17 jedinců bez specifikace pohlaví, *The Bristol Royal Hospital for Sick Children*, **Bristol, UK**

65 jedinců (29 M, 36 Ž), The London University Institute of Child Health, London, UK

Method number	Bone(s) and method	Regression equation		A	B	C
3.01	Multiple linear regression	+0·1765 FEM +0·4122 TIB +0·0250 HUM −0·2157 RAD +0·0904 ULN	+3·8915	1·96		0·85
3.02	Multiple linear regression	+0·1509 FEM +0·4056 TIB	+2·2947	1·90		0·84
3.03	Multiple linear regression	+0·2558 HUM +0·0427 RAD +0·2622 ULN	+4·3371	2·46		0·72

A – standardní chyba odhadu
C – korelace pozorování/odhad

Odhad věku plodu

SHERWOOD, R. J., R. S. MEINDL, H. B. ROBINSON a R. L. MAY, 2000. Fetal age: methods of estimation and effects of pathology. *American Journal of Physical Anthropology*. **113**(3), 305–315. ISSN 0002-9483. doi:10.1002/1096-8644(200011)113:3<305::AID-AJPA3>3.0.CO;2-R

72 JEDINCŮ (BEZ SPECIFIKACE POHLAVÍ), Akron Children's Hospital, Ohio, USA

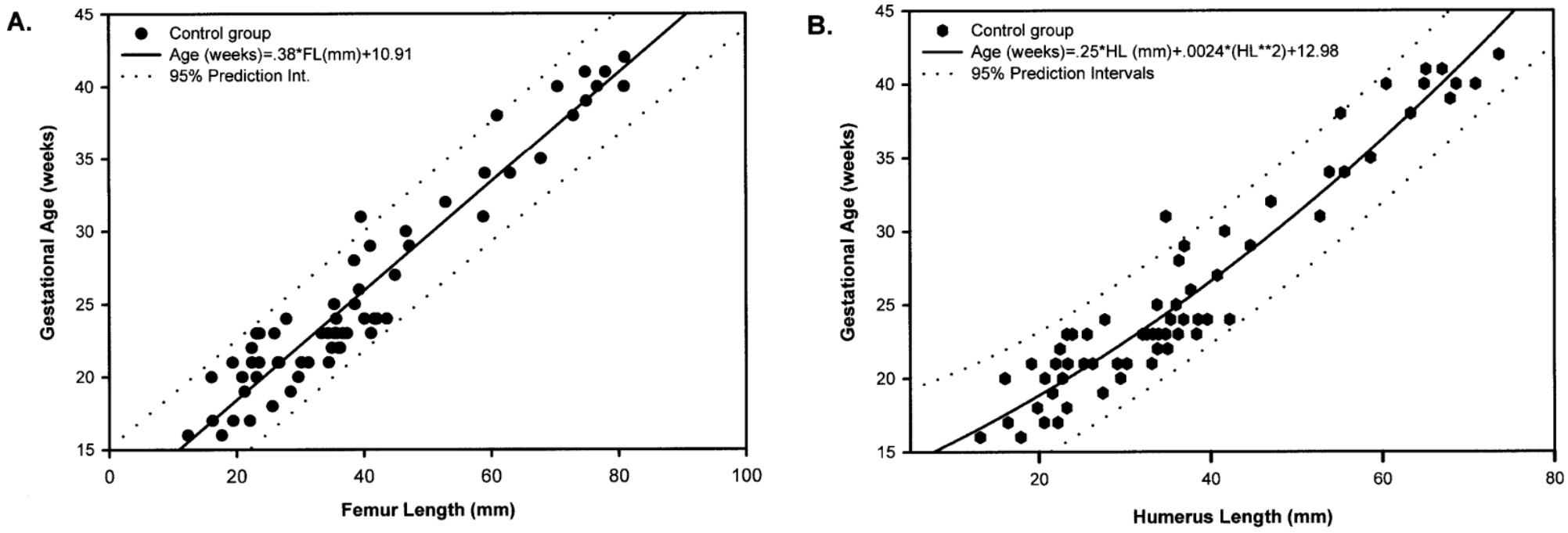
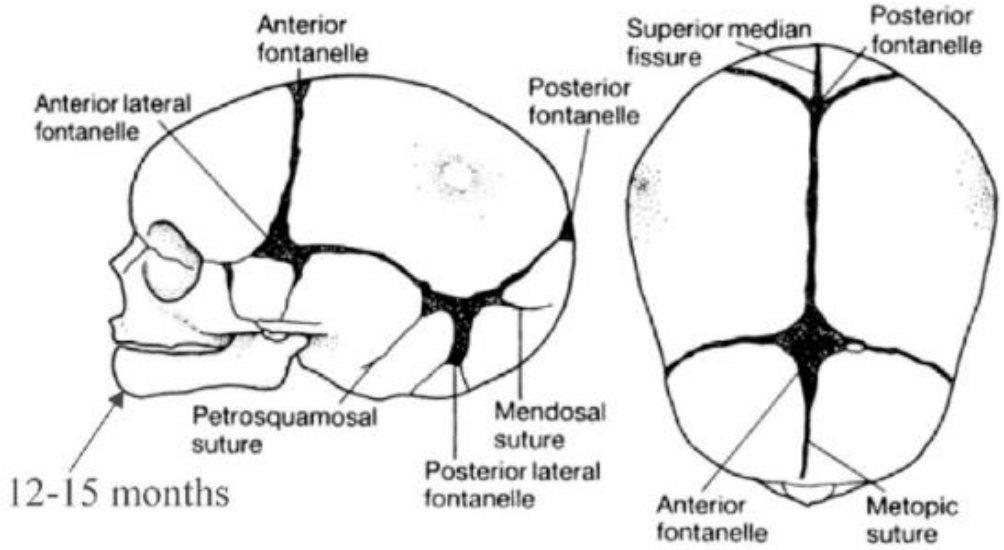


Fig. 2. Regression of gestational age on two skeletal measures. (**A**) Regression on femur length (FL) provides an example of a linear prediction model. (**B**) Regression on humerus length (HL) provides an example of a quadratic model. The 95% prediction intervals are indicated for both models.

Novorozenec

1) přítomnost šesti osifikačních center – talus, calcaneus, os cuboideum, distální epifýza femuru, proximální epifýza tibie, caput humeri, os capitatum
2) kosti spojené vazivovými proužky – nesrostlé fontanely; nesrostlá symfýza dolní čelisti



Fonticulus major (frontalis, anterior) – mizí mezi 1. a 2. rokem života

Fonticulus minor (occipitalis, posterior) – mizí brzy po narození, nejpozději ve 3 až 6 měsíci života, v některých případech není patrný již při narození

Fonticulus sphenoidalis (anterolateralis) – mizí brzy po narození, nejpozději do konce 6. měsíce.

Fonticulus mastoideus (posterolateralis) – mizí brzy po narození, nejpozději v 6. měsíci života

Odhad věku nedospělých jedinců

STLOUKAL, Milan a HANÁKOVÁ, H, 1978. Die Länge des Längsknochen altslawischer Bevölkerungen unter besonderer Berücksichtigung von Wachtumsfragen. *Homo*. 29(1), 53–69.

3 staroslovanské populace
336 jedinců

Tabulka 9
Vztah délky dlouhých kostí končetin a věku dětí od 6 měs. do 14 let (Stloukal a Hanáková 1978)

	pažní kost	vřetenní kost	loketní kost	stehenní kost	holenní kost
věk	průměr	průměr	průměr	průměr	průměr
6 měs.	88.1 (78 -97.0)	69.7 (63 -75.0)	75.9 (72 -80.0)	108.1 (95 -122)	88.8 (84 -93.0)
12 měs.	97.9 (89 -106)	76.7 (68 -85.0)	83.1 (79 -86.0)	122.0 (109-135)	99.2 (93 -105)
18 měs.	108.6 (98 -118)	84.1 (75 -90.0)	91.3 (85 -95.0)	137.5 (122-152)	111.4 (102 -120)
24 měs.	117.5 (106-129)	89.8 (80 -96.0)	98.5 (93 -102)	149.6 (135-166)	121.4 (109 -131)
30 měs.	124.9 (113-138)	95.1 (86 -103)	104.7 (98 -110)	160.9 (143-182)	131.7 (117 -144)
3 roky	133.5 (120-147)	101.6 (93 -110)	111.4 (104-117)	174.1 (156-196)	142.2 (127 -156)
4 roky	142.7 (128-159)	108.3 (98 -120)	119.8 (111-129)	188.3 (169-213)	151.9 (136 -171)
5 let	152.4 (136-170)	116.0 (105-130)	128.0 (118-139)	203.2 (183-230)	164.1 (146 -184)
6 let	163.8 (147-181)	125.1 (114-140)	137.3 (125-152)	221.1 (198-246)	177.1 (158 -201)
7 let	174.8 (157-192)	133.5 (121-152)	147.2 (134-164)	238.1 (214-263)	188.9 (168 -216)
8 let	184.6 (169-210)	141.9 (130-160)	157.1 (145-174)	253.0 (228-278)	202.0 (180 -227)
9 let	194.3 (178-210)	149.2 (139-163)	164.4 (154-178)	266.5 (241-290)	213.6 (191 -235)
10 let	203.9 (186-218)	156.9 (149-168)	172.4 (163-186)	281.2 (254-305)	224.3 (202 -246)
11 let	211.9 (196-224)	163.3 (156-175)	178.1 (169-193)	292.5 (265-323)	235.1 (212 -259)
12 let	219.9 (202-234)	168.8 (160-179)	182.9 (173-198)	302.9 (279-337)	244.4 (218 -368)
13 let	231.2 (211-247)	175.7 (165-188)	190.7 (178-208)	319.0 (286-358)	256.1 (227 -283)
14 let	240.8 (220-257)	182.5 (166-200)	198.0 (183-221)	333.3 (296-382)	269.8 (235 -301)

Odhad věku nedospělých jedinců

RISSECH, Carme, Maureen SCHAEFER a Assumpció MALGOSA, 2008. Development of the femur—Implications for age and sex determination. *Forensic Science International*. 180(1), 1–9. ISSN 03790738.

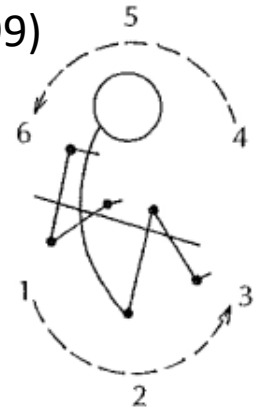
346 jedinců (173 m, 173 ž) – St. Bride, Coimbra, Lisabon, Barcelona, Dundee (*Scheuer collection*)

Table 4
Inverse functions for age prediction—coefficient of correlation of the function R^2

	R^2	Age limit
Males		
Age = 0.054 × diaphyseal length – 6.337	0.949	Up to 17 years
Age = 0.054 × diaphyseal length plus distal epiphysis – 7.367	0.946	Up to 17 years
Age = 0.061 × maximum femoral length – 9.549	0.923	Up to 19 years
Age = 0.595 × vertical diameter of the femoral head – 8.992	0.947	Up to 17 years
Females		
Age = 0.058 × diaphyseal length – 6.771	0.890	Up to 16 years
Age = 0.056 × diaphyseal length plus distal epiphysis – 7.160	0.852	Up to 16 years
Age = 0.055 × maximum femoral length – 7.256	0.835	Up to 17 years
Age = 0.559 × vertical diameter of the femur head – 7.577	0.896	Up to 15 years
Unisex series		
Age = 0.056 × diaphyseal length – 6.489	0.925	Up to 16 years
Age = 0.055 × diaphyseal length plus distal epiphysis – 7.130	0.897	Up to 16 years
Age = 0.051 × maximum femur length – 6.690	0.859	Up to 15 years
Age = 0.560 × vertical diameter of the femur head – 7.890	0.890	Up to 15 years

Odhad věku nedospělých jedinců

(Stloukal 1999)



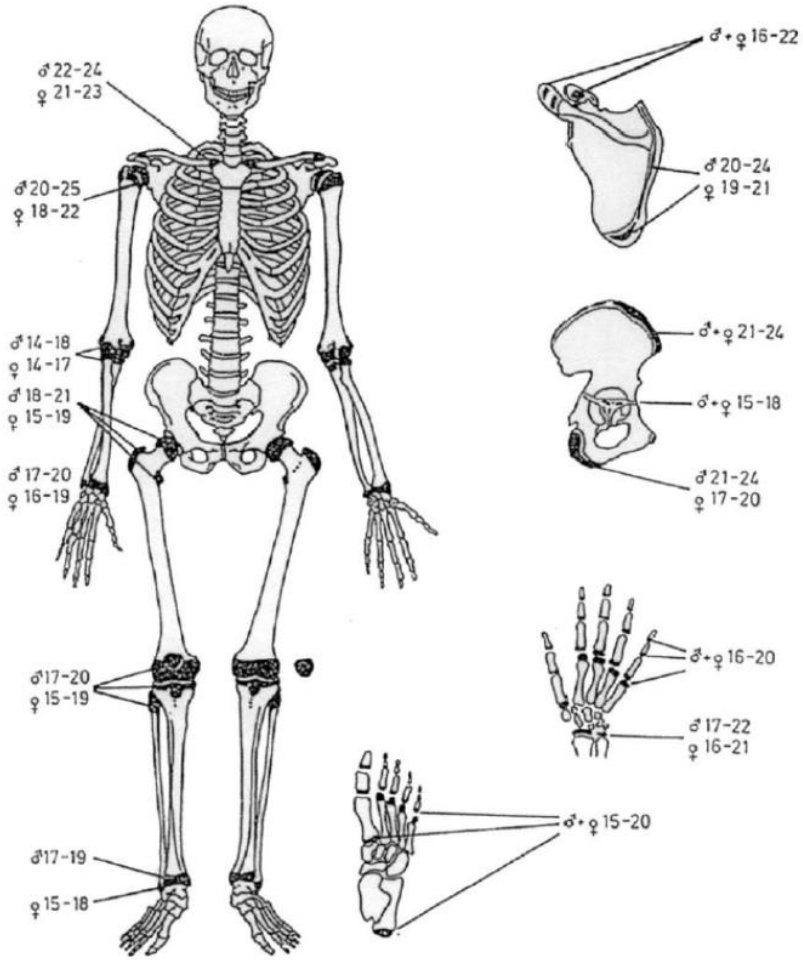
1 loketní kloub
2 pánevní kost
3 hlezenní kloub
4 kolenní kloub
5 zápěstí
6 ramenní kloub

Obr. 1

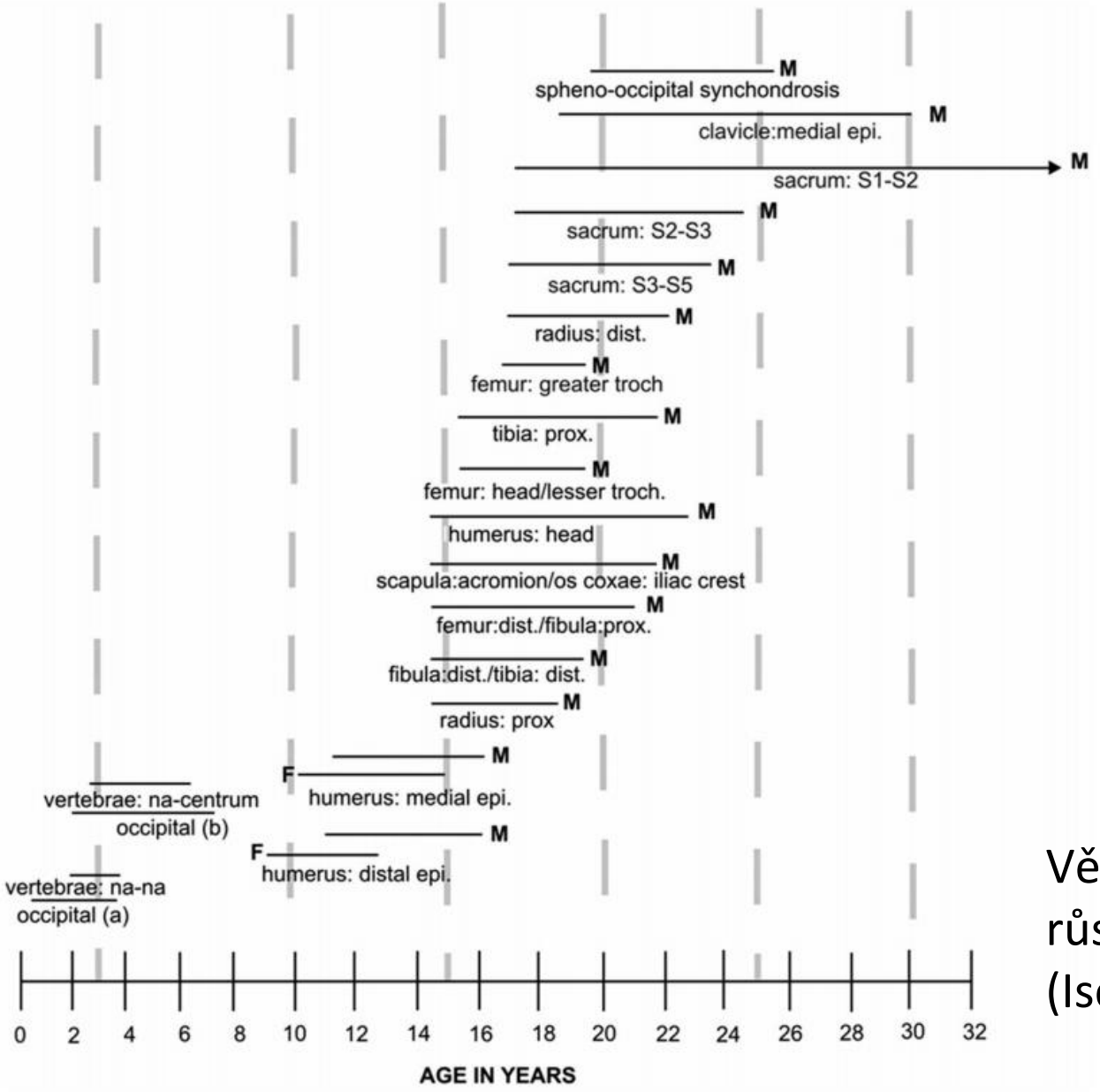
FEREMBACH, Denise, I SCHWINDEZKY a M STOUKAL, 1980. Recommendation for age and sex diagnoses of skeletons. Journal of human evolution. 9, 517–549.

BROTHWELL, Don R., 1981. *Digging up bones: the excavation, treatment, and study of human skeletal remains*. 3rd ed., rev.updated. Ithaca, N.Y. : [London]: Cornell University Press ; British Museum (Natural History). ISBN 0-8014-9875-9.

původ dat je nejasný



Odhad věku nedospělých jedinců



Věkový rozsah uzavírání růstových zón
(Iscan a Steyn 2013)

Odhad věku nedospělých jedinců

COQUEUGNIOT, Hélène a Timothy D. WEAVER, 2007. Brief communication: Infracranial maturation in the skeletal collection from Coimbra, Portugal: New aging standards for epiphyseal union. *American Journal of Physical Anthropology*. 134(3), 424–437. ISSN 00029483, 10968644.

7–29 let

137 jedinců (68 m, 69 ž), Coimbra Collection

http://osteomics.com/SSAGE/

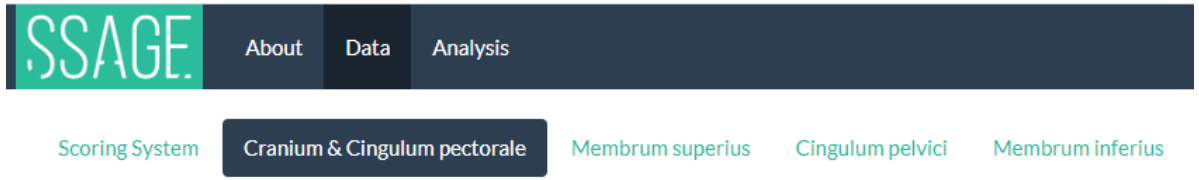
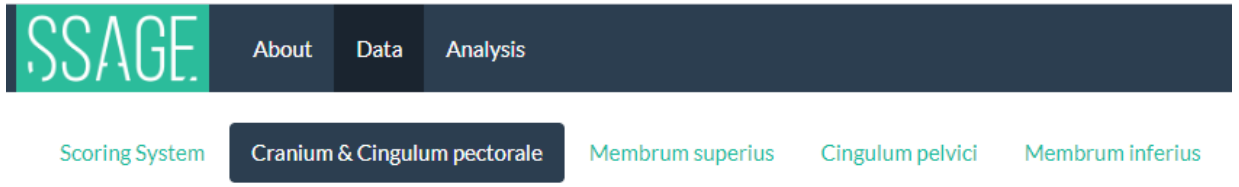


TABLE 1. Number of skeletal elements for each locus and fusion stage by sex with the list of abbreviations used

Cranial and infracranial locus	Abbreviations	Female			Male	
		a	b	c	a	b
Ilium pubis	Il_Pu	28	5	103	16	23
Upper ischium pubis	U_Is_Pu	27	5	104	18	8
Lower ischium pubis	L_Is_Pu	8	2	126	6	3
Ischium ilium	Is_Il	27	10	99	15	10
Iliac crest	Ic	49	35	49	35	27
Ischial tuberosity	It	28	53	54	24	38
Anterior inferior iliac spine	Aiis	24	5	102	18	9
Medial sacral segments 1–2	M_SS_1_2	24	33	11	24	35
Lateral sacral segments 1–2	L_SS_1_2	15	17	34	10	17
Posterior sacral segments 1–2	P_SS_1_2	17	9	41	12	13
Medial sacral segments 2–3	M_SS_2_3	14	19	35	9	27
Lateral sacral segments 2–3	L_SS_2_3	10	19	32	6	16
Posterior sacral segments 2–3	P_SS_2_3	8	6	52	6	3
Medial sacral segments 3–4	M_SS_3_4	13	17	38	8	25
Lateral sacral segments 3–4	L_SS_3_4	8	12	36	6	12
Posterior sacral segments 3–4	P_SS_3_4	7	10	49	9	5
Medial sacral segments 4–5	M_SS_4_5	12	21	31	8	24
Lateral sacral segments 4–5	L_SS_4_5	2	3	37	1	5
Posterior sacral segments 4–5	P_SS_4_5	7	11	45	7	11
Coracoid	Crd	24	4	106	13	11
Acromion	Acm	35	8	74	22	15
Sternal end	Ster	64	48	22	58	45
Humerus head	Hum_Hd	41	20	70	34	25
Humerus medial epicondyle	Hum_Me	27	1	102	17	7
Humerus distal end	Hum_De	26	0	106	12	5
Radius proximal end	Rad_Pe	26	6	105	19	11
Radius distal end	Rad_De	41	20	75	37	18
Ulna proximal end	Uln_Pe	26	2	109	17	7
Ulna proximal end	Uln_De	44	11	76	42	7
Femur head	Fem_Hd	28	29	78	21	33
Femur greater trochanter	Fem_Gt	28	12	93	23	13
Femur lesser trochanter	Fem_Lt	28	9	97	22	16
Femur distal end	Fem_De	37	14	85	31	15
Tibia proximal end	Tib_Pe	28	29	78	26	25
Tibia distal end	Tib_De	29	14	91	19	11
Fibula proximal end	Fib_Pe	27	17	76	26	15
Fibula distal end	Fib_De	31	23	80	24	24
Calcaneus posterior end	Clc_Pe	25	5	104	10	8
Spheno-Occipital synchondrosis	SOS	13	9	44	9	10

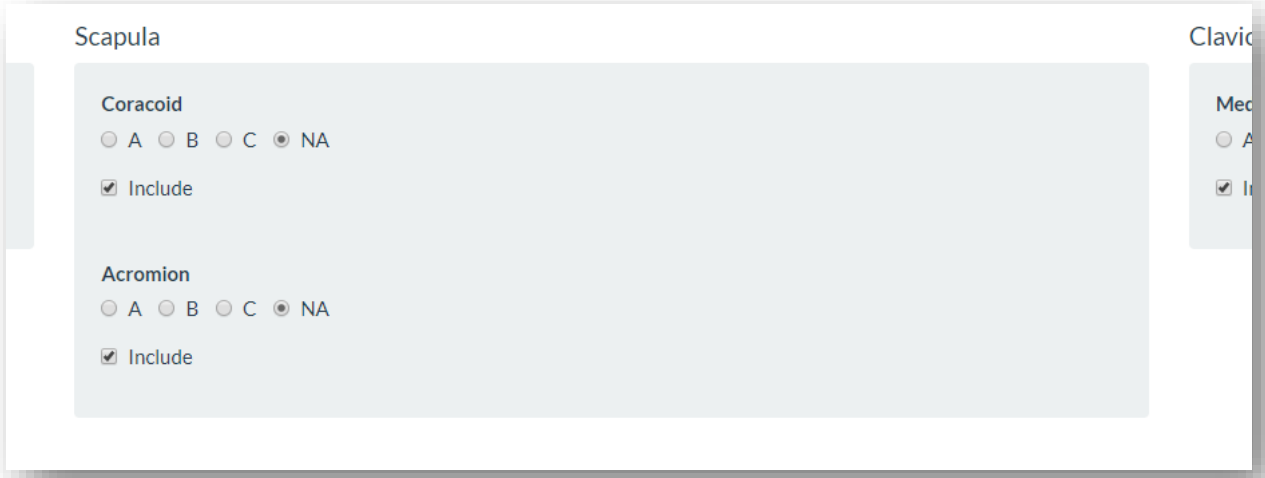
Coqueugniot a Weaver 2007



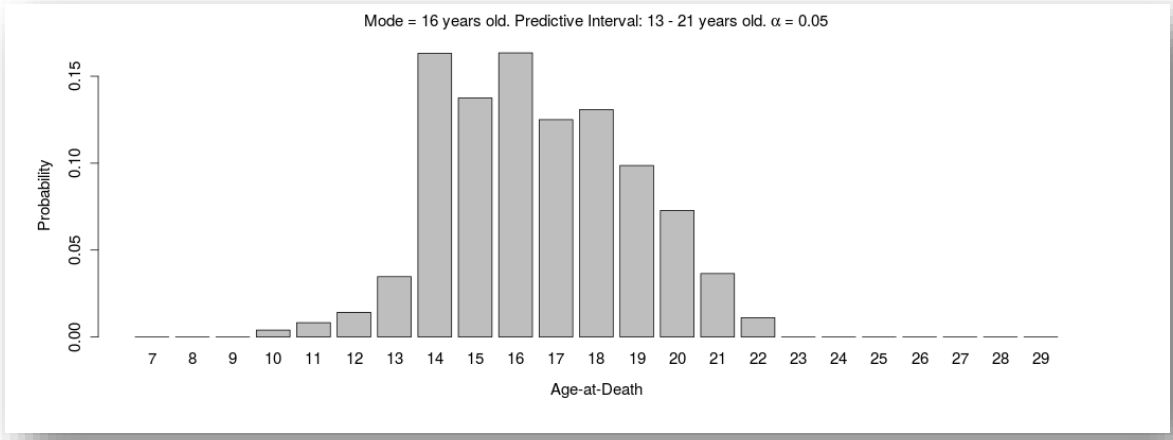
http://osteomics.com/SSAGE/

- http://osteomics.com/SSAGE/
- hodnocení stupně spojení epifýz

  A – volná
  B – částečně přirostlá (ne volná, ne přirostlá)
  C – úplný srůst
  NA – nelze spolehlivě hodnotit

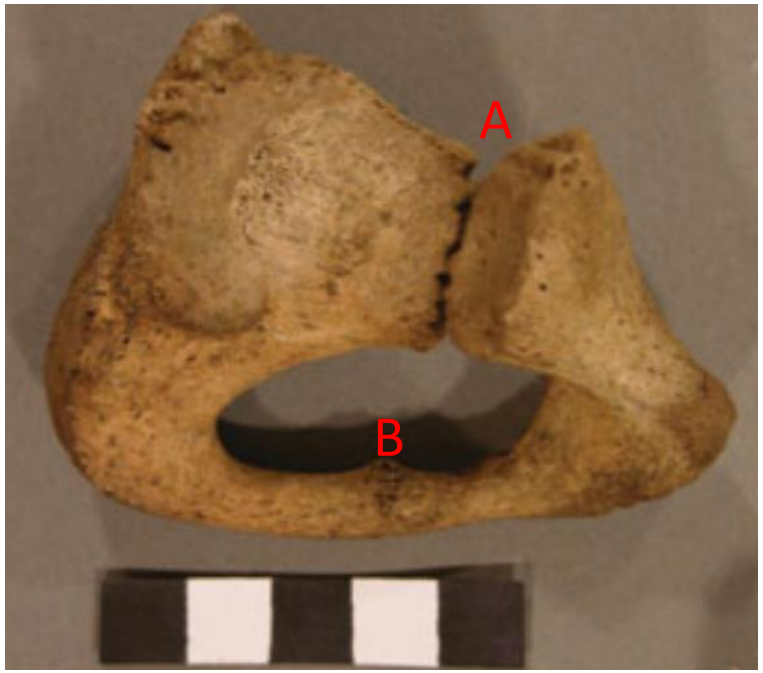


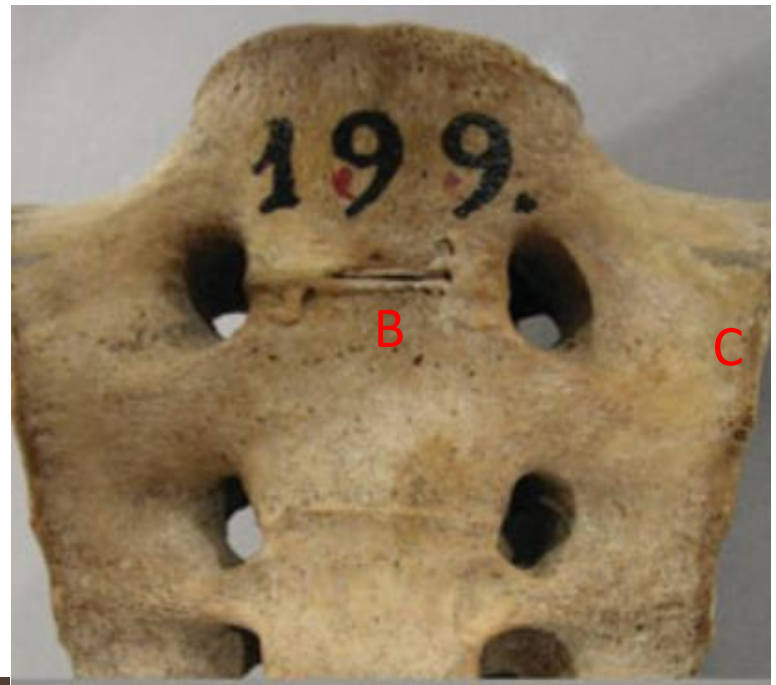
vyplnění hodnot



- distribuce pravděpodobností, že jedinec s pozorovaným stupněm fúze je daného věku

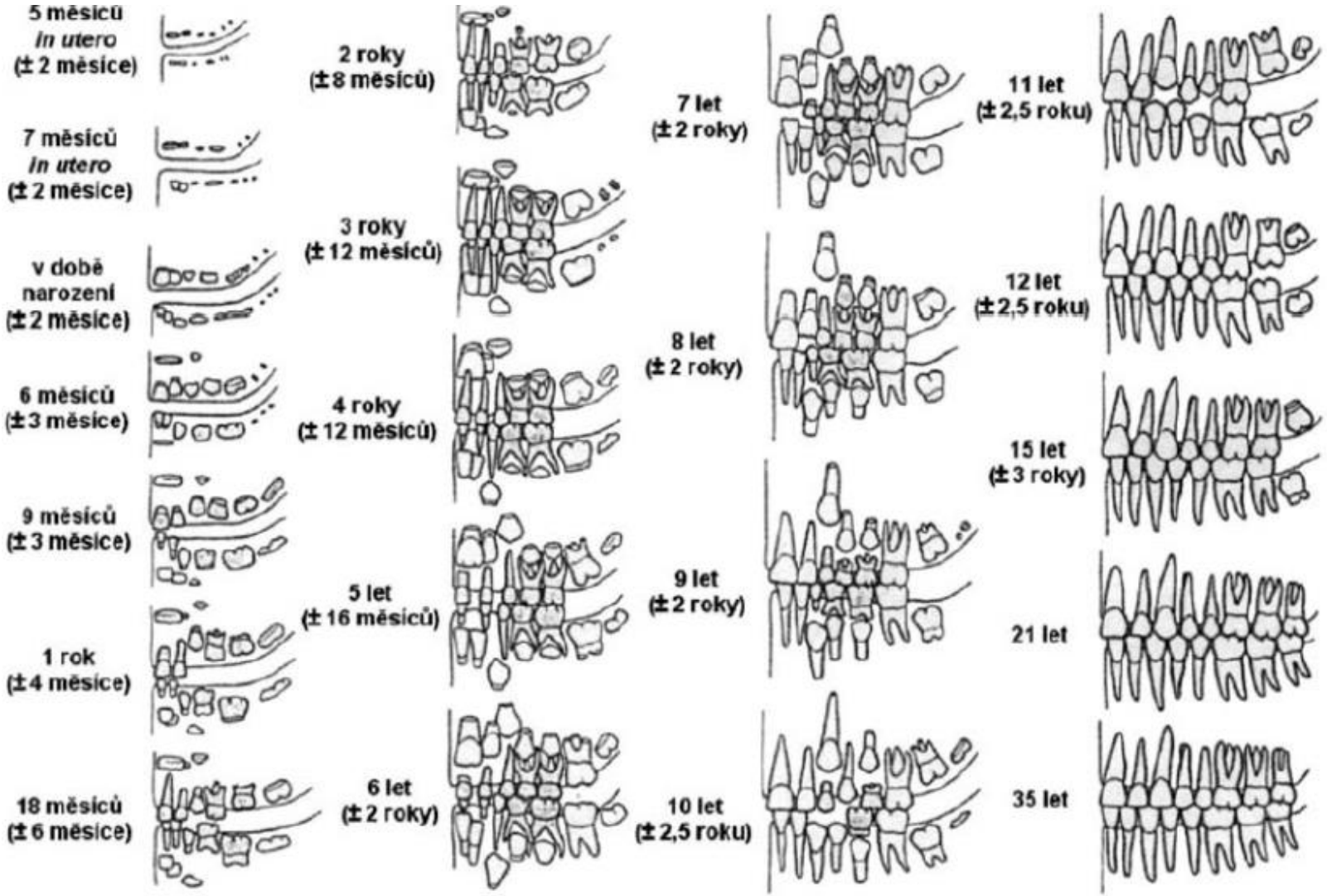
Coqueugniot a Weaver 2007 – příklady fází





Odhad věku nedospělých jedinců

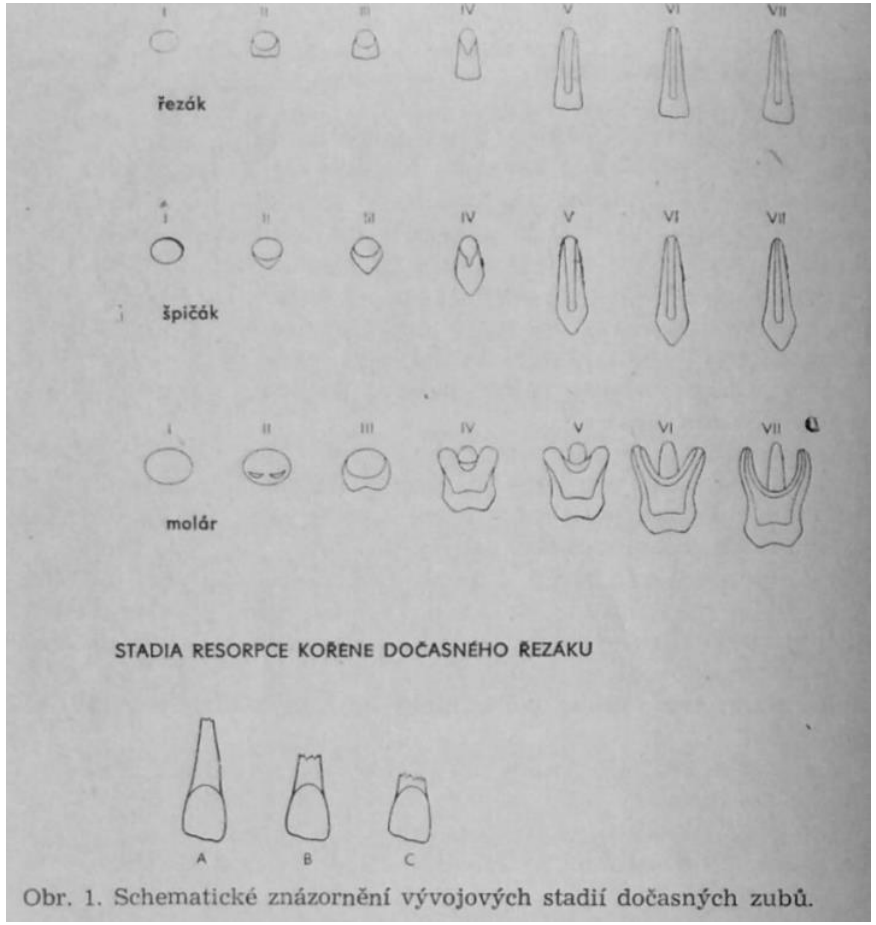
UBELAKER, Douglas H, 1987. Estimating age at death from immature human skeletons: an overview. *Journal of forensic sciences*. 32(5), 1254–1263.



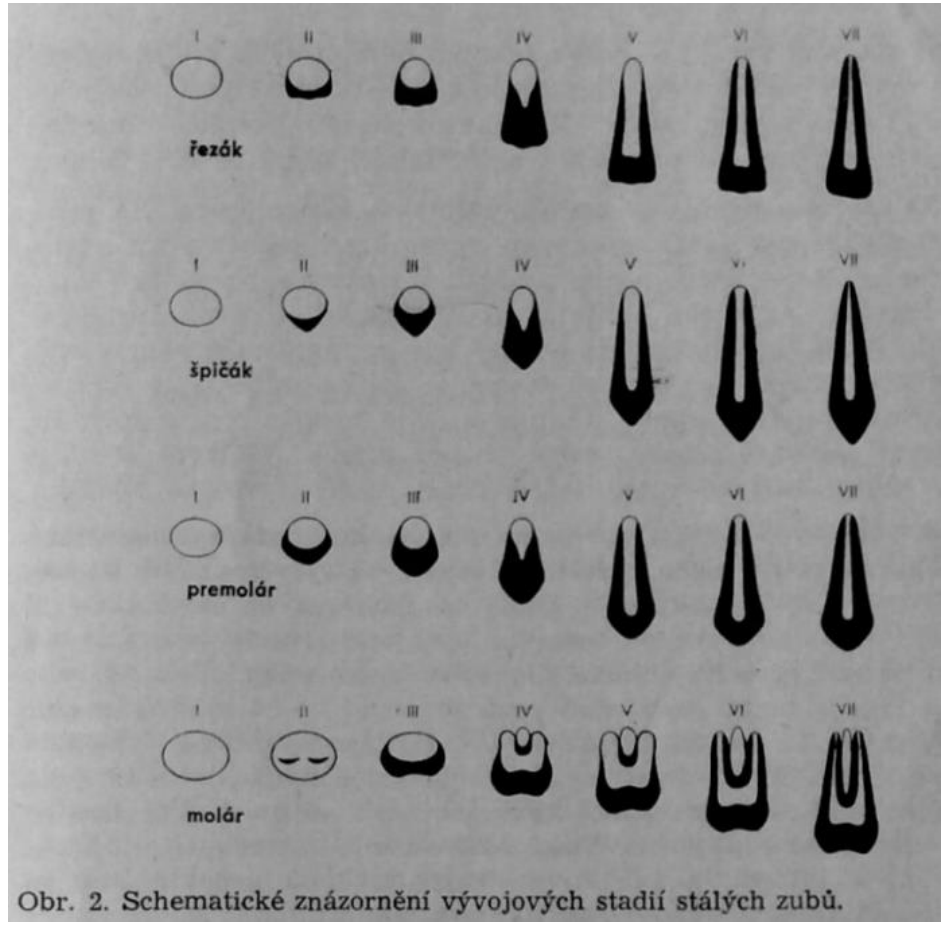
Odhad věku nedospělých jedinců

KOMÍNEK, Jaroslav a Eva ROZKOVCOVÁ, 1984. Metoda určování zubního věku a její význam pro praxi. *Pokroky ve stomatologii*. **2**, 175–208.

RTG snímky českých dětí,
(15 M, 15 Ž v každé věkové skupině)
odhad do 15 let věku



Obr. 1. Schematické znázornění vývojových stadií dočasných zubů.



Obr. 2. Schematické znázornění vývojových stadií stálých zubů.

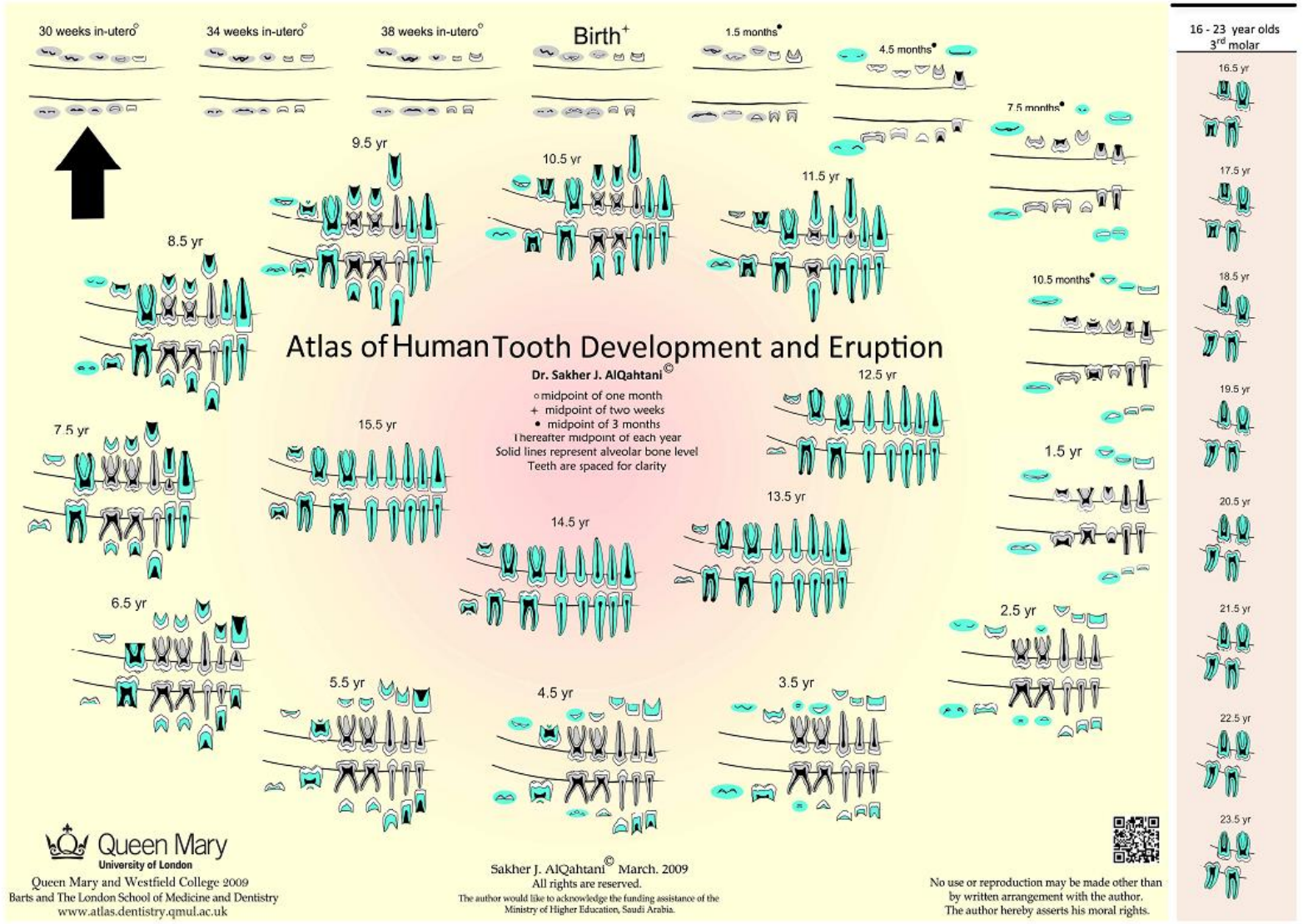
Odhad věku nedospělých jedinců

ALQAHTANI, S.J., M.P. HECTOR a H.M. LIVERSIDGE, 2010. Brief communication: The London atlas of human tooth development and eruption. *American Journal of Physical Anthropology*. 142(3), 481–490. ISSN 00029483, 10968644.

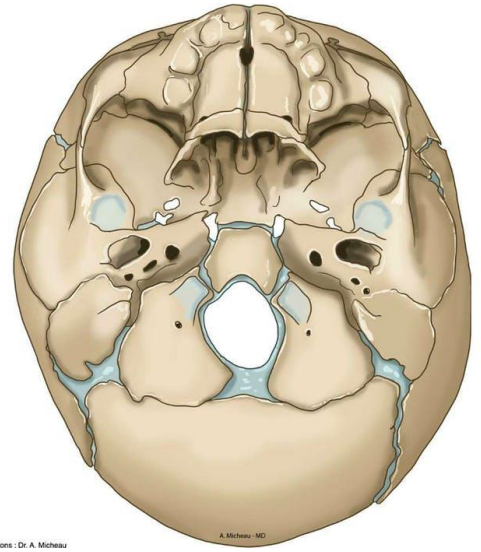
704 jedinců (368 M, 336 Ž); UK

28t nitroděložní – 23 let

https://atlas.dentistry.qmul.ac.uk/index.php?NOLOGIN=TRUE



Dospělý/nedospělý



uzavření synchondrosis sphenooccipitalis

BASSED, Richard B., C. BRIGGS a Olaf H. DRUMMER, 2010. Analysis of time of closure of the spheno-occipital synchondrosis using computed tomography. *Forensic Science International*. 200(1–3), 161–164. ISSN 03790738.

> „Results show that fusion was well underway by the age of 15 years and was complete by 17 years.“

SHIRLEY, Natalie R. a Richard L. JANTZ, 2011. Spheno-Occipital Synchondrosis Fusion in Modern Americans: BASILAR SYNCHONDROSIS. *Journal of Forensic Sciences*. 56(3), 580–585. ISSN 00221198.

> „The maximum likelihood estimates from the transition analysis indicate that females are most likely to transition from open to closing at 11.4 years and males at 16.5 years. Females transition from closing to closed at 13.7 years and males at 17.4 years.“

Uzavírání kraniálních sutur

ACSÁDI, G. a J. NEMESKÉRI, 1970. *History of Human Life Span and Mortality* [online]. B.m.: Akadémiai Kiadó.

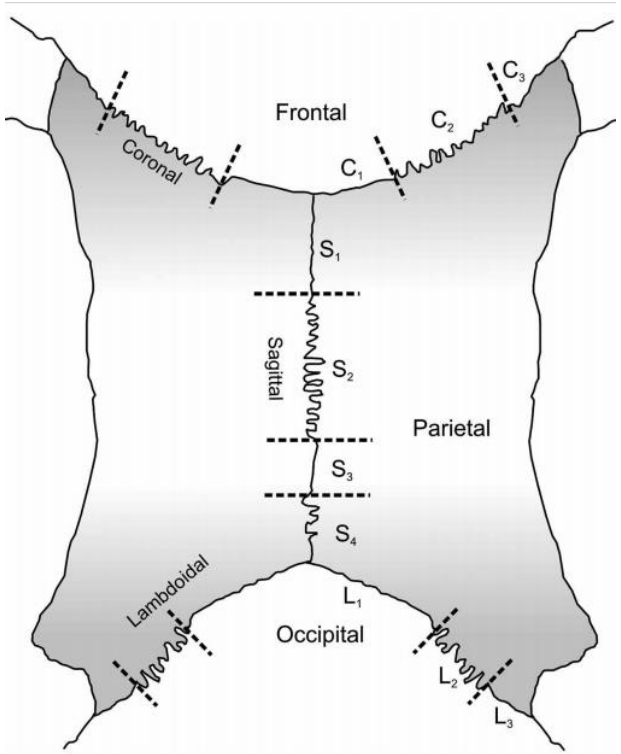
- celkem 16 oblastí, skórovaných podle stupně uzavření s následným výpočte průměrné hodnoty
- unisex

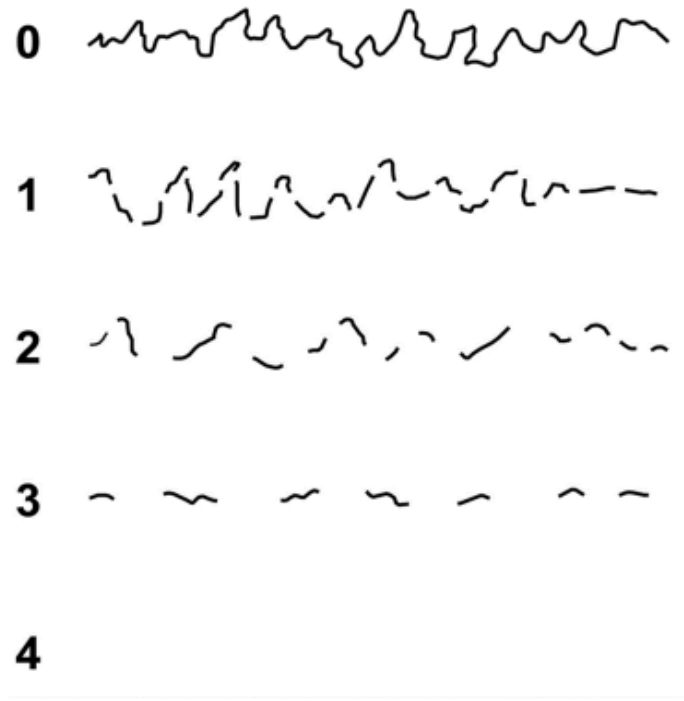
Table 3.17

Estimation of Age by Sutural Closure

Mean Closure Stage	Mean Age	SD	Range	Age Category
0.4–1.5	28.6	13.08	15–40	Juvenile–young adult
1.6–2.5	43.7	14.46	30–60	Young–middle adult
2.6–2.9	49.1	16.40	35–65	Young–middle adult
3.0–3.9	60.0	13.23	45–75	Middle–old adult
4.0	65.4	14.05	50–80	Middle–old adult

Note: From Acsádi & Nemeskéri 1970, Table 32.





Uzavírání lebečních švů

PERIZONIUS, W.R.K., 1984. Closing and non-closing sutures in 256 crania of known age and sex from Amsterdam (a.d. 1883–1909). *Journal of Human Evolution*. 13(2), 201–216. ISSN 00472484.

256 jedinců, Nizozemci (174 M, 82 Ž)

- nad 50 roky nekorelují

Figure 3. Description of the f

Stage 0. Open suture. There is still a little space left between the edges of the adjoining bones.

Stage 1. Suture is closed, but clearly visible as a continuous, often zigzagging, line.

Stage 2. Suture line becomes thinner, has less zigzags and may be interrupted by complete closure.

Stage 3. Only pits indicate where the suture is located.

Stage 4. Suture completely obliterated, even its location cannot be recognized.

Table 3(a) **Mean endocranial closure stages of the three sutures in males**

Age (years) ♂	Mean endocranial closure stage						n
	Coronal suture		Sagittal suture		Lambdoid suture		
20–29	0·50	s.d. 0·24	1·50	s.d. 0·00	1·08	s.d. 0·12	2
30–39	2·49	1·61	3·06	1·03	1·54	0·90	4
40–49	3·52	0·63	3·35	0·63	2·70	1 03	20
50–59	3·73	0·58	3·54	0·44	3·05	0·78	34
60–69	3·56	0·97	3·43	0·84	2·89	0·83	47
70–79	3·92	0·17	3·58	0·31	3·30	0·44	50
80–89	3·72	0·50	3·43	0·39	2·99	0·80	17
90–99	—	—	—	—	—	—	—

Table 3(b) **Mean endocranial closure stages of the three sutures in females**

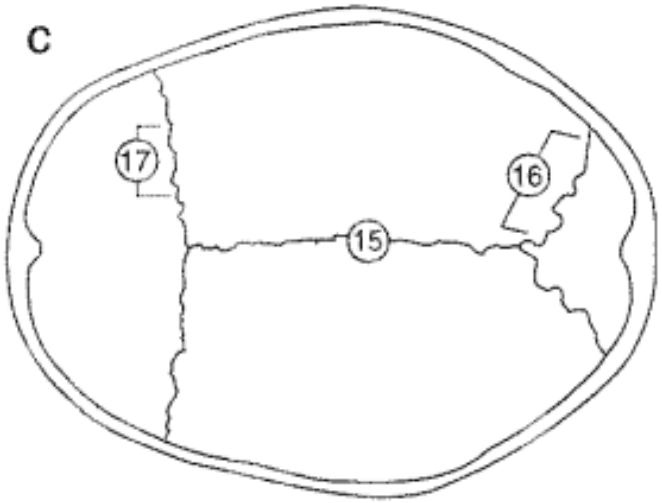
Age (years) ♀	Mean endocranial closure stage						n
	Coronal suture		Sagittal suture		Lambdoid suture		
20–29	1·67	s.d. 1·20	1·50	s.d. 0·66	0·94	s.d. 0·82	3
30–39	2·40	1·01	2·70	0·74	1·23	0·98	5
40–49	3·86	0·34	3·58	0·30	2·75	0·98	6
50–59	3·48	1·11	3·38	0·89	2·57	1·05	14
60–69	3·80	0·42	3·60	0·31	3·08	0·72	20
70–79	3·79	0·61	3·64	0·49	2·48	1·04	24
80–89	3·92	0·13	3·47	0·31	2·42	1·03	8
90–99	3·75	0·35	3·38	1·18	1·33	0·47	2

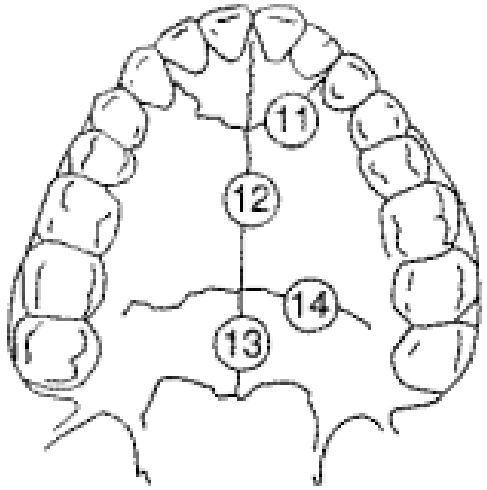
Uzavírání lebečních švů

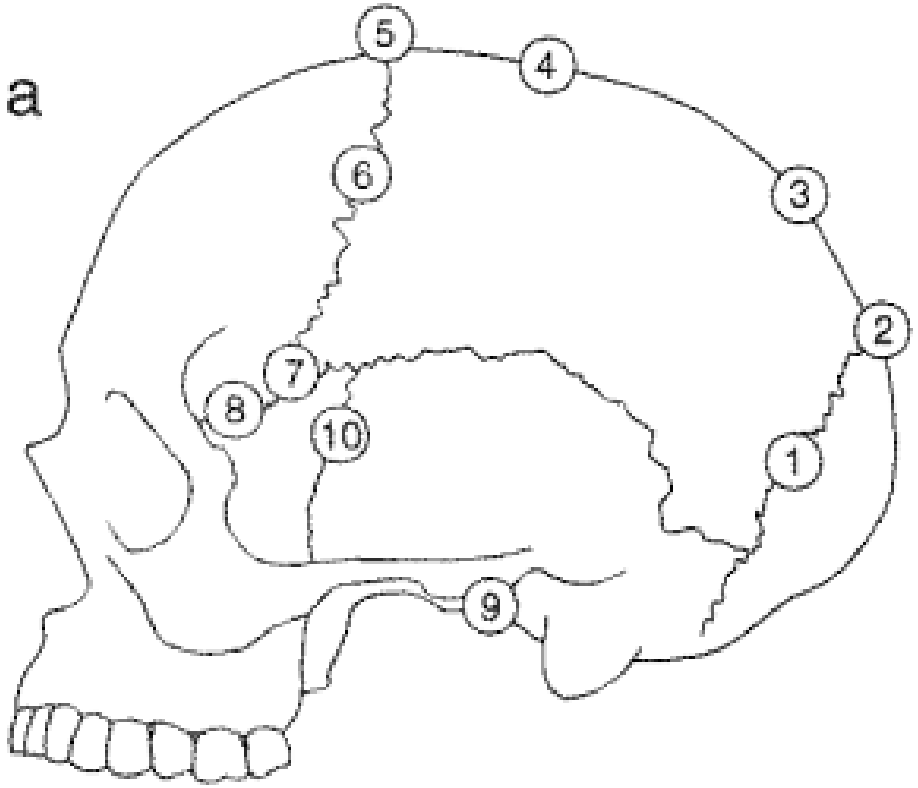
MEINDL, Richard S. a C. Owen LOVEJOY, 1985. Ectocranial suture closure: A revised method for the determination of skeletal age at death based on the lateral-anterior sutures. *American Journal of Physical Anthropology*. 68(1), 57–66. ISSN 0002-9483, 1096-8644.

236 jedinců (? M, ? Ž) Hamann-Todd collection,
Cleveland Museum of Natural History

- 10 ektokraniálních oblastí, 4 tvrdého patra a 3 endokraniální







Uzavírání lebečních švů

Meindl a Lovejoy 1985

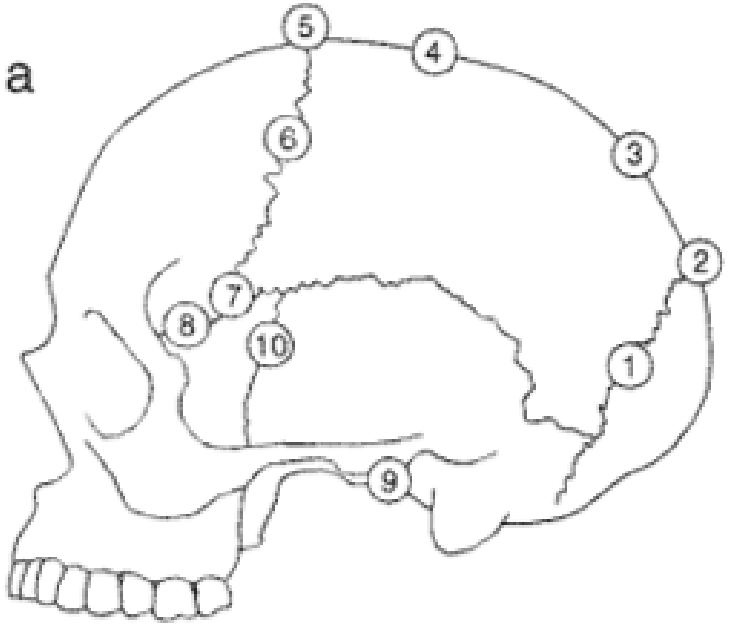
blank = Unobservable

0 = Open. There is no evidence of any ectocranial closure at the site.

1= Minimal Closure. Some closure has occurred. Score is assigned to any minimal to moderate closure, i.e. from a single bony bridge across the suture to about 50% synostosis at the site.

2 = Significant Closure. There is a marked degree of closure but some portion of the site is still not completely fused.

3 = Complete Obliteration. The site is completely fused.



lateral-anterior system – 6, 7, 8, 9, 10

vault system – 1–7

-> výpočet kompozitního skóre (suma hodnot)

-> přiřazení fáze

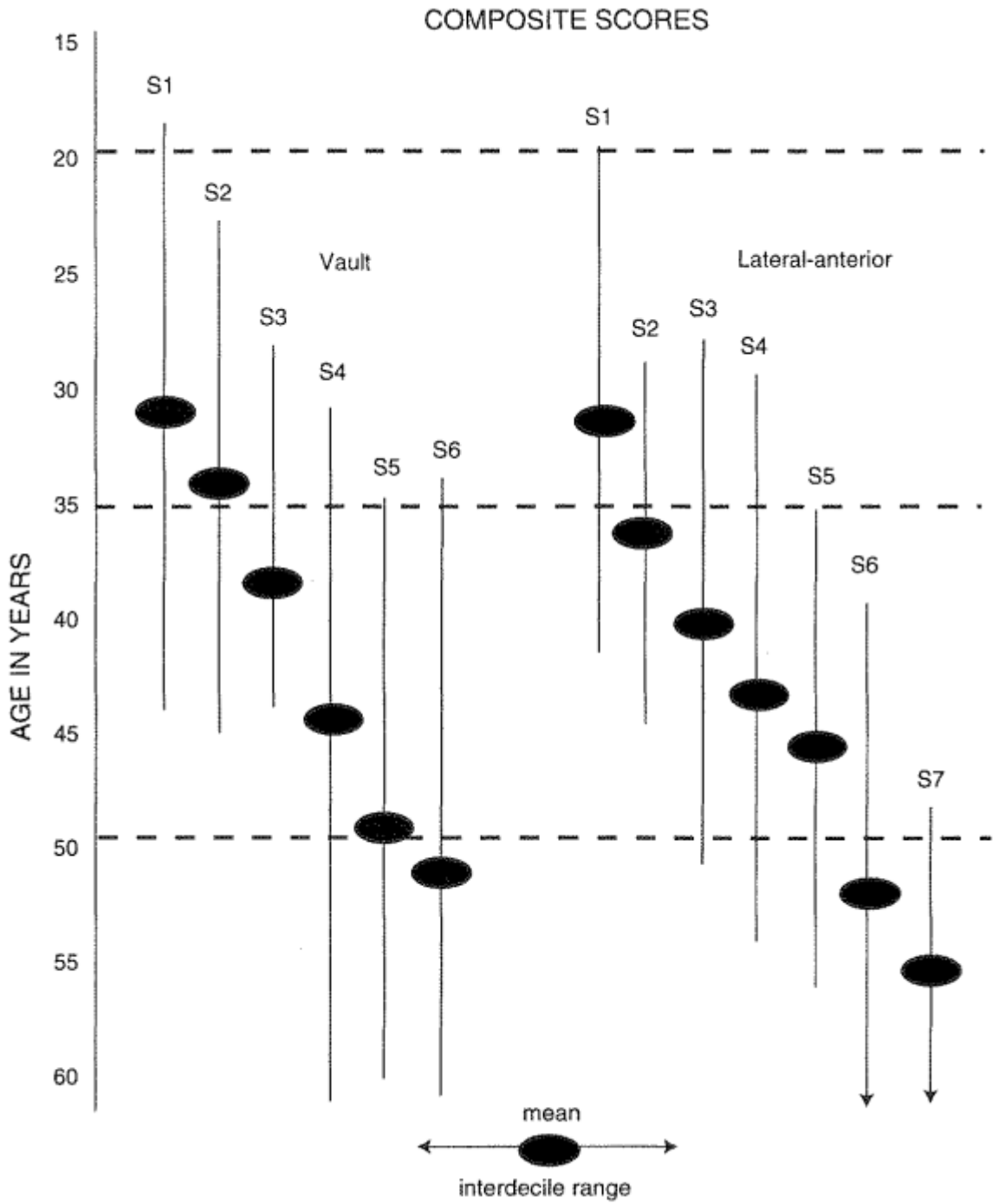
VAULT	
Composite Score	"S"
1-2	S1
3-6	S2
7-11	S3
12-15	S4
16-18	S5
19-20	S6

LATERAL-ANTERIOR	
Composite Score	"S"
1	S1
2	S2
3-5	S3
6	S4
7-8	S5
9-10	S6
11-14	S7

Uzavírání lebečních švů

Meindl a Lovejoy 1985

- ovály značí průměry, linie 1. až 9. decil



Dospělý – facies symphysialis

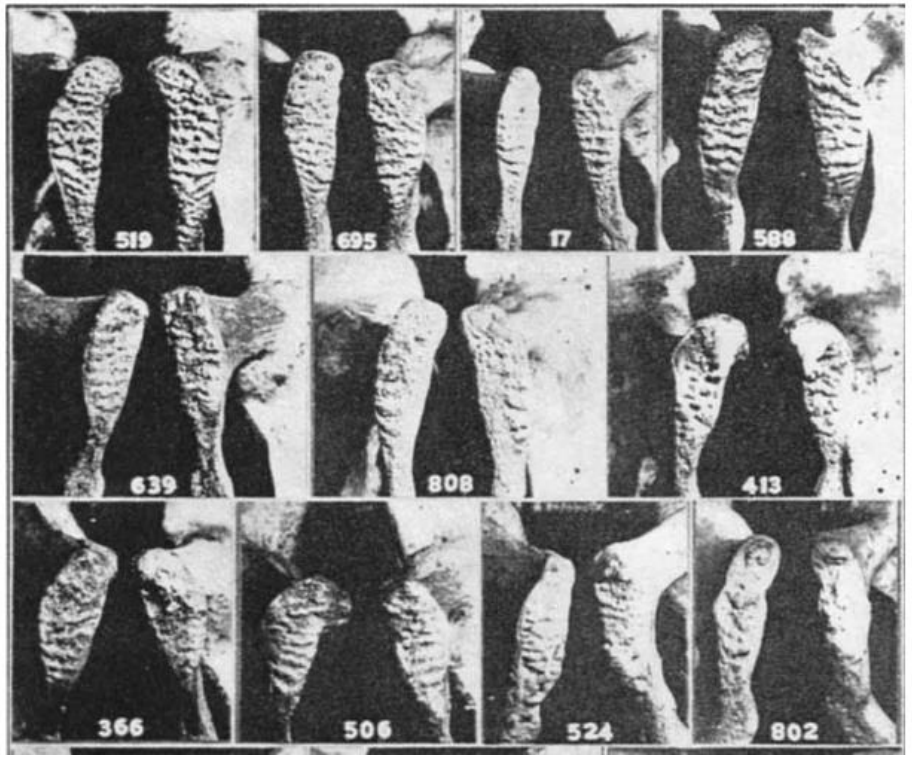
TODD, T. Wingate, 1920. Age changes in the pubic bone. I. The male white pubis. *American Journal of Physical Anthropology.* 3(3), 285–334. ISSN 0002-9483, 1096-8644.

232 jedinců; „white" (125 m, 10 f); „negroid" (68 m, 29 f)

TODD, T. Wingate, 1921. Age changes in the pubic bone. *American Journal of Physical Anthropology*. 4(1), 1–70. ISSN 00029483.

159 jedinců
„white female" (47)
„negro-white hybrid" (90 M, 22 Ž)

Hamann-Todd collection, Cleveland Museum of National history



Dospělý – facies symphysialis

BROOKS, S. a J. M. SUCHEY, 1990. Skeletal age determination based on the os pubis: A comparison of the Acsádi-Nemeskéri and Suchey-Brooks methods. *Human Evolution*. 5(3), 227–238. ISSN 0393-9375.

Součást KS: symfýza pánevní kosti
Metoda: vizuální
Populace: recentní; US, Mexiko, Evropa, Asie, Jižní Amerika

Dospělý – facies symphysialis

WINK, Alexandra E., 2014. Pubic Symphyseal Age Estimation from Three-Dimensional Reconstructions of Pelvic CT Scans of Live Individuals. *Journal of Forensic Sciences*. 59(3), 696–702. ISSN 00221198.

FIG. 4—*3D-computed tomography rendering of the pubic symphysis; Suchey–Brooks Phase III; 28-year-old female (PS018).*

DUDZIK, Beatrix a Natalie R. LANGLEY, 2015. Estimating age from the pubic symphysis: A new component-based system. *Forensic Science International*. 257, 98–105. ISSN 03790738.

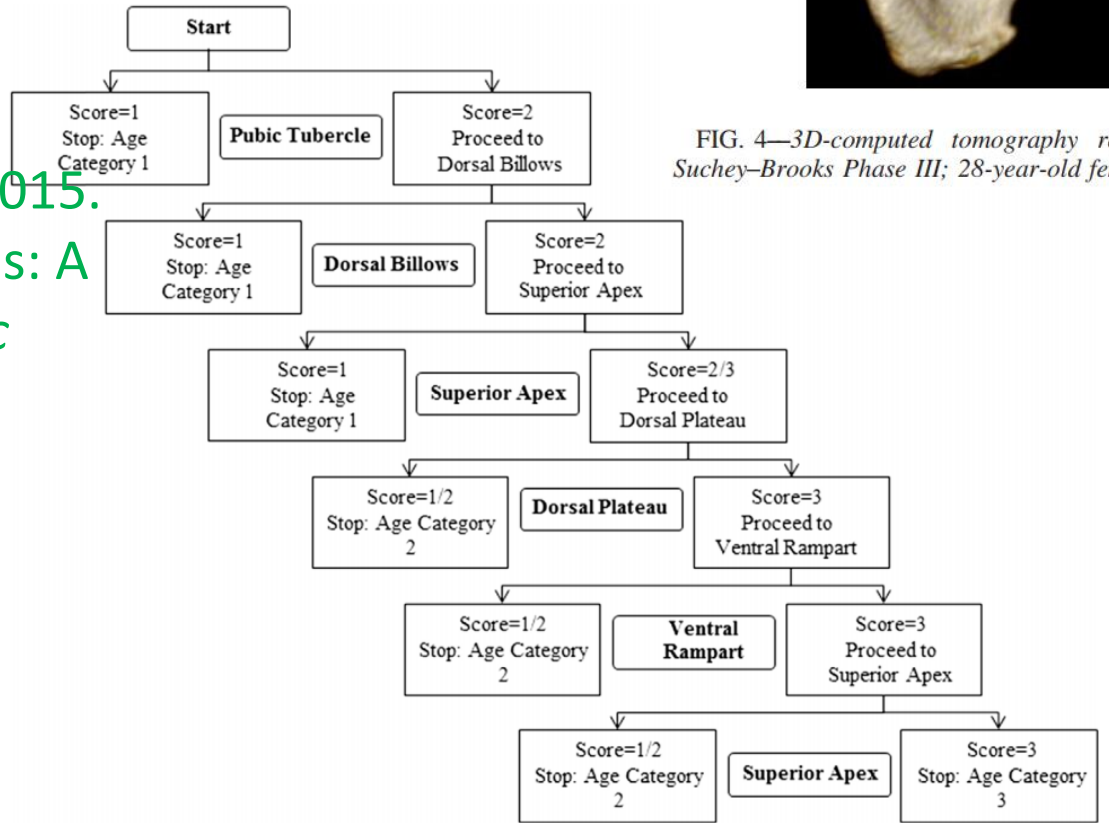


Fig. 6. Flow chart to be implemented by the practitioner.

284 jedinců (148 m, 83 ž)
4 moderní forenzní sbírky z USA

Dospělý – obrus zubů

ZUHRT, R, 1956. Stomatologische Untersuchungen an spatmittelalterlichen Funden von Reckahn (12.—14. Jh.). II. Parodontose und Zahnstellungsanomalien. *Dt. Zahn-, Mund-u. Kieferheilkde*. 25, 16.

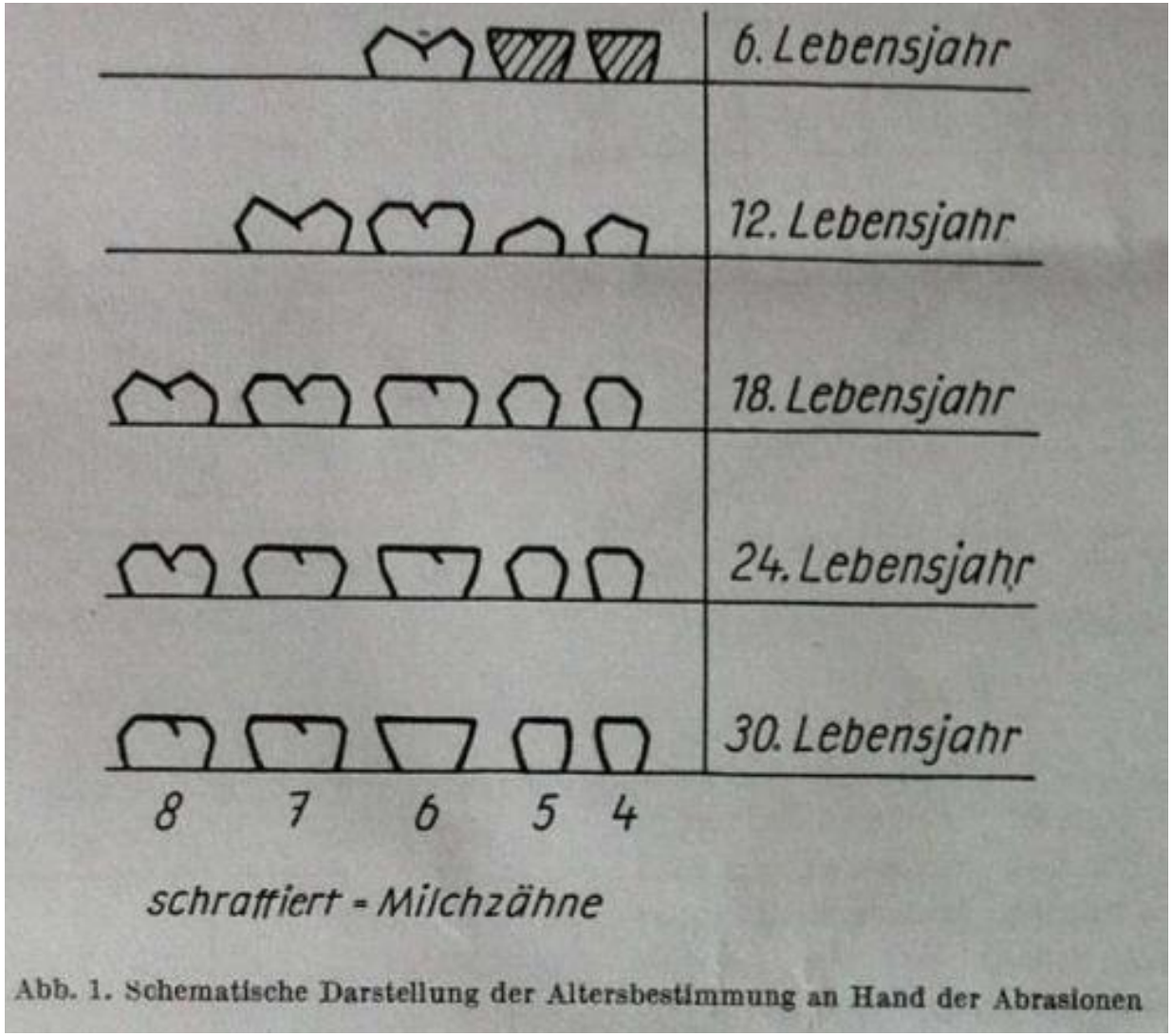


Abb. 1. Schematische Darstellung der Altersbestimmung an Hand der Abrasionen

Dospělý – obrus zubů

LOVEJOY, C. Owen, 1985. Dental wear in the Libben population: Its functional pattern and role in the determination of adult skeletal age at death. *American Journal of Physical Anthropology*. 68(1), 47–56. ISSN 0002-9483, 1096-8644.

332 jedinců
Libben population, USA (L&S)

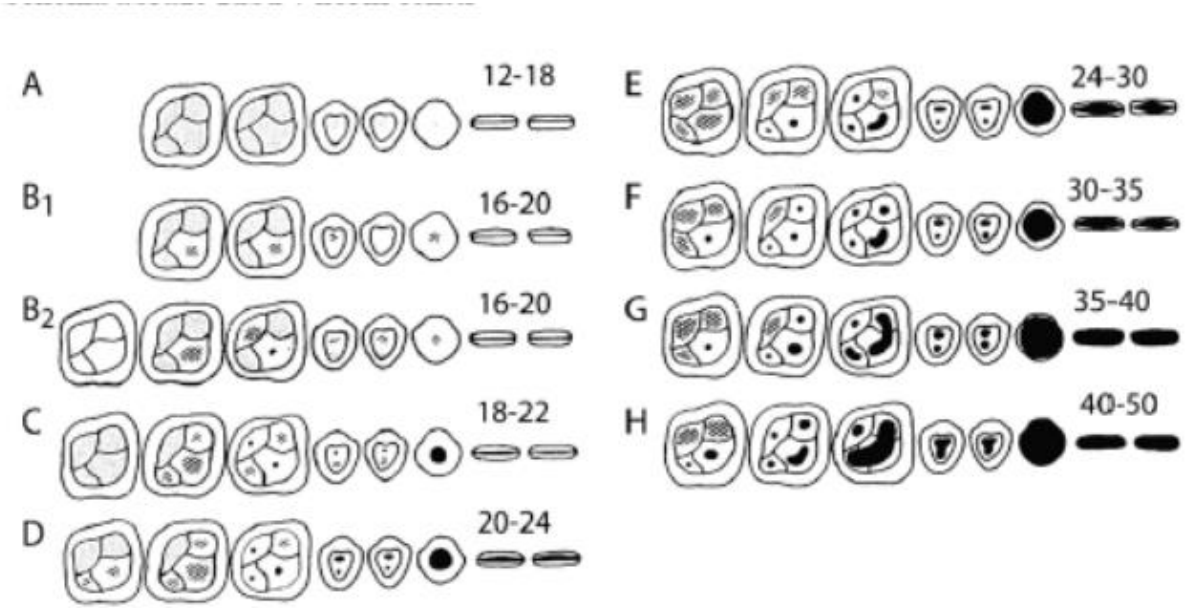
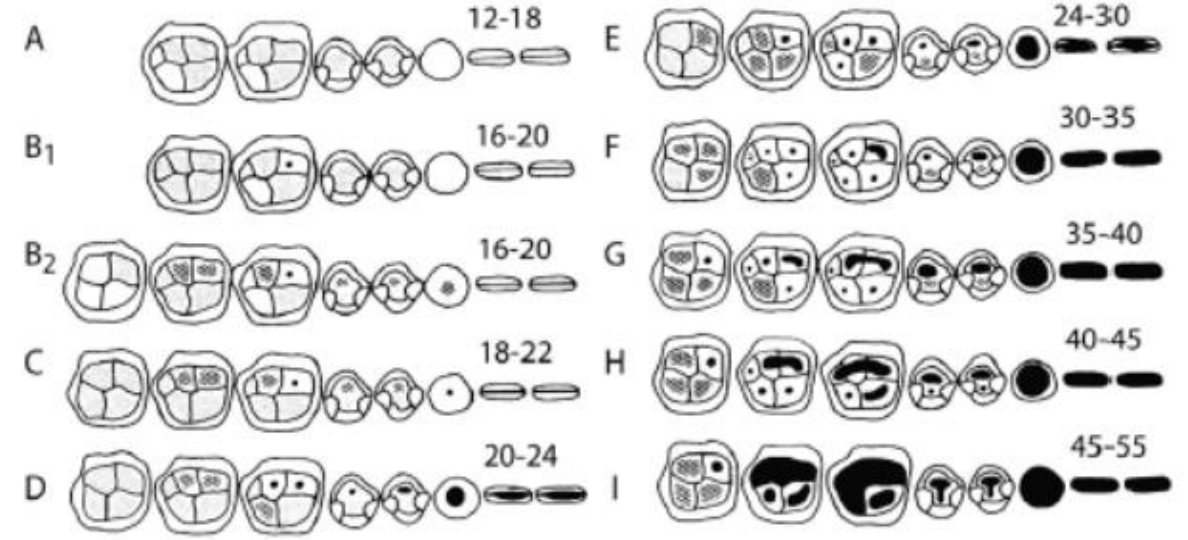


Schéma abraze zubů v dolní čelisti

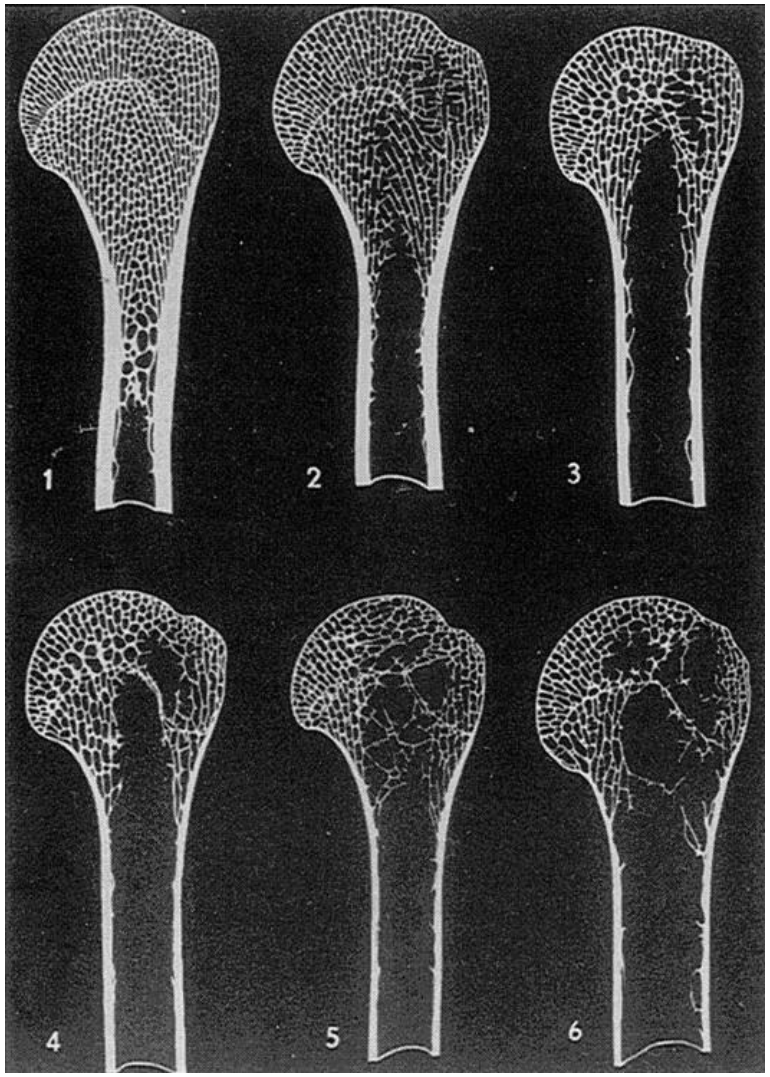


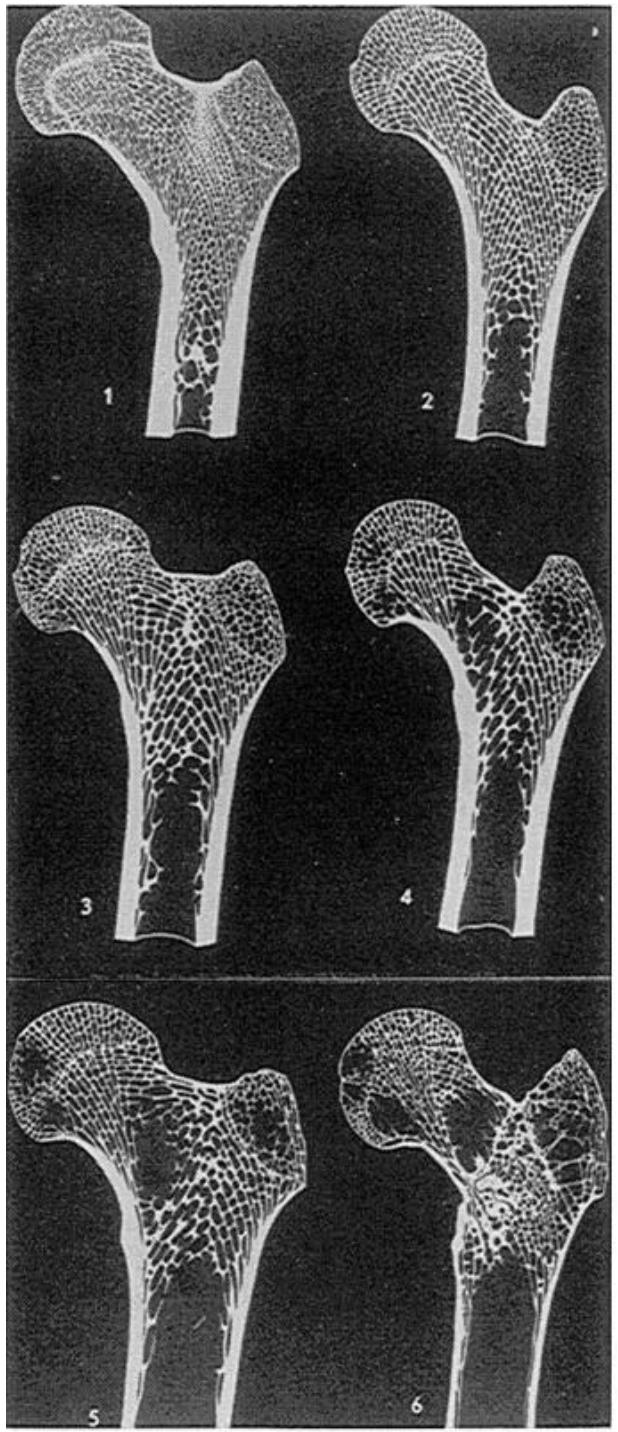
Dospělý – struktura spongiózy

ACSÁDI, G. a J. NEMESKÉRI, 1970. History of Human Life Span and Mortality. B.m.: Akadémiai Kiadó.

Hodnocení ústupu spongiózní kostní tkáně v proximálních epifýzách femuru a humeru.

- první změny se dají očekávat okolo 41. roku, a to na vrcholu dřeňové dutiny + změna struktury, vytváření dutin a ztenčování kortikální tkáně





Dospělý – struktura spongiózy

ACSÁDI, G. a J. NEMESKÉRI, 1970. History of Human Life Span and Mortality. B.m.: Akadémiai Kiadó.

- v pozdějších fázích užší intervaly
- mezipopulačně variabilní a také dimorfní

Table 3.20

Descriptive Statistics of Radiographic Age Estimation from the Proximal Epiphyses of the Humerus and Femur (Acsádi & Nemeskéri 1970)

Morpho-logical Phases	Mean Age	SD	Actual Range	Calculated Range (3 x SD)
Humerus				
I	41.1	6.60	18–68	21.3–60.9
II	52.3	2.51	24–68	44.8–59.8
III	59.8	3.59	37–86	49.0–70.5
IV	56.0	1.84	19–79	50.5–61.6
V	61.0	2.05	40–84	54.9–67.2
VI	61.1	3.39	38–84	50.9–71.2
Femur				
I	31.4	–	18–52	36.2–51.8
II	44.0	2.60	19–61	47.0–58.2
III	52.6	1.86	23–72	49.0–63.0
IV	56.0	2.32	32–86	56.8–69.9
V	63.3	2.17	38–84	56.9–78.7
VI	67.8	3.64	25–85	

(Îşcan a Steyn 2013)

Dospělý – struktura spongiózy

SZILVÁSSY, J. a H. KRITSCHER, 1990. Estimation of chronological age in man based on the spongy structure of long bones. *Anthropologischer Anzeiger; Bericht Uber Die Biologisch-Anthropologische Literatur*. 48(3), 289–298.

Institute of Forensic Medicine of the University of Vienna, Austria

Hodnotí se:
dosah horního konce dřeňové dutiny
struktura spongiózy
tvorba dutin v hlavici kosti, krčku a velkém chocholíku
relativní šířka kompakty

+ struktura silových trajektorií

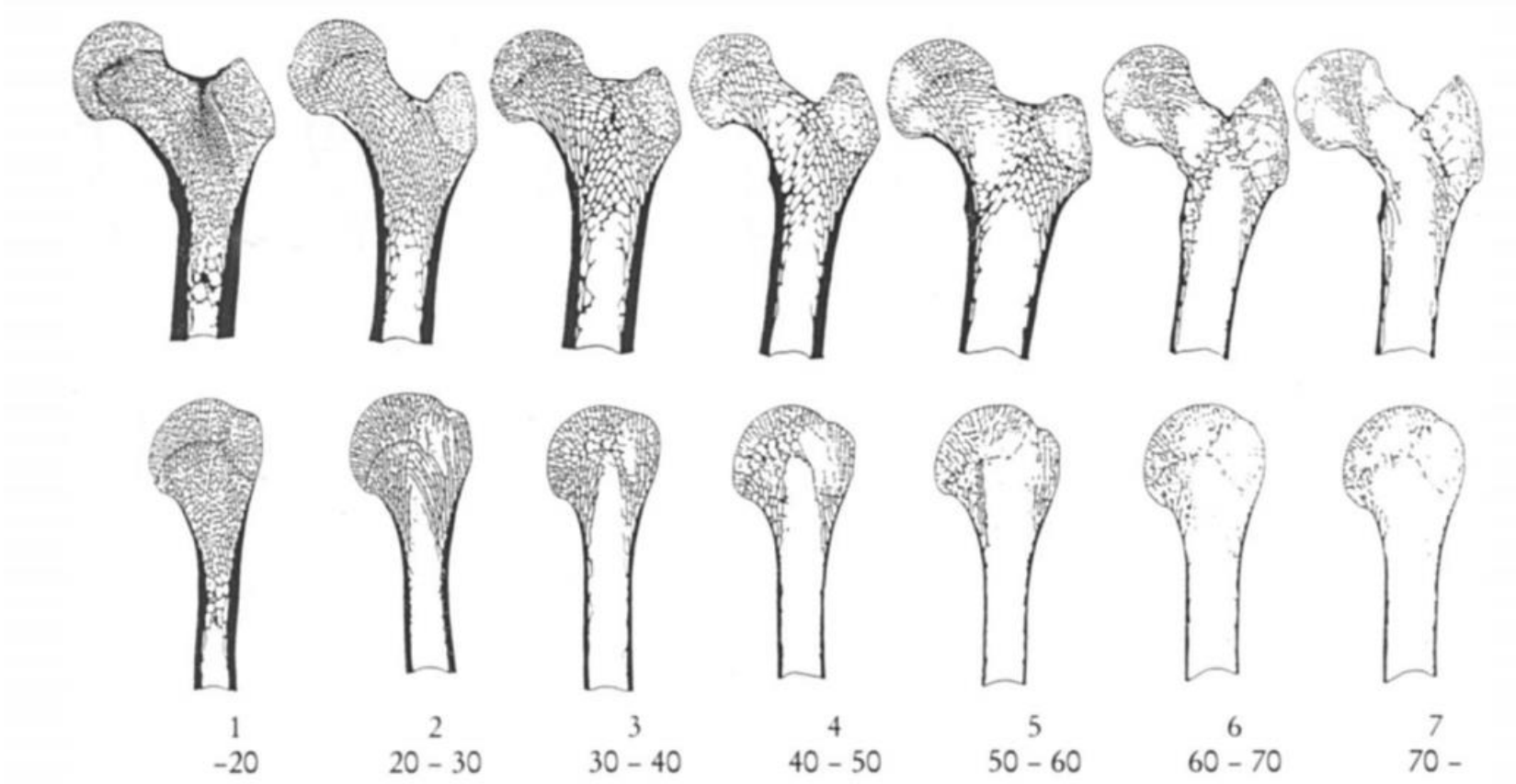
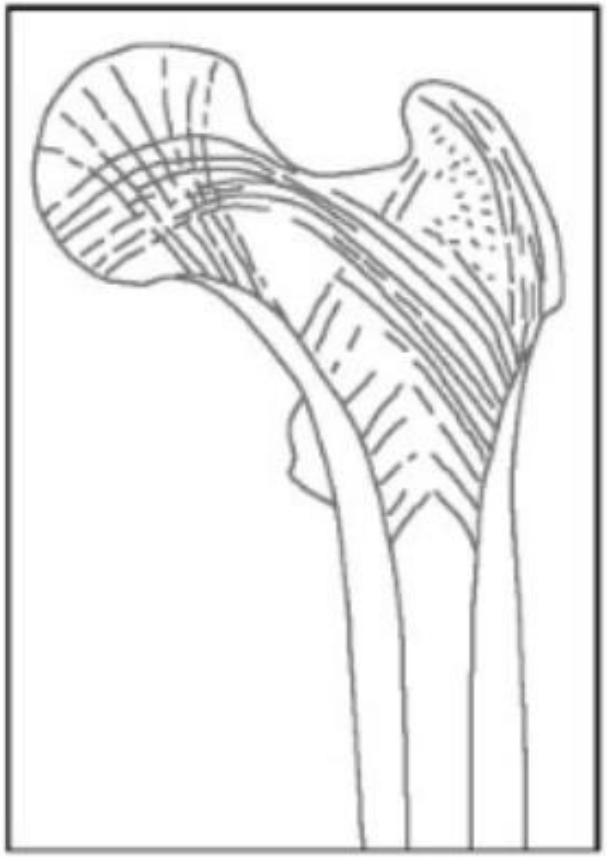


Fig. 1. Diagram showing the seven age-stages of the proximal femur and humerus.

Dospělý – struktura spongiózy

GEHRING, K.-D., H.-T. HAFFNER, D. WEBER a M. GRAW, 2002. Investigations on the reliability of determiningan individual's age from the proximal femur. *HOMO*. **52**(3), 214–220. ISSN 0018442X.

The results of the two investigators differed by **maximally 5 years in 64.4 %** of all cases examined; the average error of estimation amounted to 10.1–17.0 years. Only one-seventh of all cases examined could be precisely grouped into the 5-year class. Deviations of more than 15 years occurred in nearly one fourth of all cases.



Dospělý – facies auricularis

BUCKBERRY, J.L. a A.T. CHAMBERLAIN, 2002. Age estimatior from the auricular surface of the ilium: A revised method. *American Journal of Physical Anthropology*. 119(3), 231–23 ISSN 0002-9483, 1096-8644.

180 jedinců, Christ Church, Spitalfields, Natural History Museum, London, UK

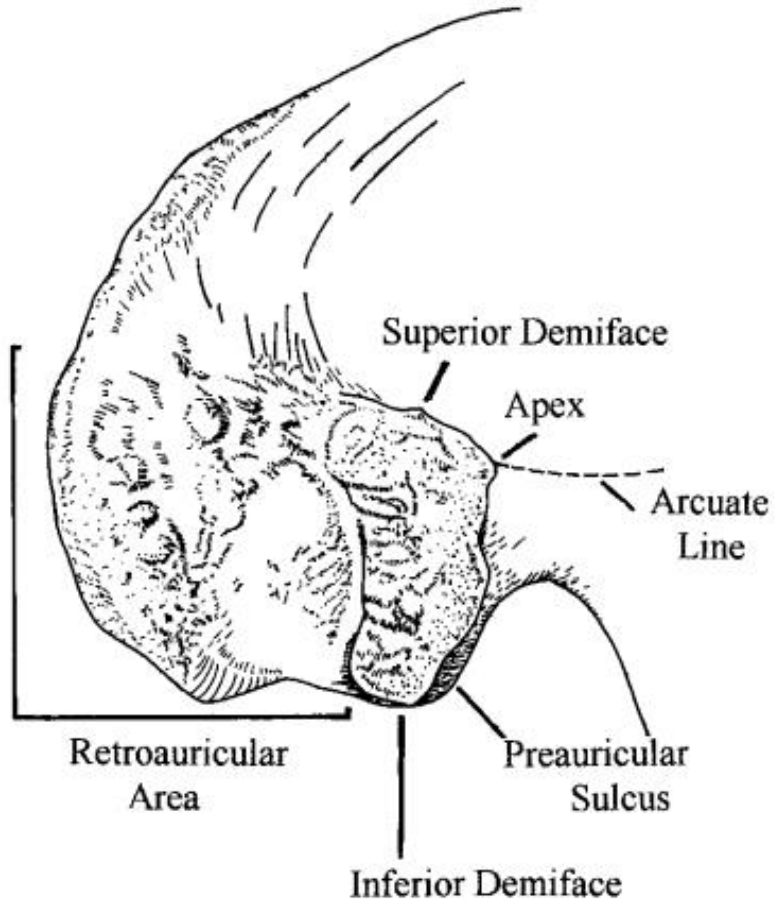
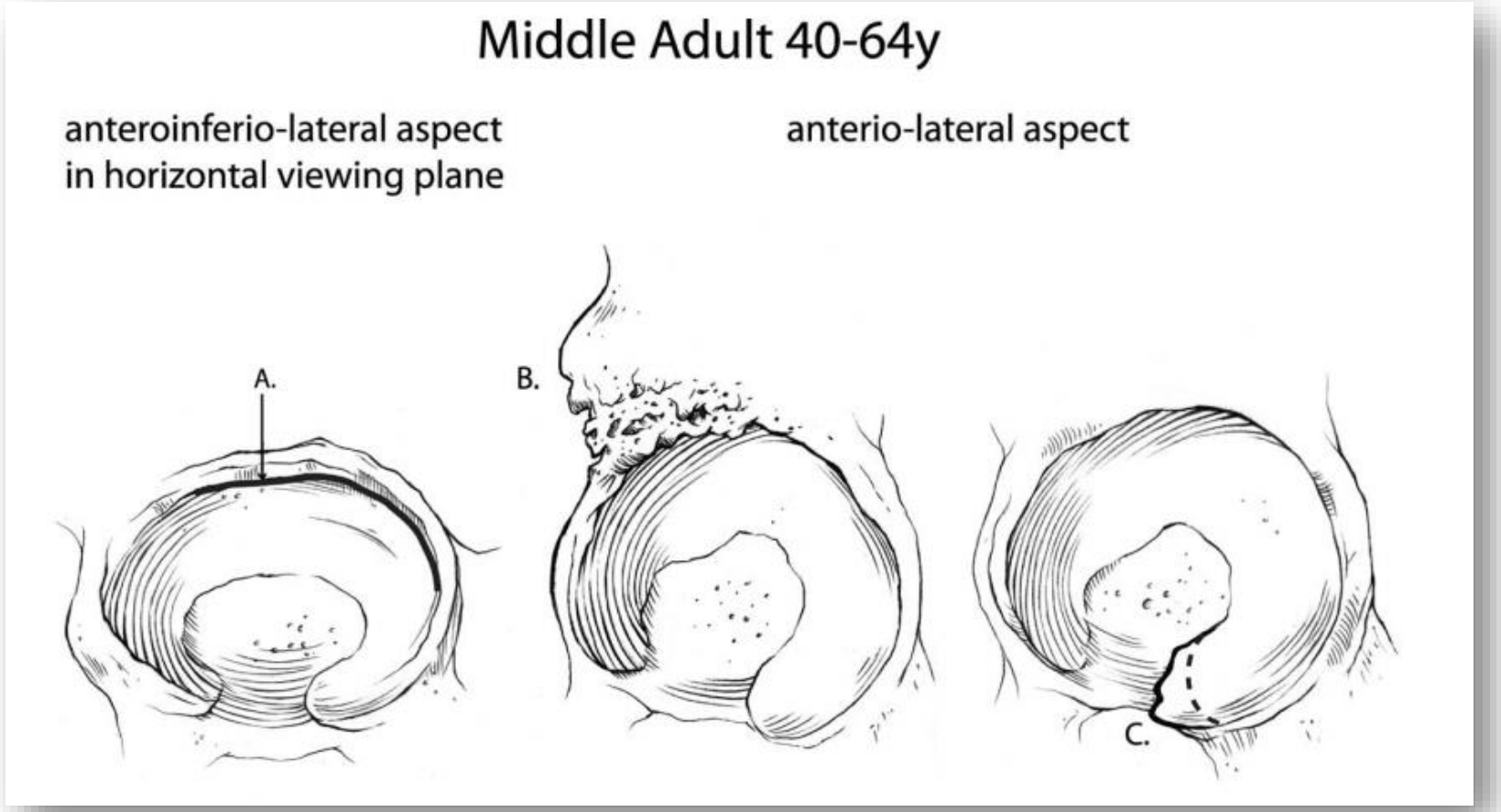


Fig. 1. Regions of the ilium used for auricular surface aging (redrawn after Lovejoy et al., 1985).

Dospělý – acetabulum

CALCE, Stephanie E., 2012. A new method to estimate adult age-at-death using the acetabulum. *American Journal of Physical Anthropology*. 148(1), 11–23. ISSN 00029483.

100 jedinců (M)

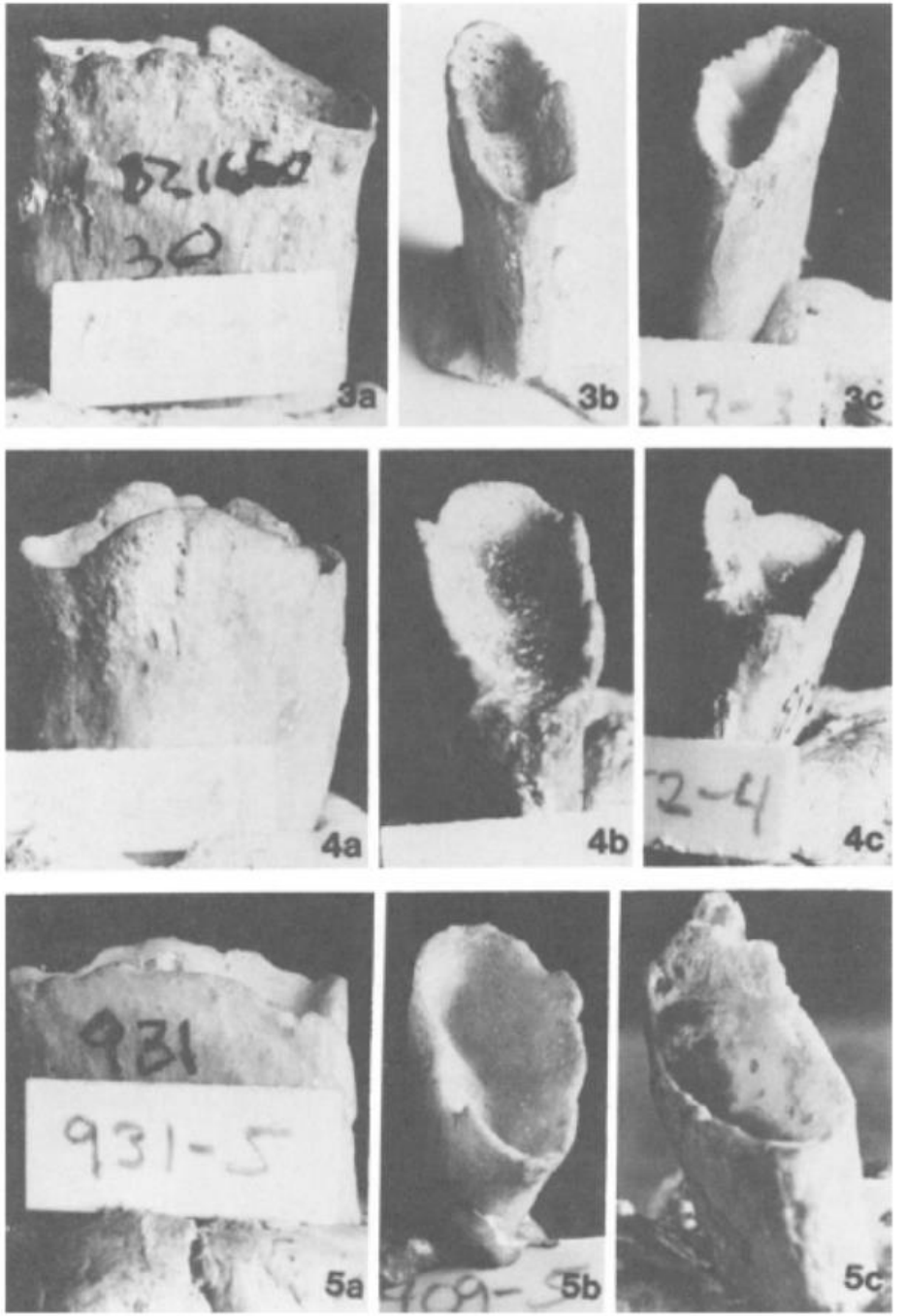


Dospělý – žebra

ÎŞCAN, Mehmet Y, Susan R. LOTH a Ronald K. WRIGHT, 1985. Age estimation from the rib by phase analysis: white females. *Journal of Forensic Sciences*. 30(3), 11018J. ISSN 00221198.
86 jedinců (f)
Broward County Medical Examiner's Office, Florida, USA

ÎŞCAN, Mehmet Y, Susan R LOTH a Ronald K WRIGHT, 1984. Age estimation from the rib by phase analysis: white males. *Journal of Forensic Sciences*. 29(4), 1094–1104.
118 jedinců (m)
Broward County Medical Examiner's Office, Florida, USA

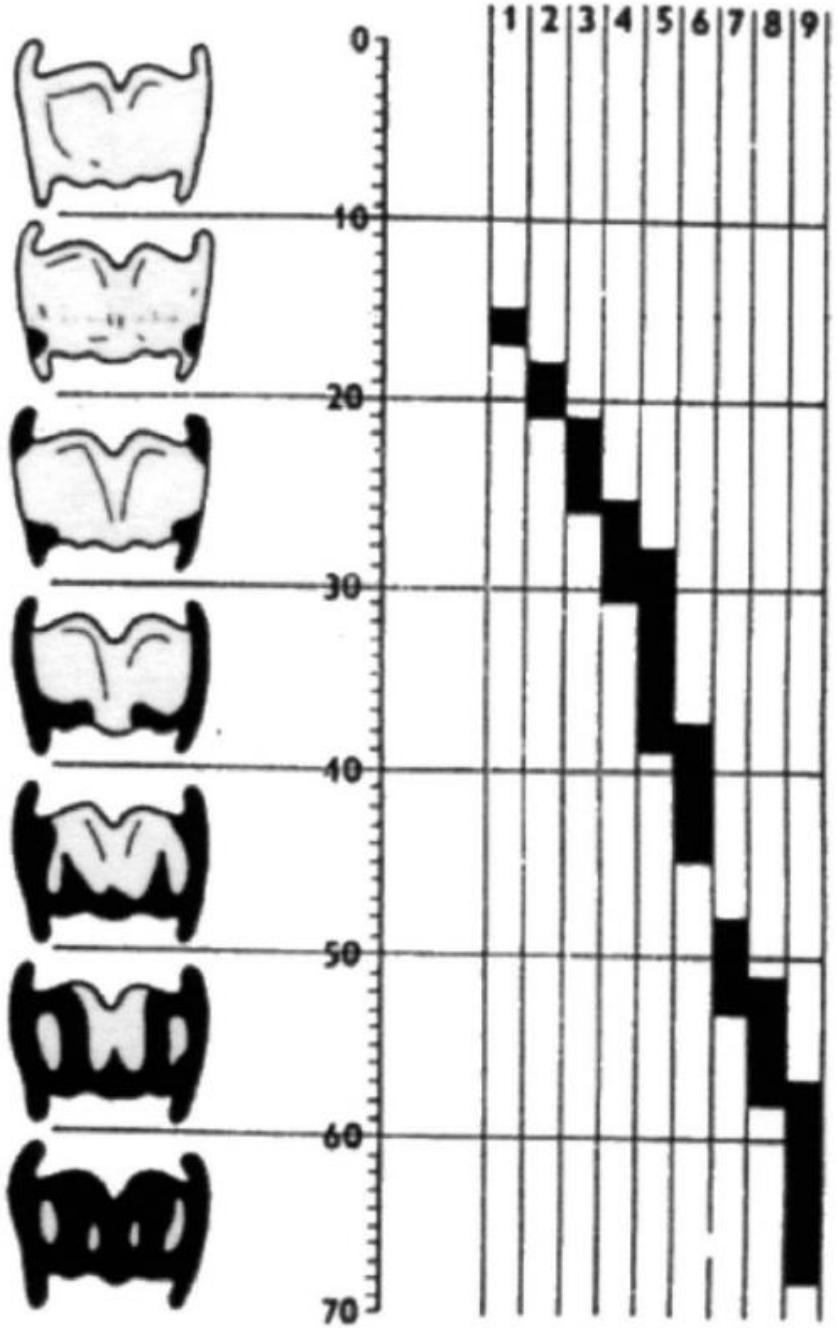
DIGANGI, Elizabeth A., Jonathan D. BETHARD, Erin H. KIMMERLE a Lyle W. KONIGSBERG, 2009. A new method for estimating age-at-death from the first rib. *American Journal of Physical Anthropology.* 138(2), 164–176. ISSN 00029483, 10968644.



Dospělý – osifikace štítné chrupavky

VLČEK, Emanuel, 1980. Estimation of age from skeletal material based on the degree of thyroid cartilage ossification. *Soudni Lekarstvi*. 25(1), 6–11. ISSN 0371-1854.

- hodně studií je deskriptivních, na malém vzorku. Podle některých osifikace s věkem statisticky významně nekoreluje (Scheuer a Black 2000) nebo alespoň tvrdí, že jsou intervaly příliš široké (Latham et al. 2010)

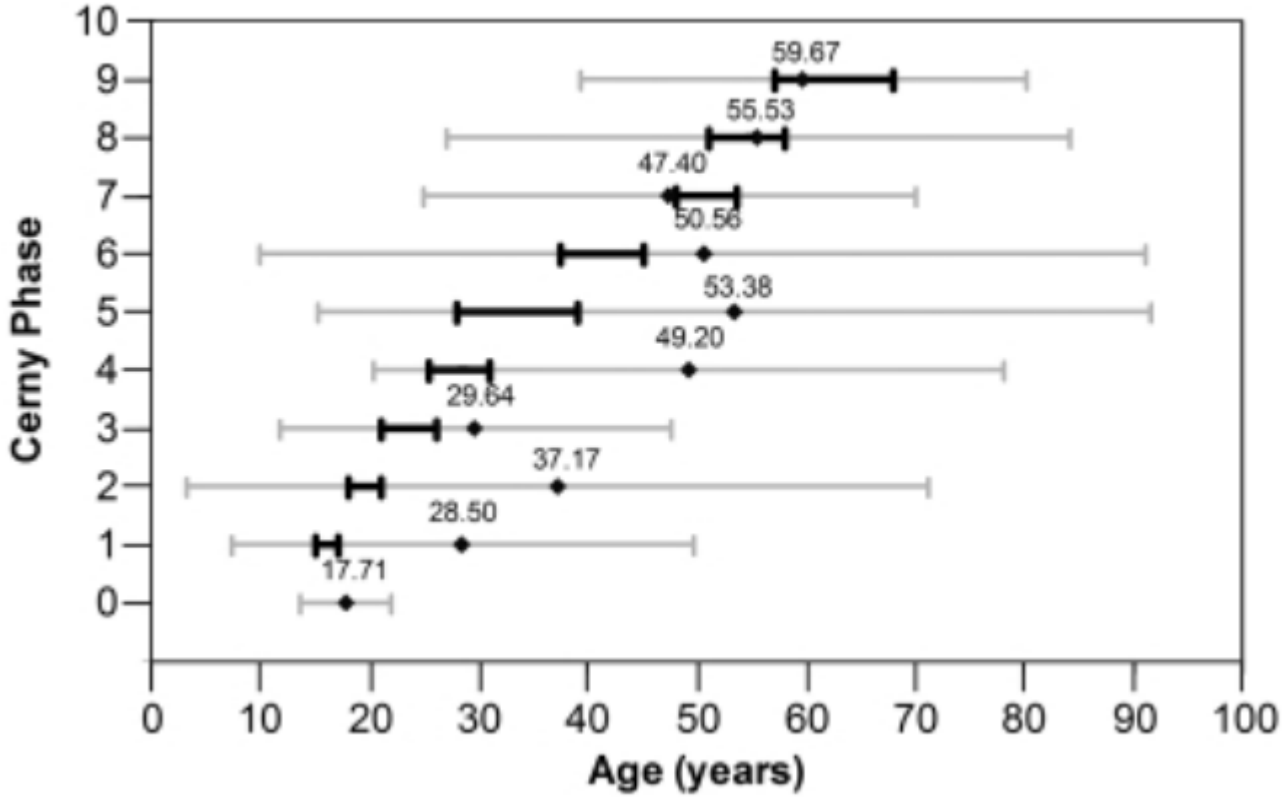


Dospělý – osifikace štítné chrupavky

GARVIN, HM, 2010. Limitations of cartilage ossification as an indicator of age at death. In: Krista E. LATHAM a J. Michael FINNEGAN, ed. Age Estimation of the Human Skeleton. B.m.: Charles C. Thomas Springfield IL, s. 118–133.

- ověření metody Milana Černého (1983) na 104 rRTG z US – 21,15 % správně klasifikováno
- přítomnost osifikace může být použita jako známka dospělosti
- pokud chybí osifikace zadních okrajů a při nasedání dolních rohů, pak < 37 let
- osifikace pod incisura laryngea > 30 let

FIGURE 8.2
ČERNY AGE RANGES (BLACK) AND OBSERVED AGE RANGES (GREY) PER PHASE



Dospělý – osifikace štítné chrupavky

A – ant midline tongue
B – cranial branch
C – sup horn
D – lamina
E – posterior border
F – posterior triangle
G – inf horn
H – caudal branch

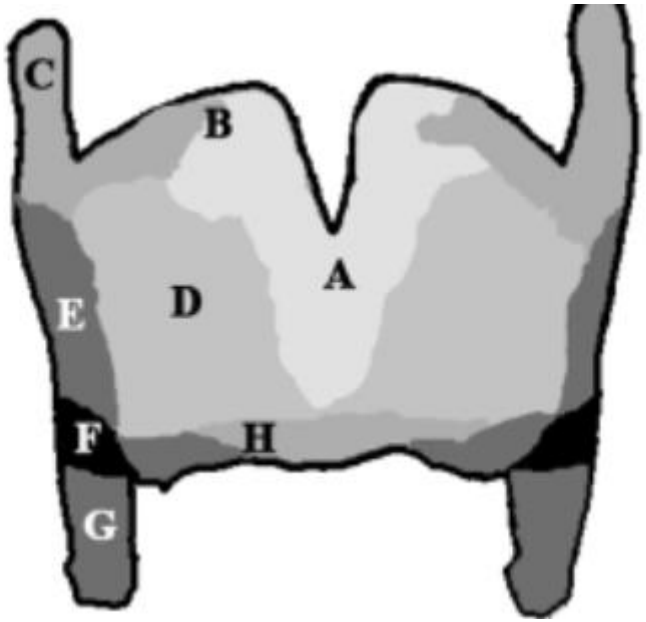


TABLE 8.2
OBSERVED TRENDS IN THYROID CARTILAGE OSSIFICATION

FEATURE	*TREND*
Any ossification	If any ossification > 18 years
Posterior triangles, posterior borders, and inferior horns	If not completely ossified < 37 years
Laminae and cranial branch	If completely ossified > 39 years
Midline tongue	If ossified > 30 years
Cricoid cartilage	If ossified > 25 years

(Garvin 2010)

Dospělý – klíční kost

VLČEK, Emanuel, 1980. Estimation of age from skeletal material based on the degree of thyroid cartilage ossification. *Soudni Lékařství*. 25(1), 6–11. ISSN 0371-1854.

Dospělý – zuby

CAMERIERE, Roberto, Luigi FERRANTE a Mariano CINGOLANI, 2004. Variations in Pulp/Tooth Area Ratio as an Indicator of Age: a Preliminary Study. *Journal of Forensic Sciences*. 49(2), 1–3. ISSN 0022-1198.

100 jedinců, (46 m, 54 f), Italové

Dospělý – zuby

VYSTRČILOVÁ, Michaela a Vladimír NOVOTNÝ, 2000. Estimation of age at death using teeth. *Variability and Evolution*. 8, 39–49.

63 jedinců, (31 m, 32 f)

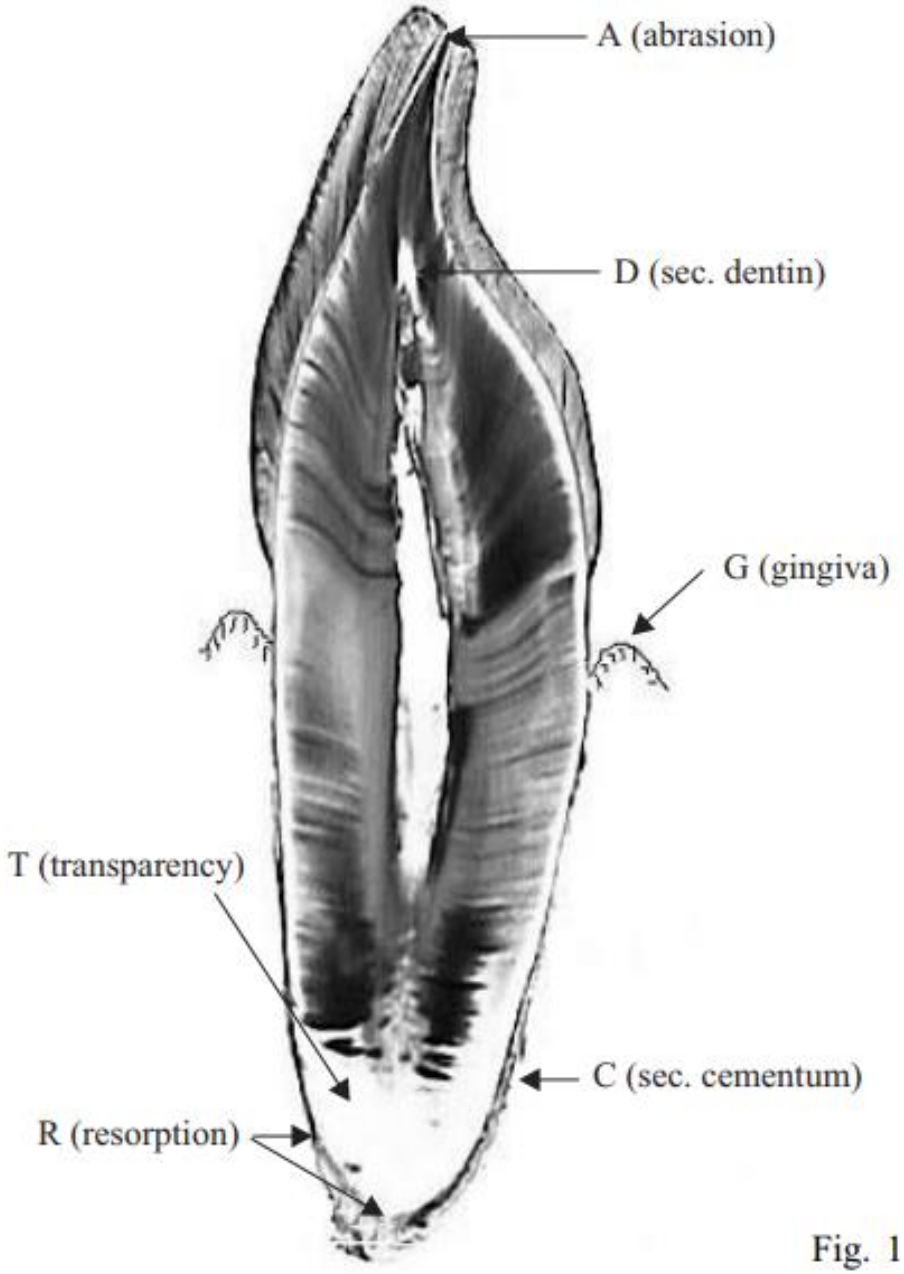


Fig. 1

Komplexní přístup

NEMESKÉRI, János, László HARSÁNYI a György ACSÄDI, 1960. Methoden zur diagnose des lebensalters von skelettfunden. *Anthropologischer Anzeiger*. (H. 1), 70–95.

ACSÁDI, G. a J. NEMESKÉRI, 1970. *History of Human Life Span and Mortality*. B.m.: Akadémiai Kiadó.

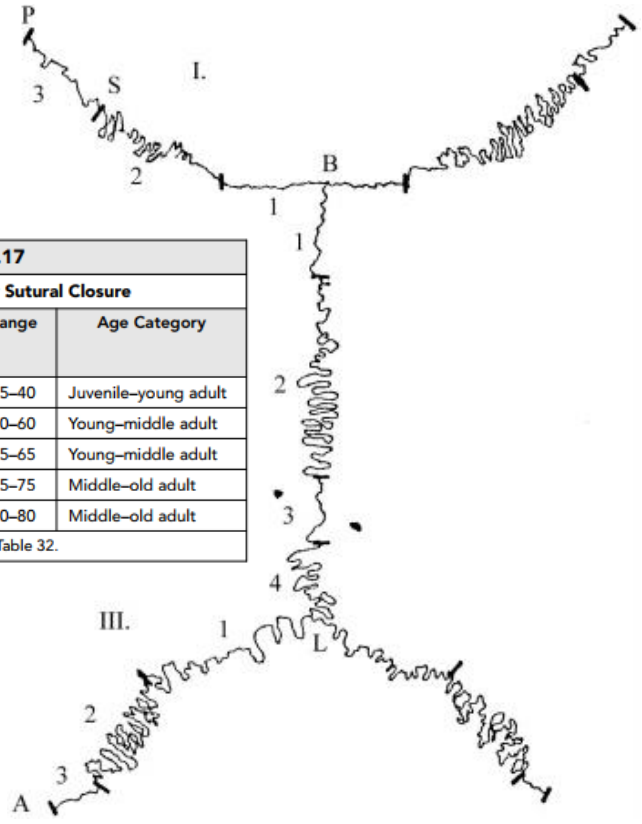
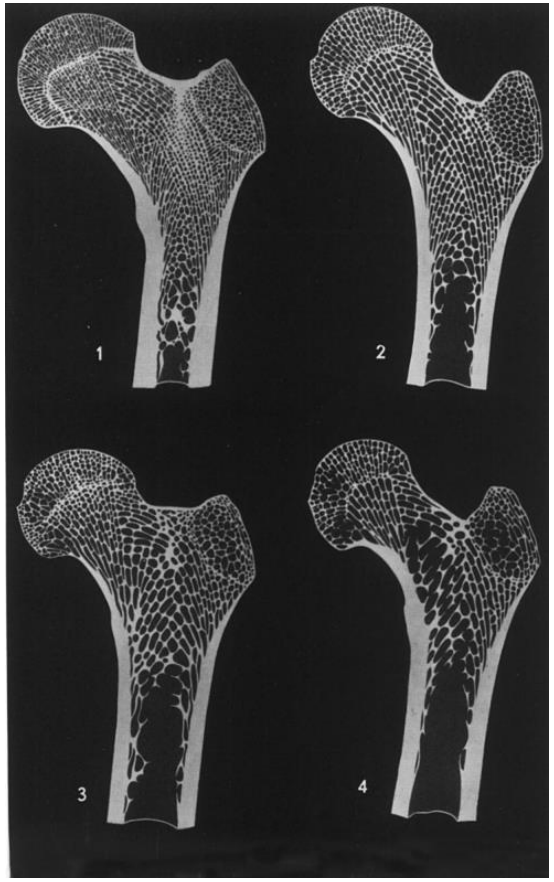


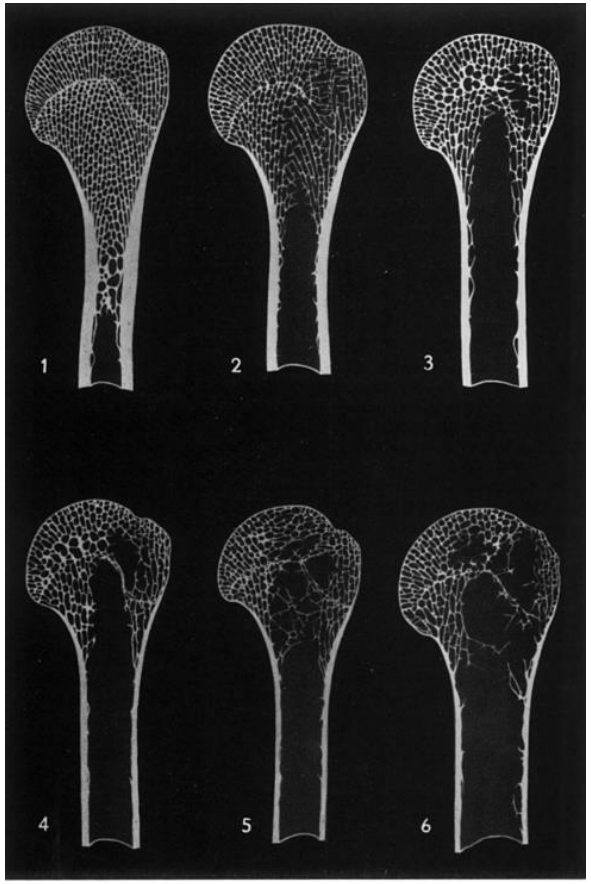
Table 3.17

Estimation of Age by Sutural Closure

Mean Closure Stage	Mean Age	SD	Range	Age Category
0.4–1.5	28.6	13.08	15–40	Juvenile–young adult
1.6–2.5	43.7	14.46	30–60	Young–middle adult
2.6–2.9	49.1	16.40	35–65	Young–middle adult
3.0–3.9	60.0	13.23	45–75	Middle–old adult
4.0	65.4	14.05	50–80	Middle–old adult

Note: From Acsádi & Nemeskéri 1970, Table 32.





Komplexní přístup – Nemeskéri et al. 1960

Základem je hodnocení symfýzy – < 50 let (I a II); 50 let (III); > 50 let (IV a V)

I a II (pod 50 let)
průměr spodních limitů

III (okolo 50 let)
průměr *mean*

Iv a V (nad 50 let)
průměr horních limitů

Tab. 3.22

Age Correspondence of the Phases of the Four Morphological Age Indicators in Years

	Lower Limit of Range				Mean				Upper Limit of Range			
Phase	Sut	Sym	Fem	Hum	Sut	Sym	Fem	Hum	Sut	Sym	Fem	Hum
I	23	23	23	23	**30**	**32**	**33**	**41**	39	40	43	57
II	35	37	35	41	**44**	**44**	**44**	**51**	52	49	53	61
III	45	46	44	48	**53**	**52**	**52**	**57**	60	58	59	65
IV	53	54	50	52	**60**	**60**	**58**	**59**	66	68	66	67
V	58	61	54	54	**63**	**67**	**63**	**61**	72	75	71	69
VI	–	–	58	55	–	–	**67**	**62**	–	–	76	70

Note: From Acsádi and Nemeskéri (1970), Table 36.
Key: Sut = endocranial sutures, sym = symphyseal face, femur = proximal end of femur, hum = proximal end of humerus.

zprůměrování hodnot pro daný ukazatel a fázi

Komplexní přístup – Nemeskéri et al. 1960

Příklad symfýza II, sutury I, humerus III a femur II

Table 3.22

Age Correspondence of the Phases of the Four Morphological Age Indicators in Years

	Lower Limit of Range				Mean				Upper Limit of Range			
Phase	Sut	Sym	Fem	Hum	Sut	Sym	Fem	Hum	Sut	Sym	Fem	Hum
I	23	23	23	23	30	32	33	41	39	40	43	57
II	35	37	35	41	44	44	44	51	52	49	53	61
III	45	46	44	48	53	52	52	57	60	58	59	65
IV	53	54	50	52	60	60	58	59	66	68	66	67
V	58	61	54	54	63	67	63	61	72	75	71	69
VI	–	–	58	55	–	–	67	62	–	–	76	70

Note: From Acsádi and Nemeskéri (1970), Table 36.
Key: Sut = endocranial sutures, sym = symphyseal face, femur = proximal end of femur, hum = proximal end of humerus.

23 + 37 + 35 + 48 = 143/4 = 35,75 let

Komplexní přístup – alternativa

FEREMBACH, Denise, I SCHWINDEZKY a M STOUKAL, 1980. Recommendation for age and sex diagnoses of skeletons. *Journal of human evolution*. 9, 517–549.

- stejné znaky, stejně hodnocené, odečet věku z tabulky

Appendix

(a) All four characters available

Table 4

Estimation of age according to the "complex method"

Symphysial face: Phase I

	Femur, proximal epiphysis: Phase I — Endocranial suture closure					Femur, proximal epiphysis: Phase II — Endocranial suture closure				
	Phase	I	II	III	IV	V	Phase	I	II	III	IV	V
Humerus, proximal epiphysis	I	23·00	26·00	28·50	30·50	31·75	I	26·00	29·00	31·50	33·50	34·75
	II	27·50	30·50	33·00	35·00	36·25	II	30·50	33·50	36·00	38·00	39·25
	III	29·25	32·25	34·75	36·75	38·00	III	32·25	35·25	37·75	39·75	41·00
	IV	30·25	33·25	35·75	37·75	39·00	IV	33·25	36·25	38·75	40·75	42·00
	V	30·75	33·75	36·25	38·25	39·50	V	33·75	36·75	39·25	41·25	42·50
	VI	31·00	34·00	36·50	38·50	39·75	VI	34·00	37·00	39·50	41·50	42·75

	Femur, proximal epiphysis: Phase III — Endocranial suture closure					Femur, proximal epiphysis: Phase IV — Endocranial suture closure				
	Phase	I	II	III	IV	V	Phase	I	II	III	IV	V
Humerus, proximal epiphysis	I	28·25	31·25	33·75	35·75	37·00	I	29·75	32·75	35·25	37·25	38·50
	II	32·75	35·75	38·25	40·25	41·50	II	34·25	37·25	39·75	41·75	43·00
	III	34·50	37·50	40·00	42·00	43·25	III	36·00	39·00	41·50	43·50	44·75
	IV	35·50	38·50	41·00	43·00	44·25	IV	37·00	40·00	42·50	44·50	45·75
	V	36·00	39·00	41·50	43·50	44·75	V	37·50	40·50	43·00	45·00	46·25
	VI	36·25	39·25	41·75	43·75	45·00	VI	37·75	40·75	43·25	45·25	46·50

	Femur, proximal epiphysis: Phase V — Endocranial suture closure					Femur, proximal epiphysis: Phase VI — Endocranial suture closure				
	Phase	I	II	III	IV	V	Phase	I	II	III	IV	V
Humerus, proximal epiphysis	I	30·75	33·75	36·25	38·25	39·50	I	31·75	34·75	37·25	39·25	40·50
	II	35·25	38·25	40·75	42·75	44·00	II	36·25	39·25	41·75	43·75	45·00
	III	37·00	40·00	42·50	44·50	45·75	III	38·00	41·00	43·50	45·50	46·75
	IV	38·00	41·00	43·50	45·50	46·75	IV	39·00	42·00	44·50	46·50	47·75
	V	38·50	41·50	44·00	46·00	47·25	V	39·50	42·50	45·00	47·00	48·25
	VI	38·75	41·75	44·25	46·25	47·50	VI	39·75	42·75	45·25	47·25	48·50

Note: The margin of error in individual age determinations according to this table is approximately ± 2·5 years with a confidence of 80–85%.

Komplexní přístup

LOVEJOY, C. Owen, Richard S. MEINDL, Robert P. MENSFORTH a Thomas J. BARTON, 1985. Multifactorial determination of skeletal age at death: A method and blind tests of its accuracy. *American Journal of Physical Anthropology*. 68(1), 1–14. ISSN 0002-9483.

pro odhad u populačních vzorků
– *fac. symphysialis* (Meindl et al. 1985)
– *fac. auticularis* (Lovejoy et al. 1985)
– spongióza femuru (Walker a Lovejoy 1985)
– lebeční švy (Meindl a Lovejoy 1985)
– abraze

v celém zpracovávaném souboru!

analýza hlavních komponent

korelace s prvním komponentou = váha

vážený průměr odhadů

praktická část

Stloukal a Hanáková 1978

Tabulka 9
Vztah délky dlouhých kostí končetin a věku dětí od 6 měs. do 14 let (Stloukal a Hanáková 1978)

	pažní kost	vřetenní kost	loketní kost	stehenní kost	holenní kost
věk	průměr	průměr	průměr	průměr	průměr
6 měs.	88.1 (78 -97.0)	69.7 (63 -75.0)	75.9 (72 -80.0)	108.1 (95 -122)	88.8 (84 -93.0)
12 měs.	97.9 (89 -106)	76.7 (68 -85.0)	83.1 (79 -86.0)	122.0 (109-135)	99.2 (93 -105)
18 měs.	108.6 (98 -118)	84.1 (75 -90.0)	91.3 (85 -95.0)	137.5 (122-152)	111.4 (102 -120)
24 měs.	117.5 (106-129)	89.8 (80 -96.0)	98.5 (93 -102)	149.6 (135-166)	121.4 (109 -131)
30 měs.	124.9 (113-138)	95.1 (86 -103)	104.7 (98 -110)	160.9 (143-182)	131.7 (117 -144)
3 roky	133.5 (120-147)	101.6 (93 -110)	111.4 (104-117)	174.1 (156-196)	142.2 (127 -156)
4 roky	142.7 (128-159)	108.3 (98 -120)	119.8 (111-129)	188.3 (169-213)	151.9 (136 -171)
5 let	152.4 (136-170)	116.0 (105-130)	128.0 (118-139)	203.2 (183-230)	164.1 (146 -184)
6 let	163.8 (147-181)	125.1 (114-140)	137.3 (125-152)	221.1 (198-246)	177.1 (158 -201)
7 let	174.8 (157-192)	133.5 (121-152)	147.2 (134-164)	238.1 (214-263)	188.9 (168 -216)
8 let	184.6 (169-210)	141.9 (130-160)	157.1 (145-174)	253.0 (228-278)	202.0 (180 -227)
9 let	194.3 (178-210)	149.2 (139-163)	164.4 (154-178)	266.5 (241-290)	213.6 (191 -235)
10 let	203.9 (186-218)	156.9 (149-168)	172.4 (163-186)	281.2 (254-305)	224.3 (202 -246)
11 let	211.9 (196-224)	163.3 (156-175)	178.1 (169-193)	292.5 (265-323)	235.1 (212 -259)
12 let	219.9 (202-234)	168.8 (160-179)	182.9 (173-198)	302.9 (279-337)	244.4 (218 -368)
13 let	231.2 (211-247)	175.7 (165-188)	190.7 (178-208)	319.0 (286-358)	256.1 (227 -283)
14 let	240.8 (220-257)	182.5 (166-200)	198.0 (183-221)	333.3 (296-382)	269.8 (235 -301)

(Stloukal 1999 – pozor na překlep)

Rissech 2008

Co asi určuje tohle R^2?

	R^2	Age limit
Males		
Age = 0.054 × diaphyseal length – 6.337	0.949	Up to 17 years
Age = 0.054 × diaphyseal length plus distal epiphysis – 7.367	0.946	Up to 17 years
Age = 0.061 × maximum femoral length – 9.549	0.923	Up to 19 years
Age = 0.595 × vertical diameter of the femoral head – 8.992	0.947	Up to 17 years
Females		
Age = 0.058 × diaphyseal length – 6.771	0.890	Up to 16 years
Age = 0.056 × diaphyseal length plus distal epiphysis – 7.160	0.852	Up to 16 years
Age = 0.055 × maximum femoral length – 7.256	0.835	Up to 17 years
Age = 0.559 × vertical diameter of the femur head – 7.577	0.896	Up to 15 years
Unisex series		
Age = 0.056 × diaphyseal length – 6.489	0.925	Up to 16 years
Age = 0.055 × diaphyseal length plus distal epiphysis – 7.130	0.897	Up to 16 years
Age = 0.051 × maximum femur length – 6.690	0.859	Up to 15 years
Age = 0.560 × vertical diameter of the femur head – 7.890	0.890	Up to 15 years

4 regresní rovnice

- diafyzální délka – největší vzdálenost mezi proximálním a distálním koncem (ne s epifýzou)
- *diaphyseal length plus distal epiphysis* (bez proximální epifýzi)
- M1 Největší délka femuru
- svislý průměr hlavice – měřený na okraji kloubní plošky, kolmo na předozadní směr

AlQahtani et al. 2010

Hodnocení vychází z prací Moorrees et al. (1963b; 1963a)

vývoj dočasného chrupu

	ci: Initial cusp formation		Ri: initial root formation with diverge edges
	Cco: Coalescence of cusps		R 1/4: root length less than crown length
	Coc: Cusp outline complete		R 1/2: root length equals crown length
	Cr 1/2: crown half completed with dentine formation		R 3/4: three quarters of root length developed with diverge ends
	Cr 3/4: crown three quarters completed		Rc: root length completed with parallel ends
	Crc: crown completed with defined pulp roof		A 1/2: apex closed (root ends converge) with wide PDL
			Ac: apex closed with normal PDL width

vývoj trvalého chrupu

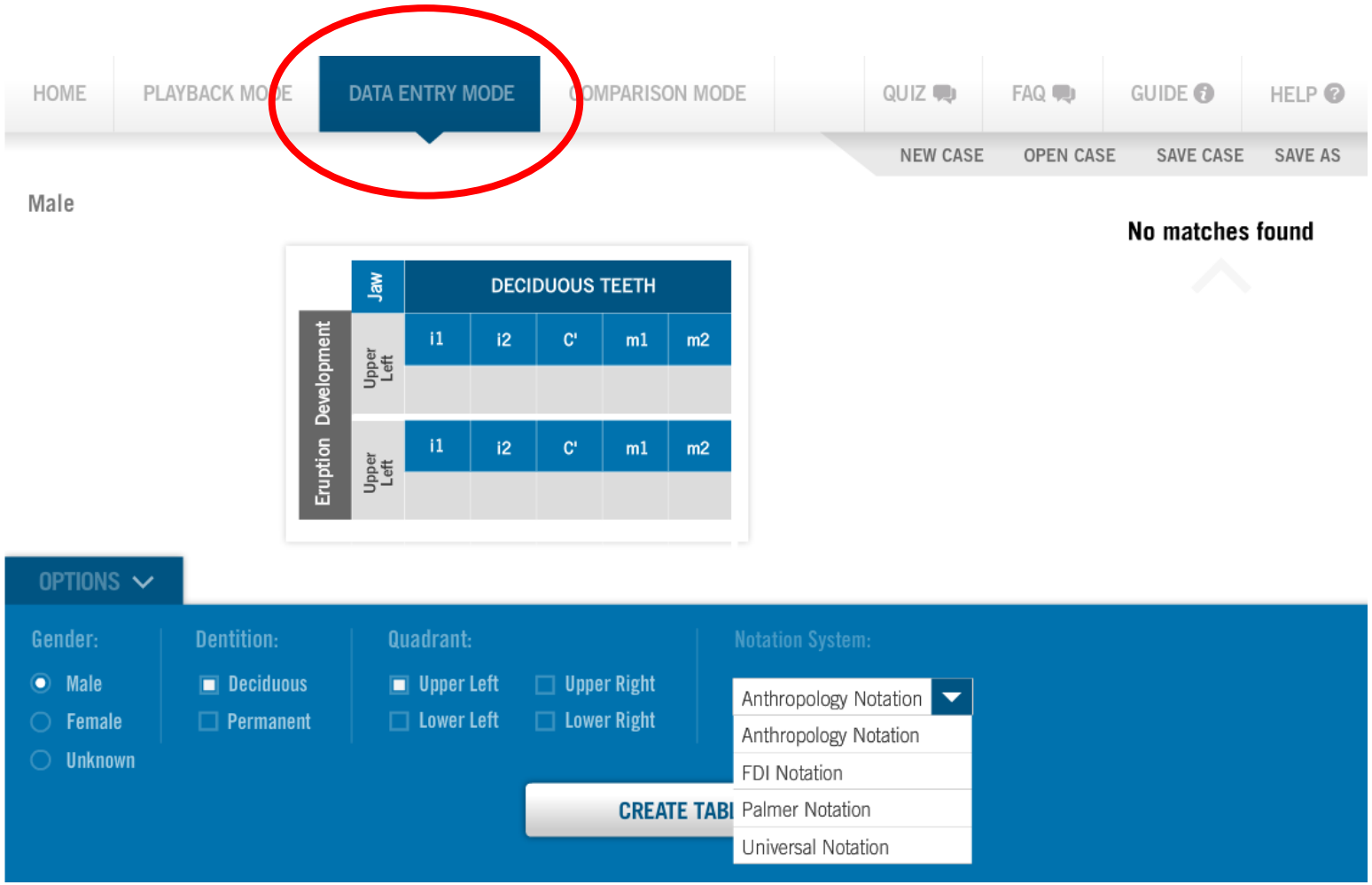
	Ci: initial cusp formation		
	Cco: Coalescence of cusps		R 1/4: root length less than crown length with visible bifurcatio area
	Coc: Cusp outline complete		R 1/2: root length equals crown length
	Cr 1/2: crown half completed with dentine formation		R 3/4: three quarters of root length developed with diverge ends
	Cr 3/4: crown three quarters completed		Rc: root length completed with parallel ends
	Crc: crown completed with defined pulp roof		A 1/2: apex closed (root ends converge) with wide PDL
	Ri: initial root formation with diverge edges		Ac: apex closed with normal PDL width

	Ac: apex closed with normal PDL width	
	Res 1/4: resorbtion of apical quarter of the root	
	Res 1/2: resorbtion of half the root	
	Res 3/4: resorbtion of three quarters of the root	

	position 1: when the occlusal or incisal surface is covered entirely by bone	
	position 2: when the occlusal or incisal surface breaks through the crest of the alveolar bone	
	position 3: when the occlusal or incisal surface is midway between the alveolar bone and the occlusal plane	
	position 4: occlusal or incisal surface is in the occlusal plane	

(Bengstone 1935)

AlQahtani et al. 2010



Anthropology notation

Upper Left	I1	I2	C'	PM1	PM2	M1	M2	M3

FDI notation

Upper Left	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8

Universal notation

Upper Left	9	10	11	12	13	14	15	16

údaje o případu

způsoby zápisu

AlQahtani et al. 2010

Eruption Development	Jaw	PERMANENT TEETH							
	Upper Left	9	10	11	12	13	14	15	16
			Ri				R 1/2		
	Upper Left	9	10	11	12	13	14	15	16

1 close match

6.5 Years

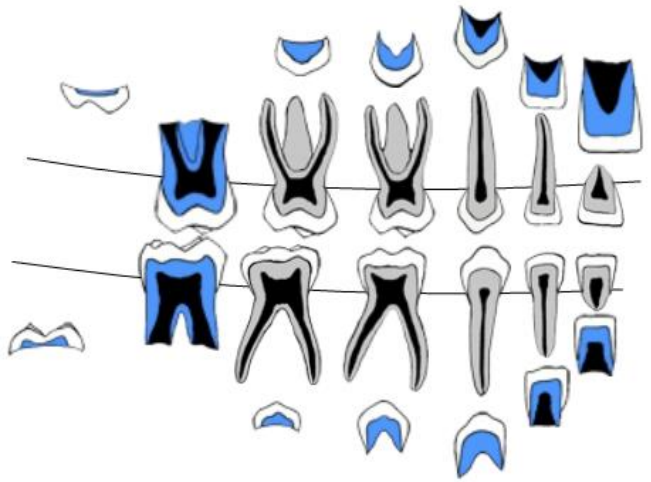
VIEW DIAGRAMS

ukáže nákresy
vytipovaných fází

1 close match

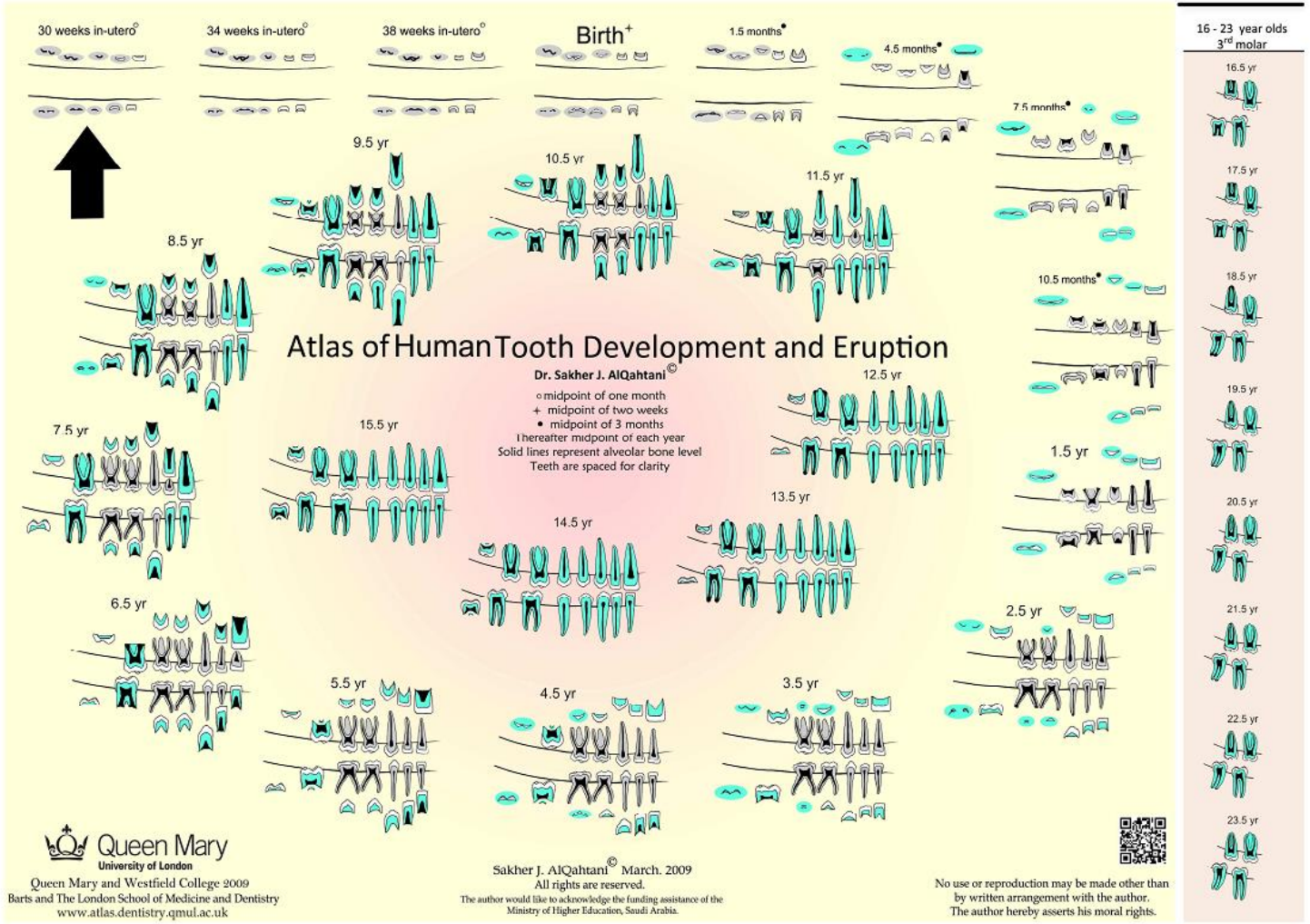
6.5 Years

BACK TO DATA ENTRY

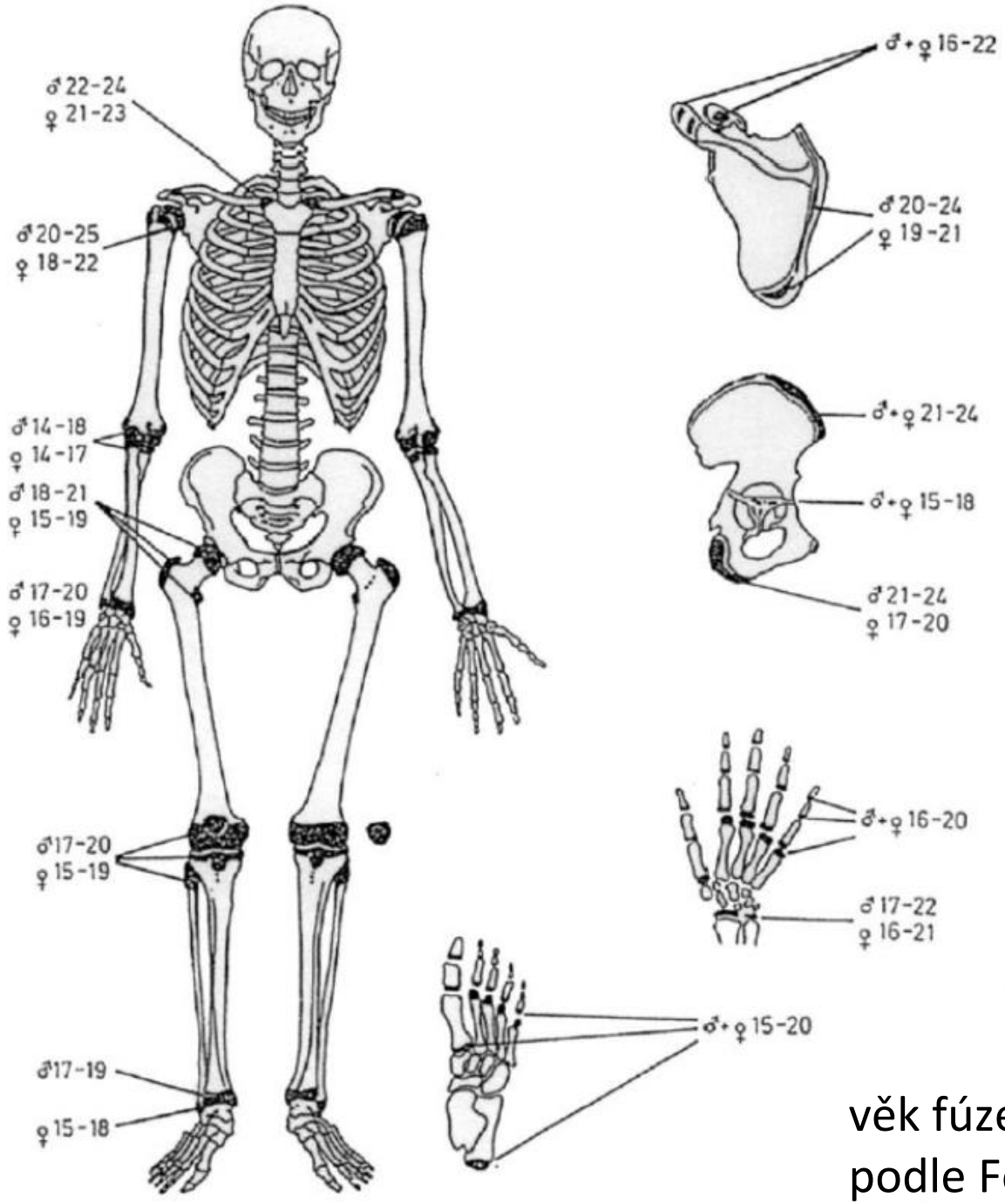


AlQahtani et al. 2010

V současné době mají výpadek SW. Použijte prosím diagram, který máte k dispozici ve studijních materiálech anebo tabulky tamtéž.

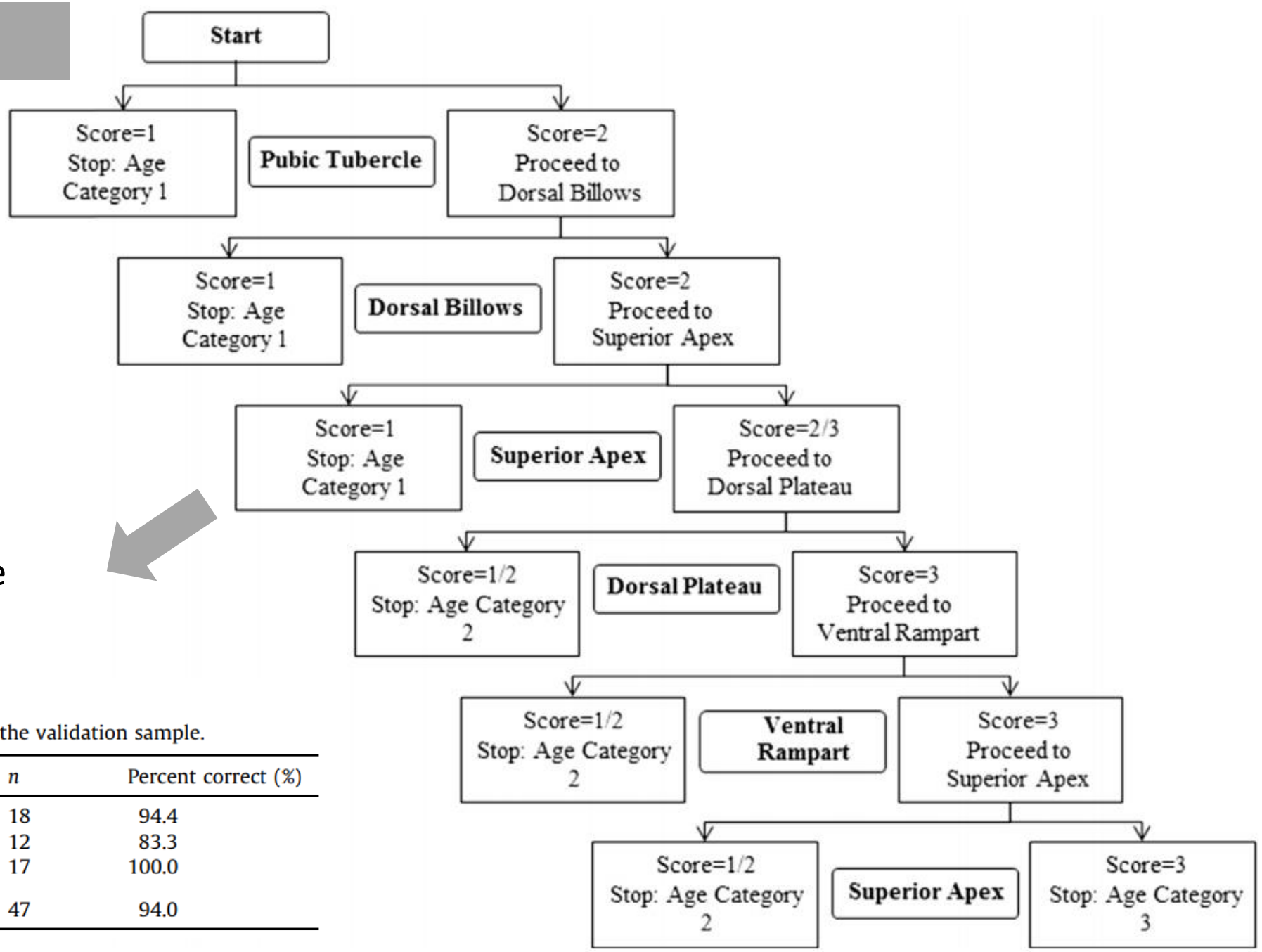


Brothwell 1965



věk fúze epifýz (Brothwell 1965 podle Ferembach et al. 1980)

Dudzik a Langley 2015

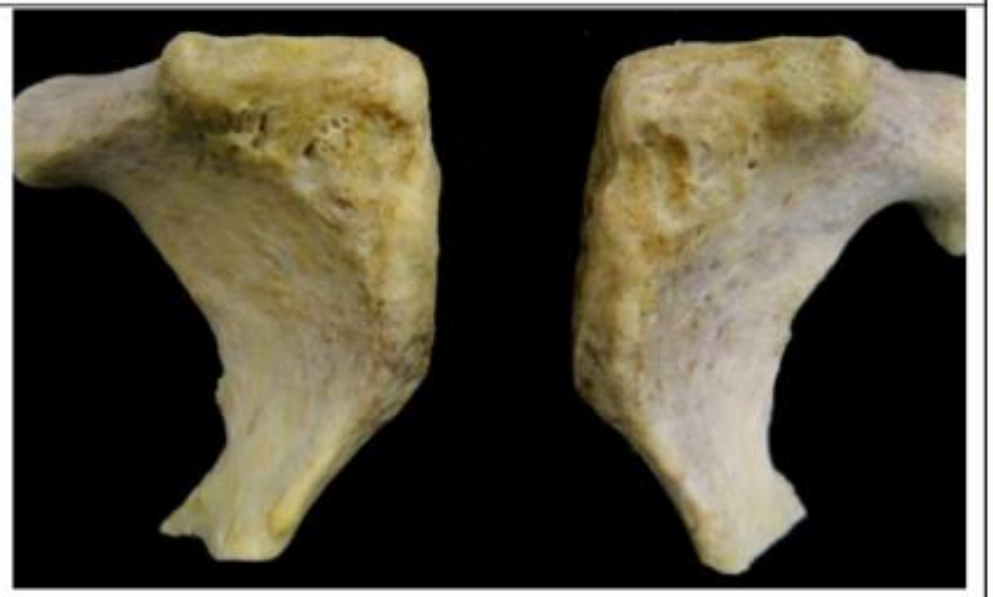


3 věkové kategorie

Table 12
Correct classification percentages reported for the validation sample.

Age category	Age interval	*n*	Percent correct (%)
1	18–26	18	94.4
2	22–32	12	83.3
3	29–40	17	100.0
Total	–	47	94.0

Dudzik a Langley 2015

1	2
	
Billows extending to/encompassing pubic tubercle	Tubercle is separate

Pubic tubercle

1 = billows extending to/encompassing pubic tubercle

2 = tubercle is a separate bony knob; billows do not extend to encompass the pubic tubercle

Dudzik a Langley 2015

1	2
	
Left Side: Billows are well-defined	Right Side: Billows not well-defined, residual, or absent (not well-defined billows pictured here)

Image of Fig. 3

Billowing

1 = billowing is present and well-defined over both demifaces

2 = billowing does not encompass the entire symphyseal demiface and/or billowing is not as well-defined; residual billowing may be present; or face is flat

Dudzik a Langley 2015

1	2	3
		
Left Side: Nodule absent	Right Side: Nodule present	Left Side: Nodule integrated

Superior apex

1 = the ossific nodule has not yet formed and is scored as absent; the surface is billowed

2 = the ossific nodule is present and resembles an epiphysis

3 = the ossific nodule has become integrated into the symphyseal rim; the surface is flat

Dudzik a Langley 2015

1	2	2
		
Left Side: Dorsal margin is absent	Left Side: Dorsal margin is forming	Right Side: Dorsal margin is complete

Dorsal plateau margin

1 = there is no bony build up forming the dorsal margin; billows extend to the edge of the face along the entire length of the dorsal rim

2 = a bony margin is forming (i.e. billows have flattened along at least one portion of the rim to form a partial margin)

3 = complete margin is formed

Dudzik a Langley 2015

1	2	2
		
Left Side: Ventral rampart is absent	Right Side: Ventral rampart is forming	Left Side: Ventral rampart is complete

Ventral rampart margin

1 = there is no bony build-up to form the rampart; billows extend to the edge of the face for the entire length of the ventral rim

2 = a bony rampart is forming (bony nodules are present and appear epiphyseal in nature)

3 = complete margin is formed

NOTE: a persistent hiatus should be scored as complete.

Dudzik a Langley 2015

Table 9
Classification matrix for males using decision tree approach.

From group	To group			% Correct
	1	2	Total	
1	29	1	30	96.7
2	11	47	58	81.0
Total	40	48	99	76.8
From group	To group			% Correct
	2	3	Total	
2	21	4	25	84.0
3	27	57	84	67.9
Total	48	61	109	71.5
From group	To group			% Correct
	1	3	Total	
1	39	3	42	92.9
3	1	58	59	98.3
Total	40	61	101	96.0

Group 1 = 18–24 years; group 2 = 25–32 years; group 3 = 33–40 years.

Table 10
Classification matrix for females using decision tree approach.

From group	To group			% Correct
	1	2	Total	
1	20	4	24	83.3
2	5	22	27	81.5
Total	25	26	51	82.4
From group	To group			% Correct
	2	3	Total	
2	19	10	29	65.5
3	7	22	29	75.9
Total	26	32	58	70.7
From group	To group			% Correct
	1	3	Total	
1	21	1	22	95.5
3	4	31	35	88.6
Total	25	32	57	91.2

Group 1 = 18–24 years; group 2 = 25–32 years; group 3 = 33–40 years.

Brooks a Suchey 1990

fáze – muži

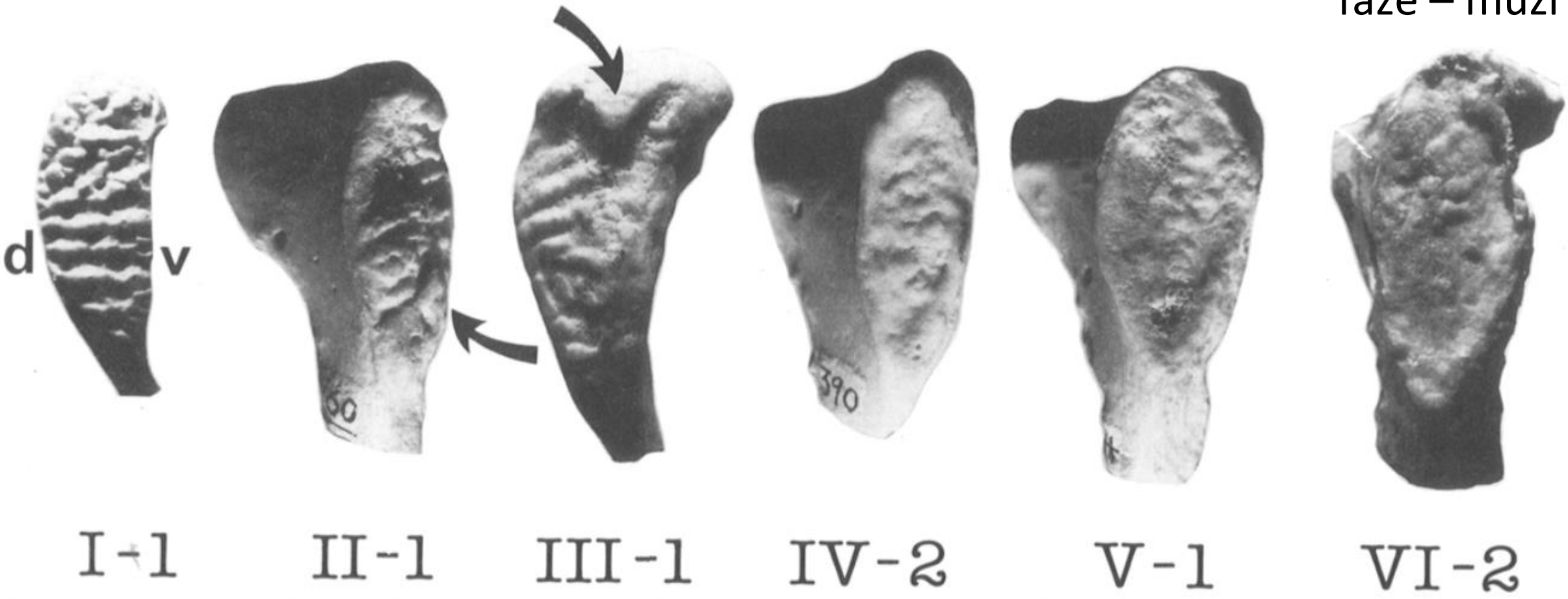


Figure 2 - SUCHEY-BROOKS male pubic age determination *Phases I-VI.* The bones cast * as model 1 (early pattern) are shown for *Phases I, II, III, V.* The bones cast as model 2 (advanced pattern) are shown for phases IV and VI. All bones are left with d = dorsal and v = ventral side. Bones are tilted to show key features. Ossific nodules are indicated by arrows for the inferior and superior position.

* Casts are available to researchers, at cost, through Diane France, 20102 Buckhorn Rd, Bellvue, CO, USA 80512. Contact J. Suchey for additional materials on phase recognition.

Brooks a Suchey 1990

fáze – ženy

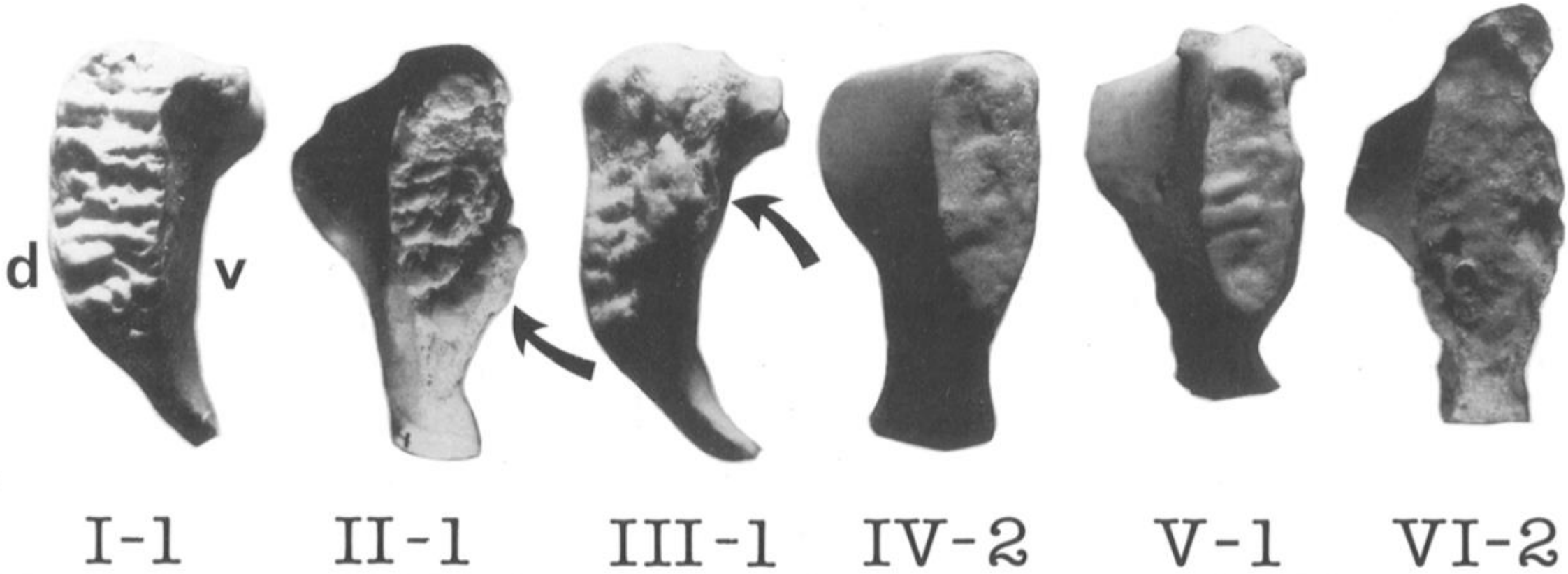


Figure 3 - SUCHEY-BROOKS female pubic age determination *Phases I-VI.* The bones cast * as model 1 (early pattern) are shown for *Phases I, II, III, V.* The bones cast as model 2 (advanced pattern) are shown for *Phases IV, VI.* All bones are left with d = dorsal side and v = ventral side. Bones are tilted to show key features. Curved arrows indicate the ventral rampart in process of formation.

* Casts are available to researchers, at cost, through Diane France, 20102 Buckhorn Rd, Bellvue CO, USA 80512. Contact J. Suchey for additional materials on phase recognition.

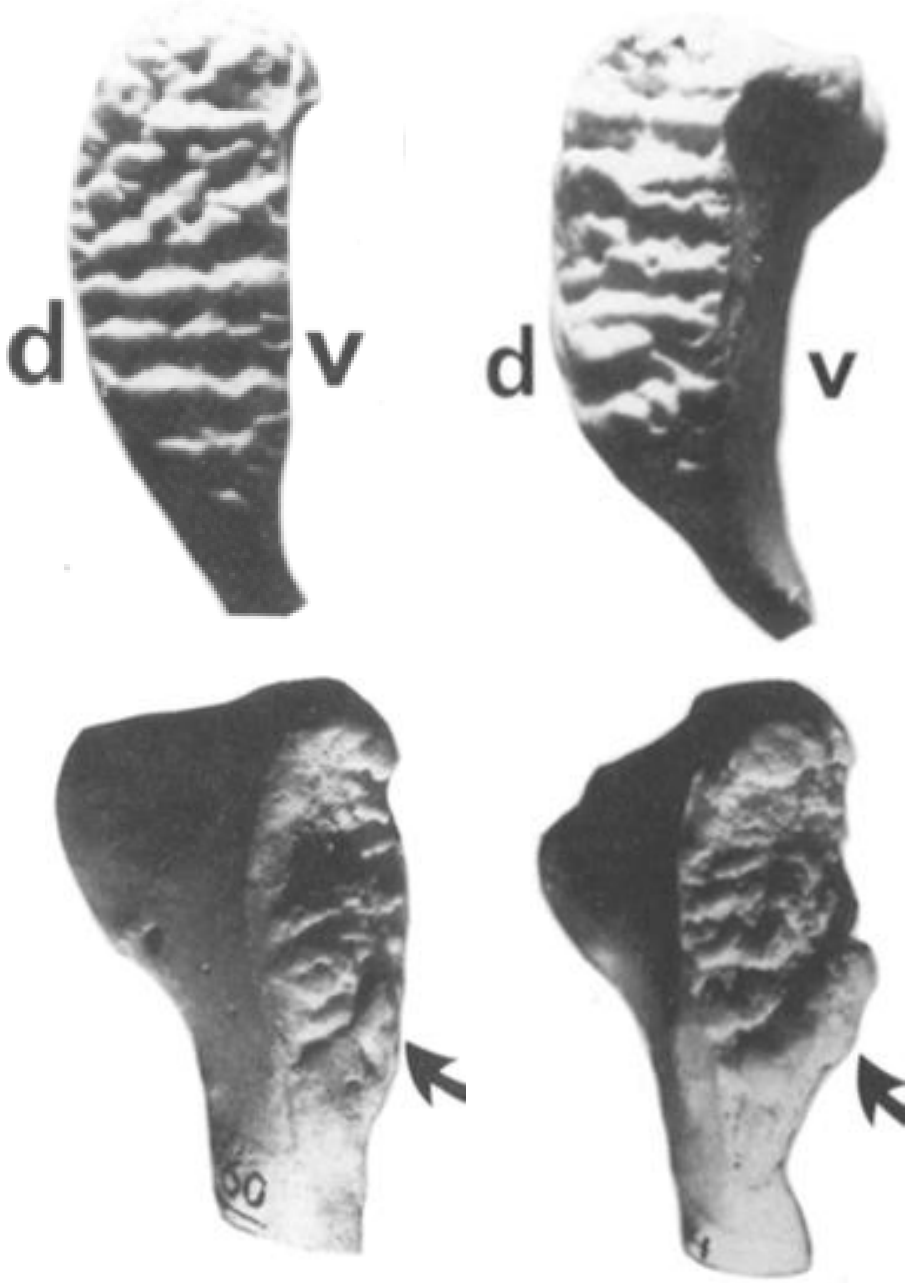
Brooks a Suchey 1990

Phase I

„Symphyseal face has a billowing surface (ridges and furrows) which usually extends to include the pubic tubercle. The horizontal ridges are well-marked and ventral beveling may be commencing. Although ossific nodules may occur on the upper extremity, *a key to the recognition of this phase* ***is the lack of delimitation of either extremity*** *(upper or lower).“*

Phase II

„The symphyseal face may still show ridge development. *The face has commencing delimitation of lower and/or upper extremities occurring with or without ossific nodules.* The ventral rampart may be in beginning phases as an extension of the bony activity at either or both extremities.“



Brooks a Suchey 1990

Phase III

„Symphyseal face shows lower extremity and *ventral rampart in process of completion*. There can be a continuation of fusing ossific nodules forming the upper extremity and along the ventral border. Symphyseal face is smooth or can continue to show distinct ridges. Dorsal plateau is complete. Absence of lipping of symphyseal dorsal margin; no bony ligamentous outgrowths.“

Brooks a Suchey 1990

Phase IV

„Symphyseal face is generally fine grained although remnants of the old ridge and furrow system may still remain. *Usually the oval outline is complete at this stage, but a hiatus can occur in upper ventral rim*. Pubic tubercle is fully separated from the symphyseal face by definition of upper extremity. The symphyseal face may have a distinct rim. Ventrally, bony ligamentous outgrowths may occur on inferior portion of pubic bone adjacent to symphyseal face. If any lipping occurs it will be slight and located on the dorsal border.“

Brooks a Suchey 1990

Phase V

„Symphyseal face is completely rimmed with some slight depression of the face itself, relative to the rim. Moderate lipping is usually found on the dorsal border with more prominent ligamentous outgrowths on the ventral border. There is little or no rim erosion. Breakdown may occur on superior ventral border. “

Brooks a Suchey 1990

Phase VI
„Symphyseal face may show ongoing depression as rim erodes. Ventral ligamentous attachments are marked. In many individuals the pubic tubercle appears as a separate bony knob. The face may be pitted or porous, giving an appearance of disfigurement with the ongoing process of erratic ossification. Crenulations may occur. The shape of the face is often irregular at this stage.“

Brooks a Suchey 1990

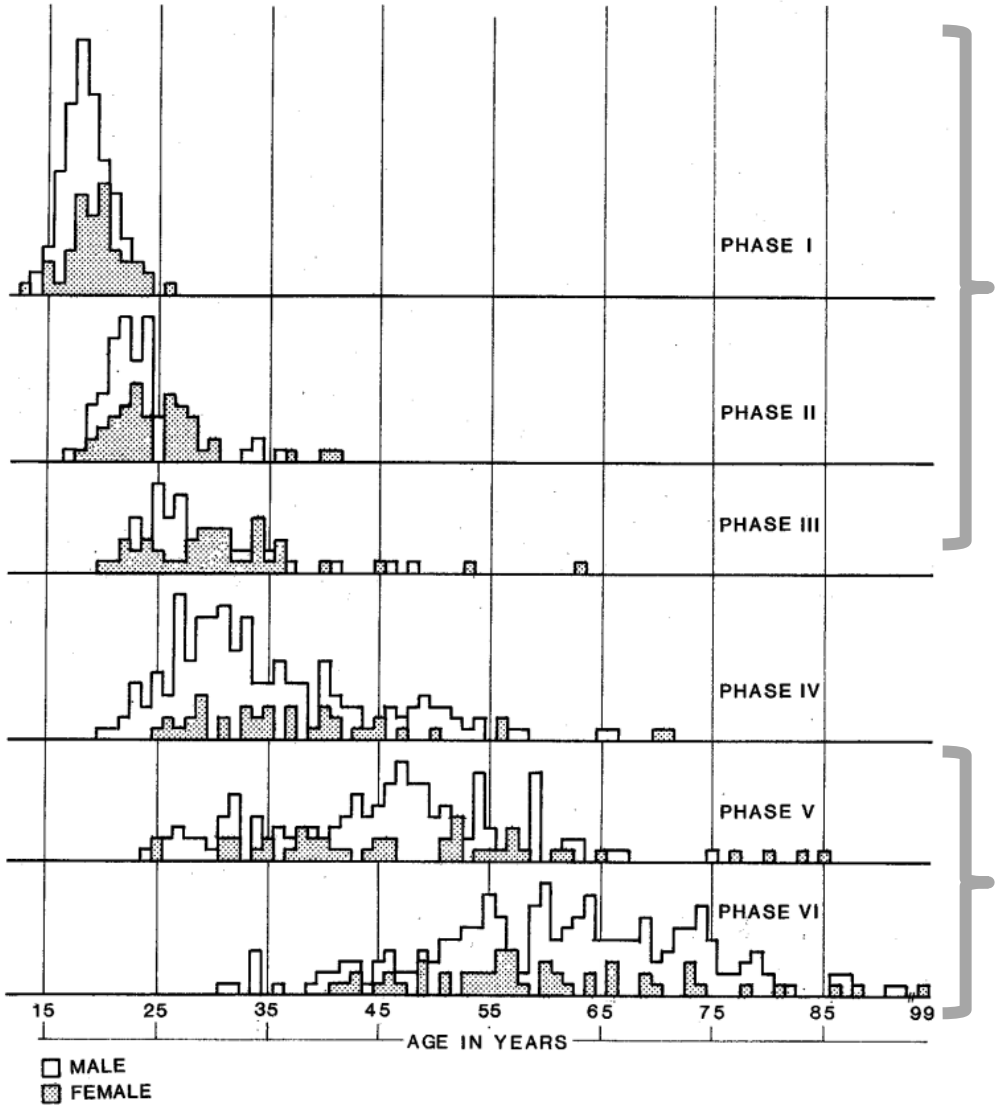


Figure 4 - Histograms comparing the age distribution of the female sample to the male sample for Phases I through VI of the SUCHEY-BROOKS age determination system. For means, standard deviations, and 95% ranges, consult *Table 1*.

TABLE 1 - *Descriptive statistics related to the Suchey-Brooks pubic age determination system.*

Phase	Female (n = 273)			Male (n = 739)		
	mean	S.D.	95% range	mean	S.D.	95% range
I	19.4	2.6	15-24	18.5	2.1	15-23
II	25.0	4.9	19-40	23.4	3.6	19-34
III	30.7	8.1	21-53	28.7	6.5	21-46
IV	38.2	10.9	26-70	35.2	9.4	23-57
V	48.1	14.6	25-83	45.6	10.4	27-66
VI	60.0	12.4	42-87	61.2	12.2	34-86

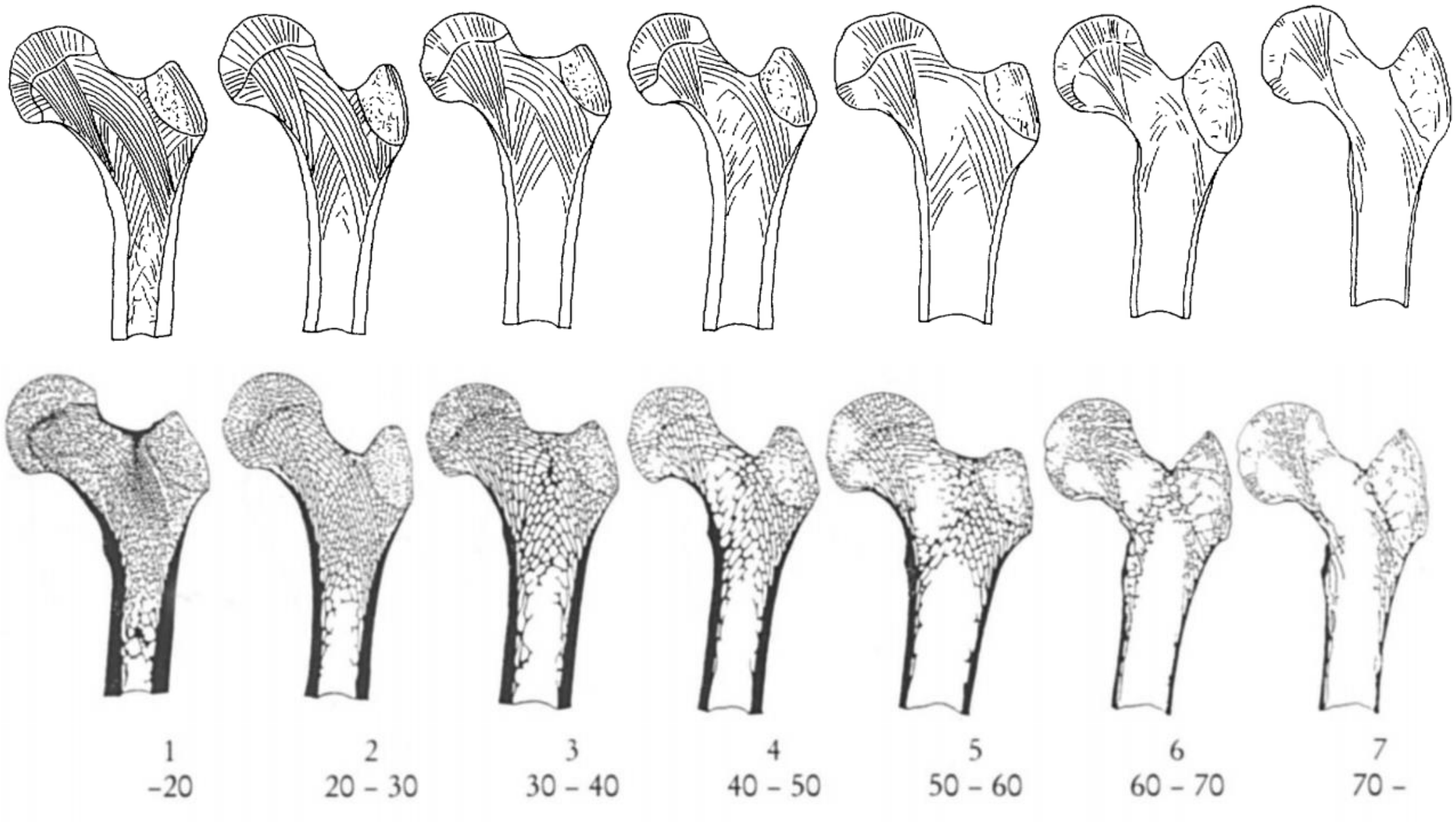
relativně malé rozptyly – rozsahy lze využít pro odhad horní limity věku (spodní limita – zuby nebo srůst epifýz)

>30

>40

velké rozptyly – lze použít jako spodní limity

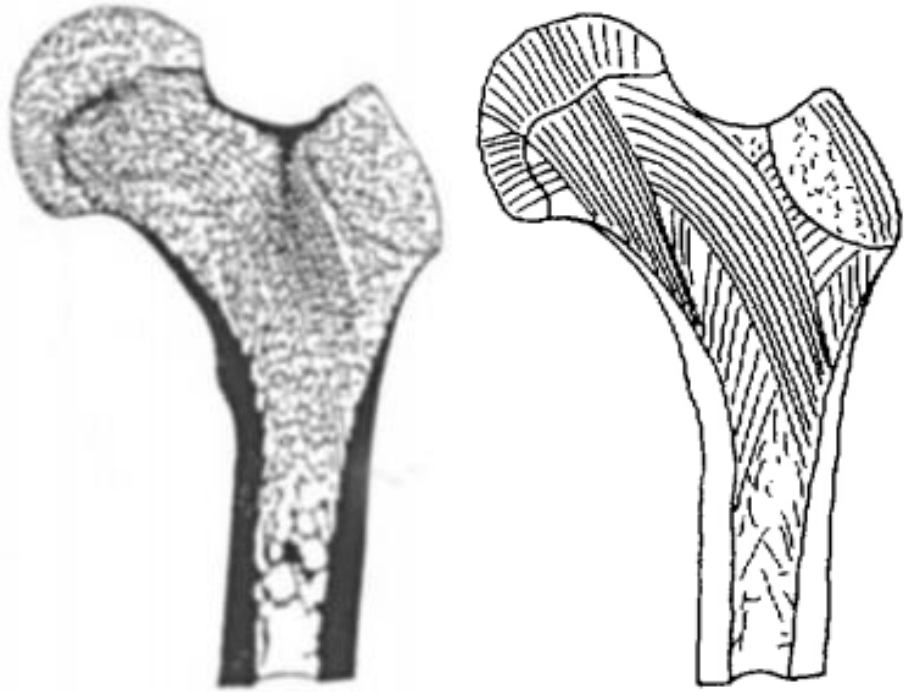
Szilvássy a Kritscher 1990



Szilvássy a Kritscher 1990

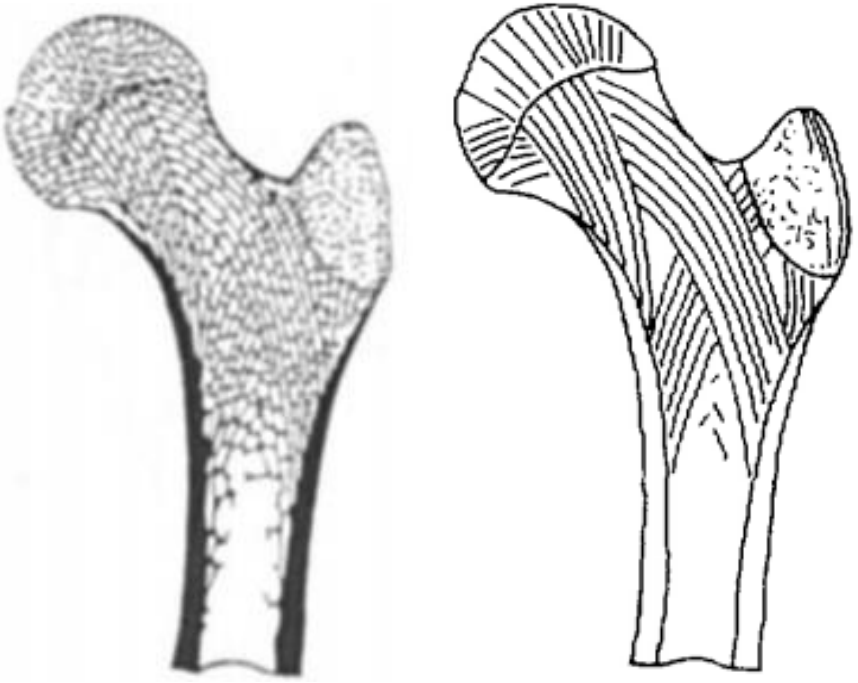
Stage 1: 18–20 years (Figs. 1, 2, 4)

Apex of the medullary cavity: Deep below the trochanter minor.
Structure of spongiosa: Very dense.
Cavity formations: None recognizable.
Trajectorial structure: All trajectories clearly recognizable.
Cortex: Very thick.



Stage 2: 20–30 years (Figs. 1, 2, 4)

Apex of the medullary cavity: Reaches the lower limit of the trochanter minor an partially exceeds it.
Structur of spongiosa: Dense.
Cavity formations: Slight loosenings in the areas of collum and trochanter major.
Trajectorial structure: Clearly recognizable but appearing less dense.
Cortex: Thick.



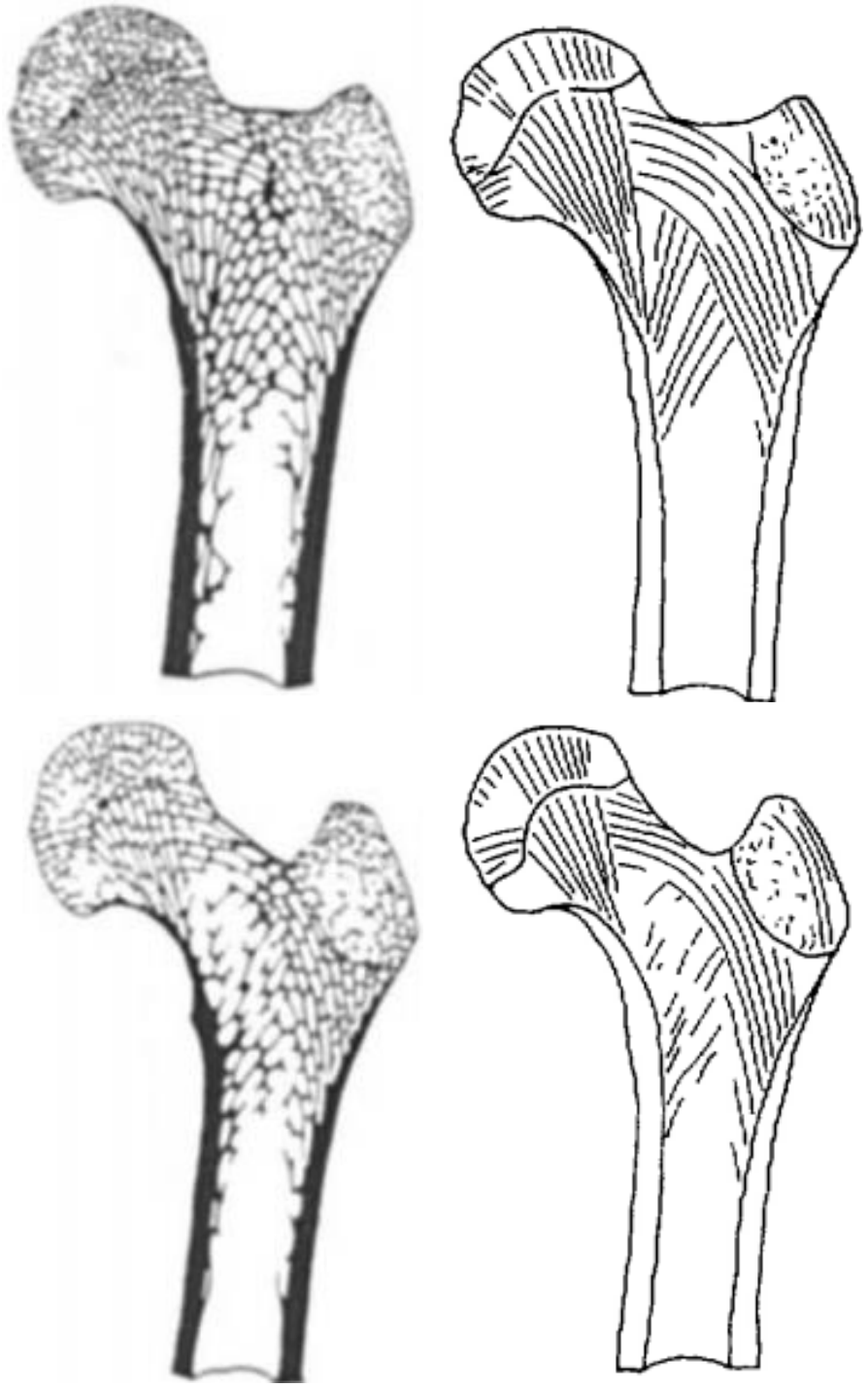
Szilvássy a Kritscher 1990

Stage 3: 30–40 years (Figs. 1, 2, 4)

Apex of the medullary cavity: Reaches the upper margin of the trochanter major.
Structure of spongiosa: Loosened.
Cavity formations: Beginning of cavity formation in the middle part of the collum and in the trochanter major.
Trajectorial structure: Recognizable, the single trajectories becoming slightly thinner.
Cortex: Medium thick.

Stage 4: 40–50 years (Figs. 1, 2, 4)

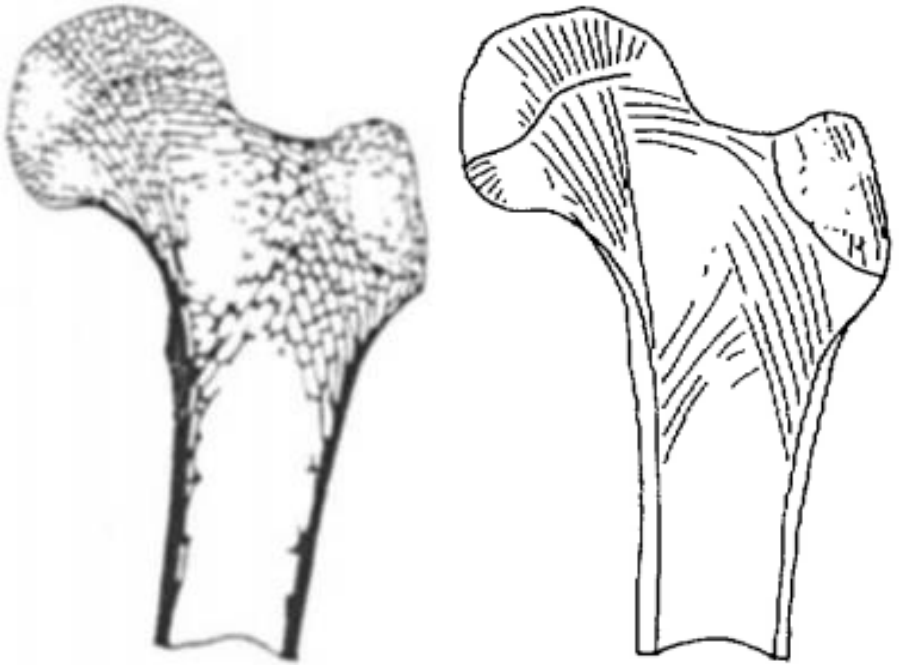
Apex of the medullary cavity: Exceeds the upper limit of the trochanter minor.
Structure of spongiosa: Clearly loosened.
Cavity formations: Small cavities in the collum and in the trochanter major.
Trajectorial structure: Partially interrupted and of smaller dimensions.
Cortex: Medium thick.



Szilvássy a Kritscher 1990

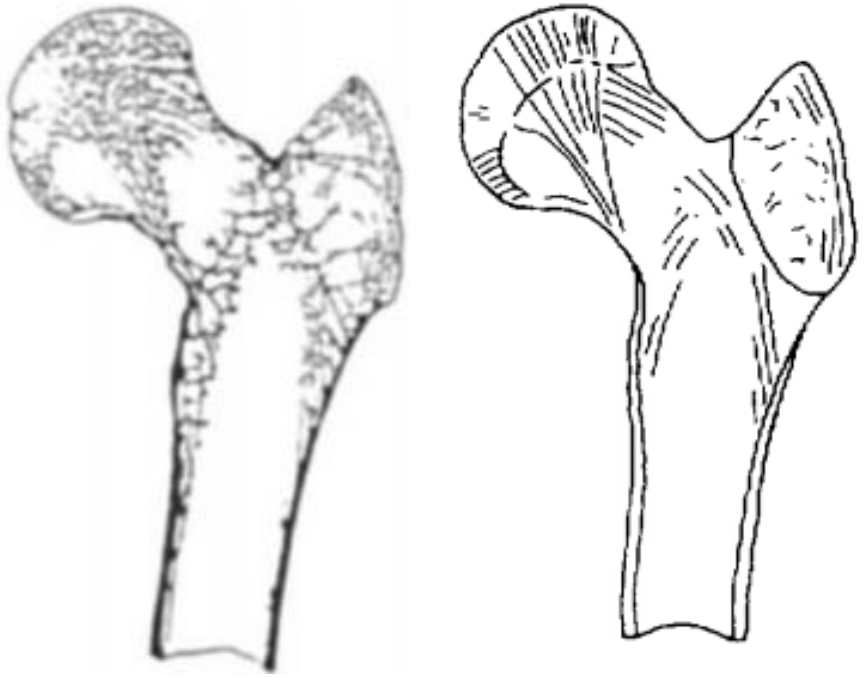
Stage 5: 50–60 years (Figs. 1, 2, 4)

Apex of medullary cavity: Very clearly above the upper limit of the trochanter major.
Structure of spongiosa: Very much loosened.
Cavity formations: Clearly recognizable, medium size cavities in the collum and in the trochanter major.
Trajectorial structure: Strongly interrupted recognizable only in its basic alignments.
Cortex: Moderately thick.



Stage 6: 60–70 years (Figs. 1, 2, 4)

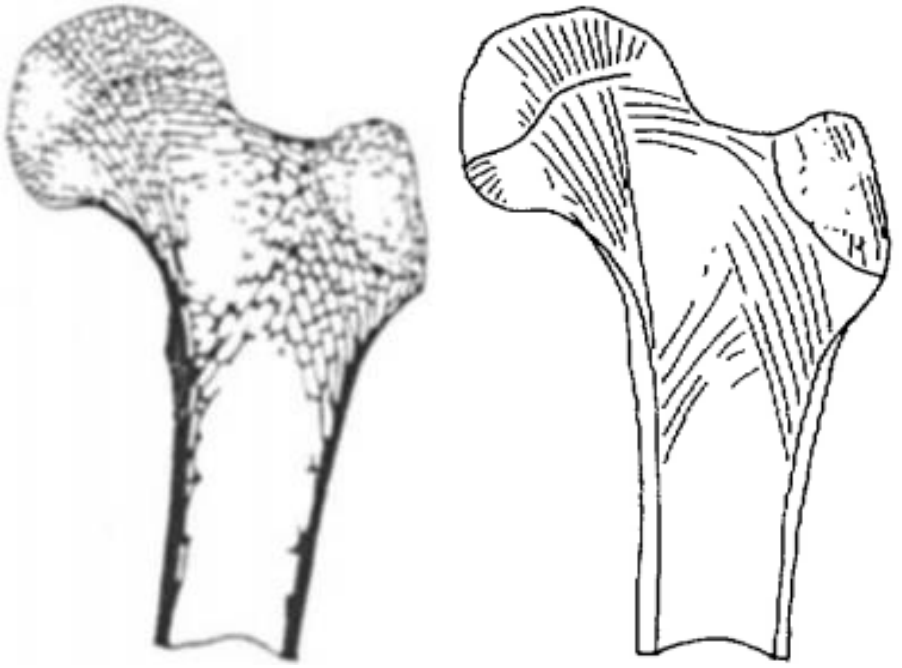
Apex of the medullary cavity: Approaching the collum femoris.
Structure of spongiosa: Very disintegrated.
Cavity formations: Large cavities in the collum and in the trochanter major.
Trajectorial structure: Only remnants recognizable.
Cortex: Thin.



Szilvássy a Kritscher 1990

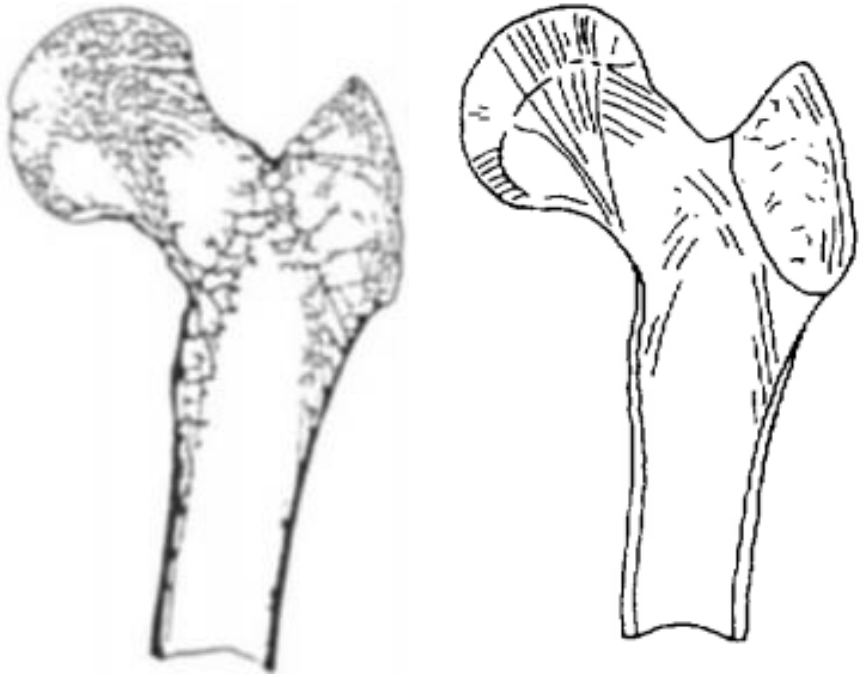
Stage 5: 50–60 years (Figs. 1, 2, 4)

Apex of medullary cavity: Very clearly above the upper limit of the trochanter major.
Structure of spongiosa: Very much loosened.
Cavity formations: Clearly recognizable, medium size cavities in the collum and in the trochanter major.
Trajectorial structure: Strongly interrupted recognizable only in its basic alignments.
Cortex: Moderately thick.



Stage 6: 60–70 years (Figs. 1, 2, 4)

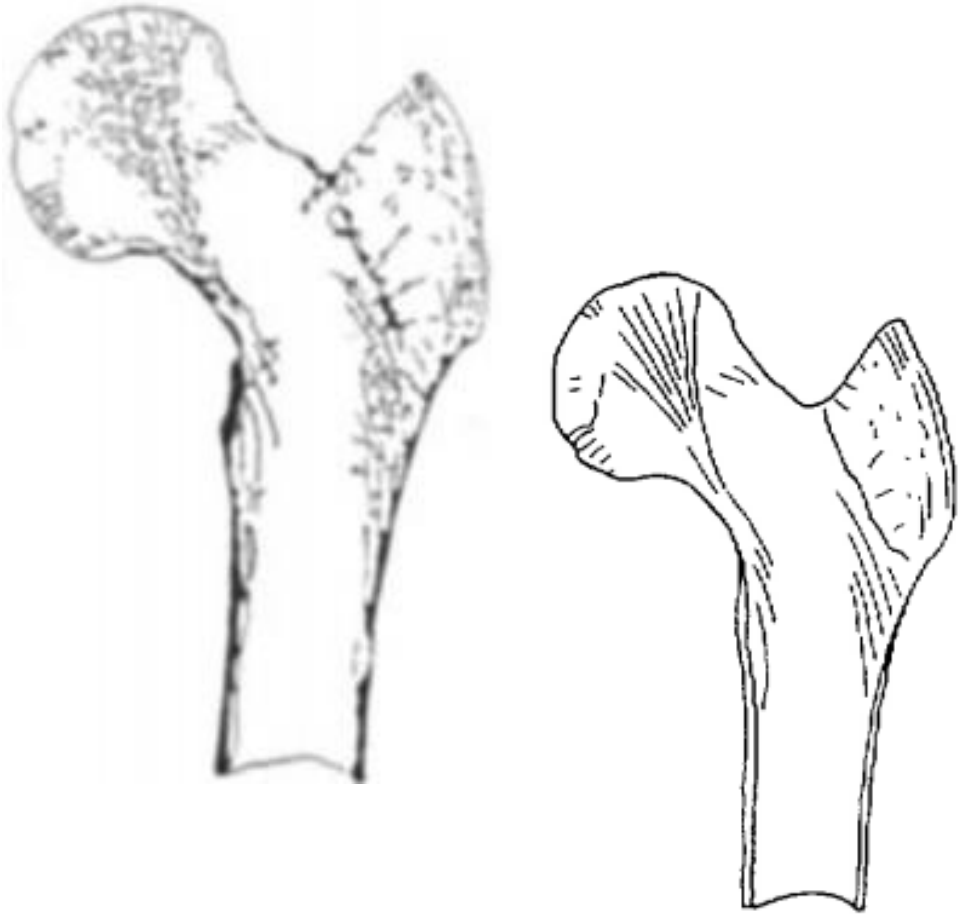
Apex of the medullary cavity: Approaching the collum femoris.
Structure of spongiosa: Very disintegrated.
Cavity formations: Large cavities in the collum and in the trochanter major.
Trajectorial structure: Only remnants recognizable.
Cortex: Thin.



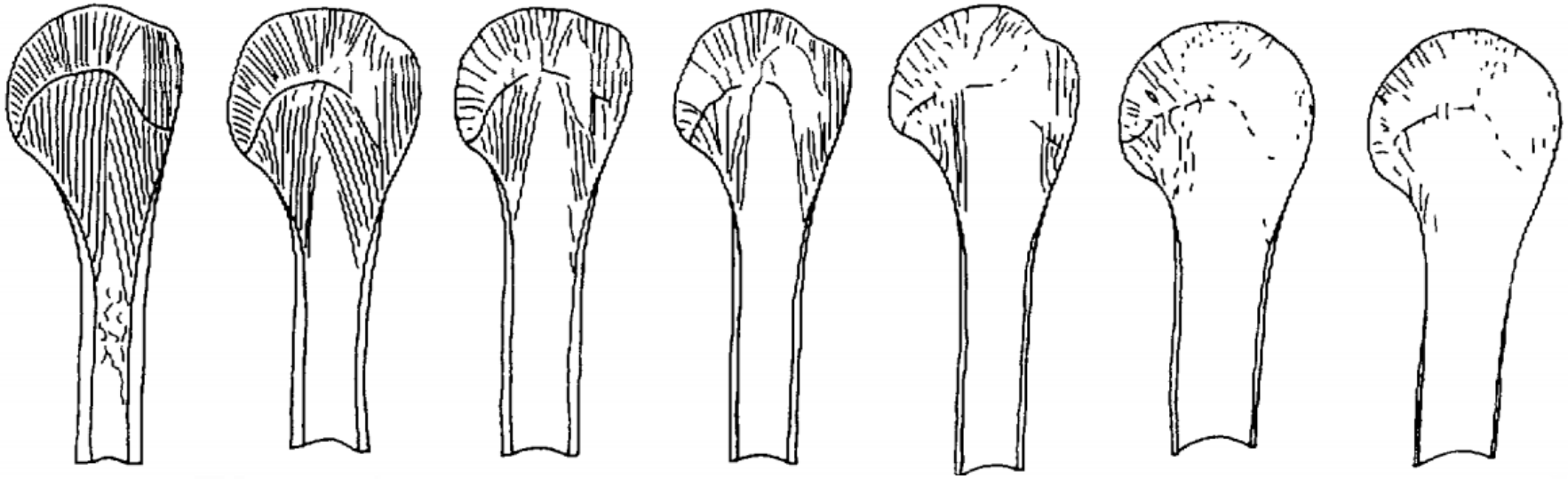
Szilvássy a Kritscher 1990

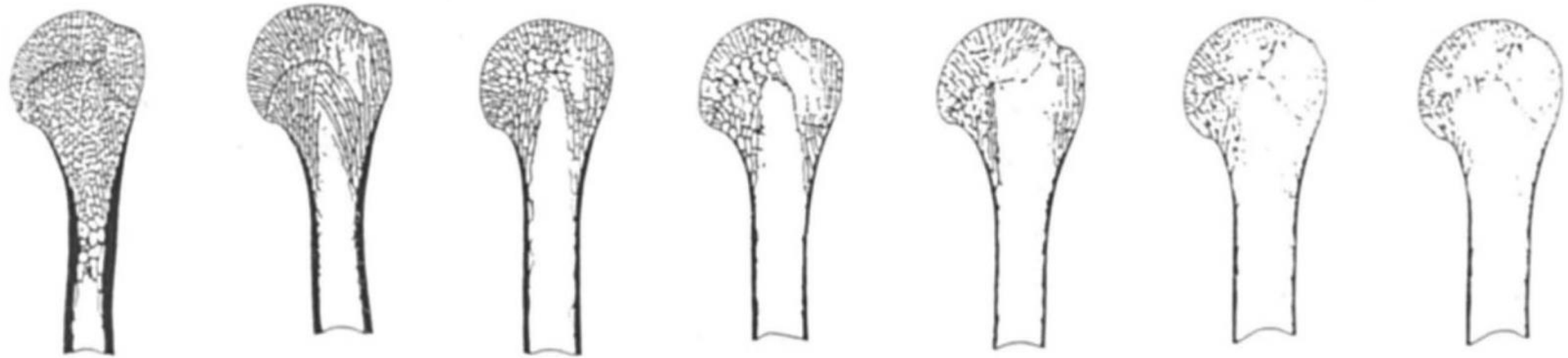
Stage 7: 70–x years (Figs. 1, 2, 4)

Apex of the medullary cavity: Reaches into the collum femoris.
Structure of spongiosa: Remnants only along the cortex.
Cavity formations: Cavities very large.
Trajectorial structure: Barely recognizable.
Cortex: Very thin.



Szilvássy a Kritscher 1990





1
–20

2
20 – 30

3
30 – 40

4
40 – 50

5
50 – 60

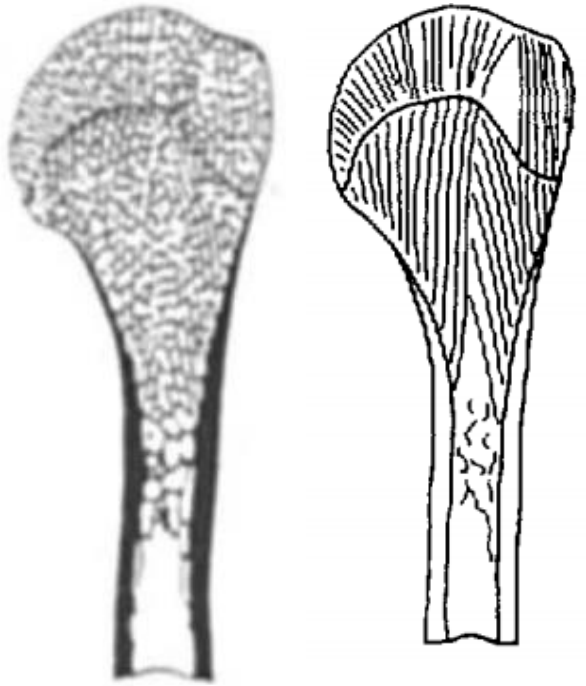
6
60 – 70

7
70 –

Szilvássy a Kritscher 1990

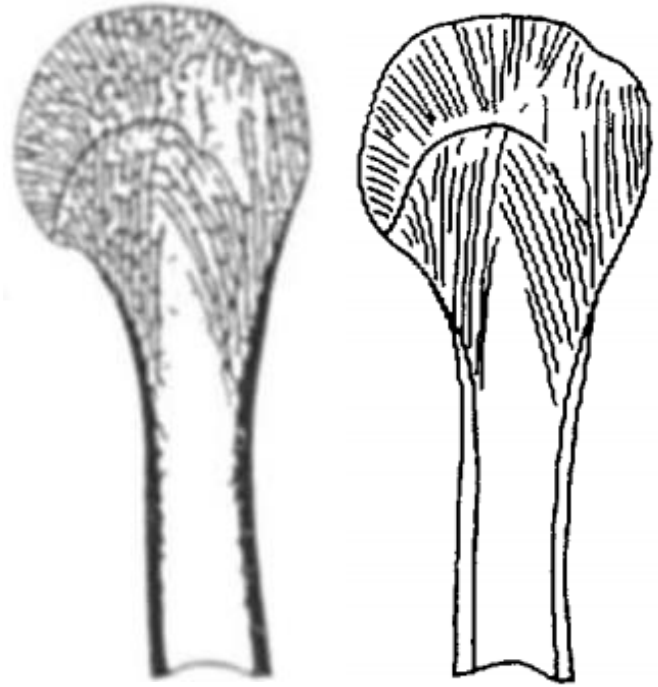
Stage 1: 18–20 years (Figs. 1, 2, 5)

Apex of the medullary cavity: Deep below the collum chirurgicum.
Structure of spongiosa: Very dense.
Cavity formations: None recognizable.
Trajectorial structure: All trajectories clearly recognizable.
Cortex: Very thick.



Stage 2: 20–30 years (Figs. 1, 2, 5)

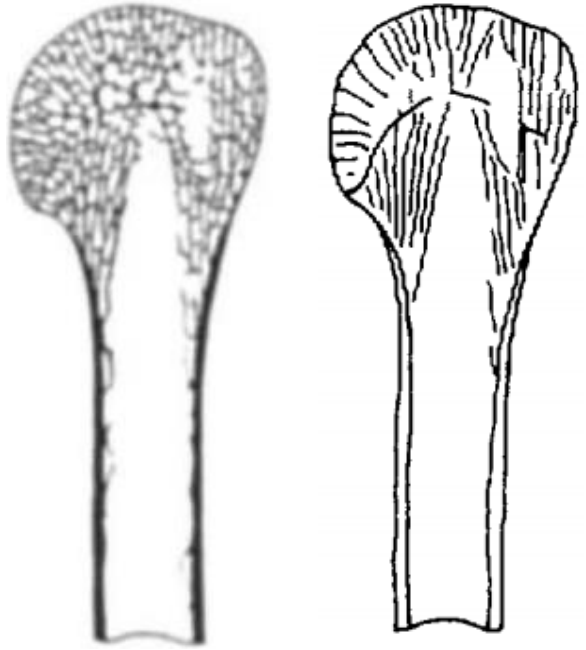
Apex of the medullary cavity: Reaches the lower limit of the collum chirurgicum.
Structure of spongiosa: Dense.
Cavity formations: Slight loosenings in the area of the tuberculum majus.
Trajectorial structure: Clearly recognizable, slightly loosened.
Cortex: Medium thick.



Szilvássy a Kritscher 1990

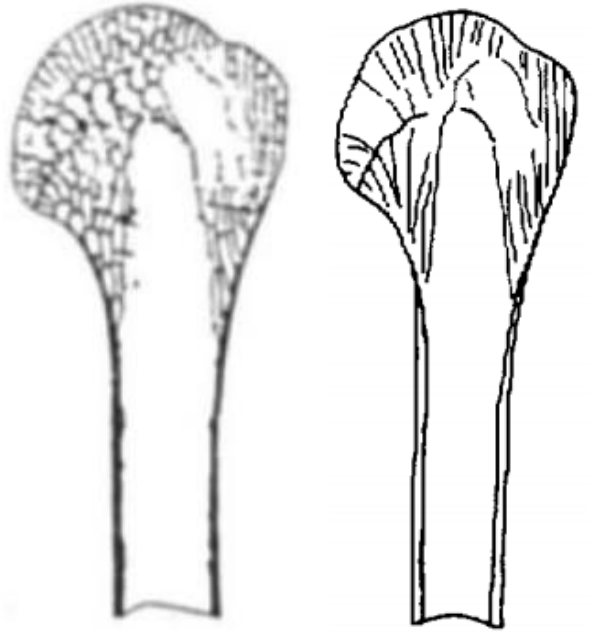
Stage 3: 30–40 years (Figs. 1, 2, 5)

Apex of the medullary cavity: Exceeds the collum chirurgicum.
Structure of spongiosa: Loosened.
Cavity formations: Clearly recognizable small cavities in the tuberculum majus.
Trajectorial structure: Recognizable only in its basic alignments.
Cortex: Medium thick.



Stage 4: 40–50 years (Figs. 1, 2, 5)

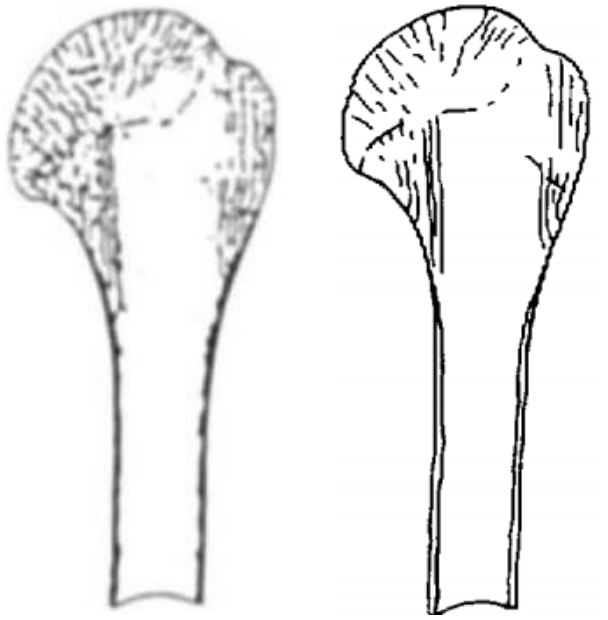
Apex of the medullary cavity: Reaches the epiphyseal line.
Structure of spongiosa: Very much loosened.
Cavity formations: Large cavities in the tuberculum majus, beginning of cavity formation in the epiphysis.
Trajectorial structure: Only in the marginal zones weakly recognizable.
Cortex: Moderately thick.



Szilvássy a Kritscher 1990

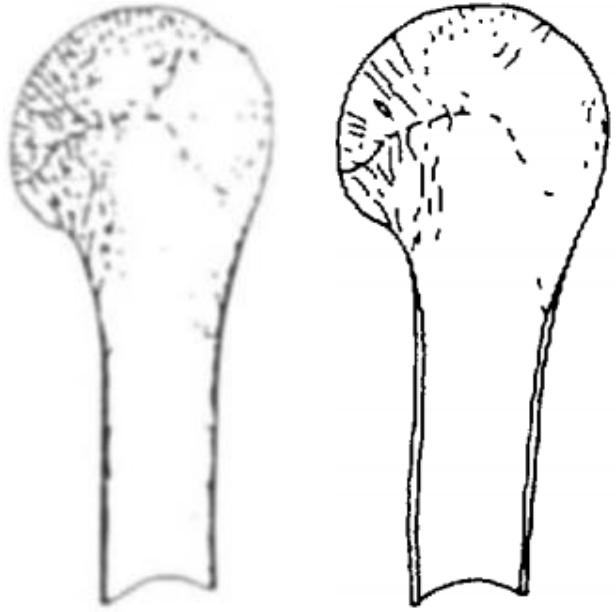
Stage 5: 50–60 years (Figs. 1, 2, 5)

Apex of the medullary cavity: Exceeds the epiphyseal line and reaches into the tuberculum majus.
Structure of spongiosa: Much loosened.
Cavity formations: Cavity formation in the tuberculum majus connected with the apex of the medullary cavity.
Trajectorial structure: Only in the marginal zones very weakly recognizable.
Cortex: Thin.



Stage 6: 60–70 years (Figs. 1, 2, 5)

Apex of the medullary cavity: Reaches the proximal margin of the cortex.
Structure of spongiosa: Remnants only.
Cavity formations: Very large cavities.
Trajectorial structure: Barely recognizable.
Cortex: Very thin.



Szilvássy a Kritscher 1990

Stage 7: 70–x years (Figs. 1, 2, 5)

Apex of the medullary cavity: Extends almost completely into the proximal caput of the humerus.
Structure of spongiosa: Weakly recognizable in the marginal zones.
Cavity formations: Excessive cavities.
Trajectorial structure: Not recognizable.
Cortex: Very thin.