16th International Symposium on Dental Morphology (ISDM)

1st Congress of the International Association for Paleodontology (IAPO)

Programme & Book of abstracts

August, 26 – 30, 2014

Zagreb, Croatia

The organizers acknowledge the support of the following institutions and persons:

President of the Republic of Croatia – Dr Ivo Josipović

Mayor of the city of Zagreb – Mr. Milan Bandić

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Editor of the Programme & Book of abstracts

Marin Vodanović

Contents

Welcome

Dear Colleagues and Friends

On behalf of the Organizing Board, it is my pleasure and honour to welcome you at the 16th International Symposium on Dental Morphology (ISDM) and 1st Congress of the International Association for Paleodontology (IAPO). In Newcastle UK, 2011 at the 15th International Symposium on Dental Morphology, Zagreb – the capital of the Republic of Croatia was chosen as the venue for the next meeting. Although Zagreb and Croatia have a long academic and scientific tradition in this scientific field, this is the first time that this meeting is organized in Croatia. Just for your information, the Department of Dental Anthropology School of Dental Medicine University of Zagreb was established on February 8, 1966 under the name Department of Teeth Morphology and the first course was named Teeth morphology and introduction to dentistry. The organizers of the ISDM IAPO 2014 are School of Dental Medicine University of Zagreb, together with the International Association for Paleodontology and Croatian Association of Forensic Stomatologists.

The program of the ISDM IAPO 2014 has been designed to accommodate a rich cultural social program on very exclusive and interesting places in Zagreb and surrounding along with an outstanding and stimulating scientific experience. More than 150 abstracts from more than 30 countries worldwide will be presented on the meeting. The scientific program is determined by three main areas: dental morphology, paleodontology and forensic dentistry. Dental evolution, dental growth, craniofacial development, dental genetics, clinical aspects of dental morphology, dental tissues and dental bioarchaeology are some of the topics that will be thoroughly addressed and discussed during the scientific sessions.

Having accomplished all necessary preparations the organising board invites all of you to enjoy the 16th ISDM and 1st IAPO congress and attain a genuine experience of the Croatian spirit.

I hope that this will be a memorable journey for you, both scientifically and socially.

Welcome to Zagreb

Marin Vodanović

President of the Organizing Board of ISDM IAPO 2014 and

Head of the Department of Dental Anthropology School of Dental Medicine University of Zagreb

Scientific Board of the ISDM IAPO 2014

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Each of 159 abstracts submitted for presentation at ISDM IAPO 2014 was reviewed by at least two experts – ISDM IAPO 2014 board members. In addition, the deadline for abstract submission was kept as late as possible to allow researchers to present their latest findings.

We are therefore enormously grateful to the reviewers for their careful and speedy work during the very short period between the submission deadline and the notification of conference participants.

Programme

Congress venue

Hotel Westin, Izidora Kršnjavog 1, HR-10000 Zagreb, Croatia

Please remember that the ISDM IAPO 2014 badge is OBLIGATORY to enter conference and events.

Tuesday 26.8.2014			
15.00 - 18.00		**Registration**	
18.00 - 19.30		**Zagreb intro - walking tour** *starts in the lobby of the Hotel Westin (congress venue), Zagreb*	

O – oral presentation
P – poster presentation

Wednesday 27.8.2014			
8.00 - 9.00		**Registration**	
9.00 - 9.30		**Opening**	
9.30 - 10.00	O1	**Keynote lecture**: Ridges, roots, wrinkles and banks: the origins and evolution of the Arizona State University Dental Anthropology System	G Richard Scott
10.00 - 10.20	O2	Krapina Neandertal collection: 115 years of active research	Davorka Radovčić
10.20 - 10.30	O3	International Association for Paleodontology – past, present and future perspectives	Marin Vodanović
10.30 - 10.45		**Coffee break**	
		Dental morphology (including clinical aspects) 1 *Chairpersons: G Richard Scott and Elzbieta Zadzinska*	
10.45 - 10.55	O4	Season of birth and selected maternal factors affecting enamel thickness in human deciduous teeth	Elzbieta Zadzinska, Marta Kurek, Beata Borowska-Struginska, Aneta Sitek, Iwona Rosset, Wieslaw Lorkiewicz
10.55 - 11.05	O5	The impact of dental impairment on health and nutrition in a wild primate population	Frank P Cuozzo, Michelle L Sauther, Cora Singleton, James B Millette, Peter S Ungar, Nayuta Yamashita, Aimee Norris
11.05 - 11.15	O6	Virtual close-up view on occlusal contacts reveals functional variability in hominid molars	Ottmar Kullmer, Stefano Benazzi

11.15 - 11.25	O7	Jaw gape and biomechanics in grazing and/or browsing cervids, bovids and equids	William L. Hylander
11.25 - 11.35	O8	The 'Sialo-Microbial-Dental-Complex' in oral health and disease	John Kaidonis, Grant Townsend
11.35 - 11.45	O9	Anatomical evaluation of root apex morphology	Cena Dimova, Ivona Kovacevska, Lidija Popovska, Julija Zarkova, Kiro Papakoca, Katerina Zlatanovska
11.45 - 11.55	O10	The first moderns in Anatolia: Üçağızlı cave	Erksin Güleç
11.55 - 12.05	O11	Lobodontia: genetic entity with specific pattern of dental dysmorphology	Tomislav Skrinjaric, Kristina Gorseta, Ilija Skrinjaric
12.05 - 12.15		Discussion	
12.15 - 13.00		**Lunch**	
		Dental morphology (including clinical aspects) 2 *Chairpersons: Shara E Bailey and Eisaku Kanazawa*	
13.00 - 13.20	O12	Christy G. Turner II: The life and times of a roving dental anthropologist	G Richard Scott
13.20 - 13.30	O13	A performance analysis of deciduous morphology in the detection of biological siblings	Kathleen S. Paul, Christopher M. Stojanowski
13.30 - 13.40	O14	Analysis of skeletal components of temporomandibular joint of an early medieval Croatian population	Josip Kranjčić, Mario Šlaus, Sanja Peršić, Marin Vodanović, Denis Vojvodić
13.40 - 13.50	O15	Mineral integrity of human and animal teeth and bones using FTIR – new perspectives for characterizing diagenetic alteration	Beata Stepańczak, Krzysztof Szostek, Marzena Król, Aleksandra Lisowska-Gaczorek
13.50 - 14.00	O16	Morphological differences between two gingival biotypes, Croatian cross-sectional study	Jelena Petričević, Bojana Križan Smojver, Andrej Aurer
14.00 - 14.10	O17	Variation in the expression of a derived molar trait in Papionini relative to other Old World Monkeys	Tesla Monson, Leslea J. Hlusko
14.10 - 14.20		Discussion	
14.20 - 14.30		**Coffee break**	
14.30 - 18.00		**Poster session 1** *Chairpersons: Ivan Galić, Ivana Savić Pavičin, Selma Zukić*	
	P1	Dental development preserves population fluctuations in wild ungulates: the present is the key to the past	Caitlin Brown, Caroline E. Rinaldi, Blaire Van Valkenburgh
	P2	The woman of metropolis	A.Sadi Çağdır, Hüseyin Afşin, Serdar Aybek,Yalçın Büyük
	P3	Dental variation and migration at ancient Alalakh	Kimberly Consroe M.A
	P4	Quantification of tooth wear for age estimation purposes in paleodontology: technical note	Ana Družijanić, Marin Vodanović

	P5	Investigation of fossil material from the XII century burials in Drutsk town, Vitebsk region (Belarus)	Olga Goncharova
	P6	Mating systems of the Jomon people from the mainland Japan indicated by dental traits	Hiroko Hashimoto
	P7	Radiomorphometric indices of mandibular bones in an 18th century population sample	Ana Ivanišević Malčić, Jurica Matijević, Marin Vodanović, Dubravka Knezović Zlatarić, Goranka Prpić Mehičić, Silvana Jukić
	P8	Relationship between Chinese ethnic minorities and Okhotsk cultural people in dental metric trait	Shota Kataoka, Shigeru Kobayashi, Toshihiro Ansai
	P9	Cementoblastoma in a red deer (Cervus elaphus) from the Late Pleistocene of Rochedane, France	Uwe Kierdorf, Anne Bridault, Carsten Witzel, Horst Kierdorf
	P10	Enamel pearl anomaly in an archaeological sample from Kranj – Slovenia	Marissa Wojcinski, Marijana Kljajić, Jozo Perić - Peručić
	P11	Dental morphology of individual with congenital syphilis from 16th century	Tomislav Lauc, Petra Rajić Šikanjić, Zrinka Premužić, Cinzia Fornai, Boris Mašić, Marin Vodanović
	P12	Dental caries in human skeletal series from 17th – 18th century archeological sites on south Poland	Justyna Marchewka, Daniel Nowakowski, Magdalena Sławińska, Lech Popiołek
	P13	Frequency and distribution of enamel hypoplasias in an 18th century sample	Ana Ivanišević Malčić, Jurica Matijević, Marin Vodanović, Damir Mihelić, Goranka Prpić Mehičić, Silvana Jukić
	P14	Frequency and timing of linear enamel hypoplasia in two early medieval Irish populations - Augherskea and Omey Island	Mario Novak
	P15	Selected orthodontic anomalies and malocclusions from archeological sites Grodzka 19, Kraków	Daniel Nowakowski, Justyna Marchewka, Magdalena Sławińska , Henryk Głąb
	P16	Symmetry of mental foramen	Ivan Pavušek, Marija Šimović
	P17	Paleostomatological analysis of a skeletal population from antique period site of Vinkovci - Cibale	Dunja Peko
	P18	Oval bone cavity in a 4th century mandible	Ivan Salarić, Ivan Galić, Mario Šlaus, Marin Vodanović
	P19	Hypoplastic defects in two 17th-18th century skeleton series from Krasicznyn and Krakow (southern Poland)	Krzysztof Jarzębak, Justyna Marchewka, Iwona Wronka, Henryk Głąb
	P20	Teeth morphology of Anatolian Çorakyerler Hominoidea and its	Ayla Sevim Erol, Alper Yener Yavuz

		comparison with other Hominoideas	
	P21	Accuracy of the sexual dimorphism evaluation using the goniac angle in a Brazilian sample	Maria G. H. Biazevic, Edgard Michel-Crosato, Thaís Torralbo Lopez, Luiz Airton Saavedra de Paiva, Diogo C B Silva
	P22	The use of regression formulae derived from daily incremental counts to estimate the chronological age of stressful events occurring during deciduous enamel formation	Wendy Birch, Christopher Dean
	P23	Training in forensic age estimation using anterior median palatine suture	Luka Banjšak, Jelena Bradić
	P24	Cameriere's third molar index in assessing 18 years of age	Ivan Galić, Hrvoje Brkić, Tomislav Lauc, Elizabeta Galić Maria Gabriela Haye Biazevic, Ivan Brakus, Jozo Badrov, Roberto Cameriere
	P25	Finnish legislation on forensic age assessment	Mari Metsäniitty, Olli Varkkola, Helena Ranta
	P26	Sexual dimorphism in the permanent canines of the Bosnian-Herzegovinian population and its implications in forensic investigations	Belma Muhamedagić , Nermin Sarajlić , Lejla Muhamedagić
	P27	Is the palatal rugae pattern as unique as a fingerprint?	Senad Muhasilović , Goran Batinjan, Marin Vodanović
	P28	Age estimation of teeth with Raman spectrometry - preliminary study	Aziz Osmani, Ozren Gamulin, Marin Vodanović
	P29	Forensic aspects of lips dimensions in a sample of Croatian population	Marija Šimović, Ivan Pavušek
	P30	The relationship between skull morphology, masticatory muscle force and cranial response to biting	Viviana Toro-Ibacache, Víctor Zapata Muñoz, Paul O'Higgins
	P31	Function of Haldanodon (Docodonta, Mammaliaformes) pseudotribosphenic molar dentition	Janka J. Brinkkötter, Thomas Martin
	P32	Evolution of the occlusal morphology of hominin postcanines as modeled through the inhibitory cascade	Kes Schroer, Bernard Wood
	P33	Cusp 6 variation and frequency in non-human apes and hominins	Matthew M. Skinner, Elissa M. Ludeman, Shara Bailey, Jean-Jacques Hublin
	P34	Positive effects of growth hormone treatment on craniofacial morphology in Tuner syndrome patients	Jovana Juloski, Jelena Dumančić, Ivana Šćepan, Ivana Savić Pavičin, Branislav Glišić, Tomislav Lauc, Jelena Milašin, Zvonimir Kaić, Miroslav Dumić,

			Marko Babić
	P35	The application of LA-ICP-MS and SEM-EDS techniques in trace element concentration measurements in human teeth	Małgorzata Kępa, Krzysztof Szostek, Henryk Głąb, Stanisław Walas
19.00 - 21.00		**Welcome reception** *Croatian National Theatre - Trg maršala Tita 15, Zagreb*	

Thursday 28.8.2014			
8.00 - 9.00		**Registration**	
		Paleodontology (dental bioarchaeology) 1 *Chaipersons: David W Frayer and Emmanuel D'Incau*	
9.00 - 9.20	O18	Dental studies of the Krapina Neandertals	David W Frayer, Joseph Gatti, Ivana Fiore, Luca Bondioli
9.20 - 9.30	O19	An example of supernumerary tooth from ancient Patara, Turkey	Ayla Sevim Erol, Alper Yener Yavuz, Ahmet İhsan Aytek
9.30 - 9.40	O20	Hypercementosis: definition, frequency and aetiologies in two medieval samples from France. Application of these results to a number of Neanderthal teeth	Emmanuel D'Incau, Christine Couture, Natacha Crépeau, Fanny Chenal, Cédric Beauval, Vincent Vanderstraete, Bruno Maureille
9.40 - 9.50	O21	A closer examination of childhood diet and physiology using stable isotope analysis of incremental human dentine	Julia Beaumont, Janet Montgomery
9.50 - 10.00	O22	Parafacets in Middle Paleolithic dentitions: questioning their usefulness for behavior reconstruction	Rachel Sarig, Anne-Marie Tillier, Alexander D Vardimon, Israel Hershkovitz
10.00 - 10.10	O23	Serial founder effects, population isolation and migration, and rare incisor variants in Mexico and the U.S. Southwest	Heather J.H. Edgar, Alexis O'Donnell, Corey S. Ragsdale, Catherine M. Willermet
10.10 - 10.20	O24	Amelogenesis Imperfecta (AI) in Crocuta crocuta spelaea	Tibor Lenkei, Attila Patócs, Peter Kertesz
10.20 - 10.30	O25	Biological proximity and dental heritability from internal tooth structure analysis of early agriculturalists from the Neolithic necropolis of Gurgy (France)	Mona Le Luyer, Stéphane Rottier, Priscilla Bayle
10.30 - 10.40	O26	Dental caries and ante-mortem tooth loss in an early medieval population from western Ireland	Mario Novak
10.40 - 10.50		Discussion	
10.50 - 11.10		**Coffee break**	
		Paleodontology (dental bioarchaeology) 2 *Chairpersons: Anja Petaros and Andrei Zinoviev*	
11.10 - 11.30	O27	Review of paleodontological analyses carried out at the Anthropological centre of the Croatian Academy of Sciences and Arts	Mario Šlaus

11.30 - 11.40	O28	Analysis of interaction between indexes of physiological stress in mediaeval population from city of Wrocław and village Sypniewo	Aleksandra Gawlikowska-Sroka, Paweł Dąbrowski
11.40 - 11.50	O29	Stable isotopes in human teeth and bone as indicators of breastfeeding practices in the Neolithic period – a collective grave from Bronocice (Poland)	Krzysztof Szostek, Beata Stepańczak, Małgorzata Kępa, Elżbieta Haduch, Henryk Głąb, Jacek Pawlyta, Gordon Cook, Rob Ellam
11.50 - 12.00	O30	Reliability of novel light-induced fluorescence measurements in detection of occlusal caries lesion in historical material	Jacek Tomczyk, Julian Komarnitki
12.00 - 12.10	O31	Dental analysis of Miocene Lufengpithecus fossils from Yunnan, south China	Cuibin Wang, Lingxia Zhao
12.10 - 12.20	O32	Favourable preservation of fossil dire wolf teeth in anaerobic/anhydrous petroleum seeps: hydrocarbon impregnation maintains apatite integrity without interfering with histological analysis	Sabrina B. Sholts, Leslea J. Hlusko, Joshua P. Carlson, Sebastian K. T. S. Wärmländer
12.20 - 12.30	O33	Oral history in highland Ethiopia: Dental health and livelihood changes	Mary S. Willis, Shimelis Beyene, Belaineh Legesse, Martha Mamo, Teshome Regassa, Tsegaye Tadesse, Yitbarek Woldohawariat
12.30 - 12.40		Discussion	
12.40 - 13.30		**Lunch**	
13.30 - 19.00		**Bus trip to Krapina and the Neanderthal Museum** *starts in the lobby of the Hotel Westin, Zagreb*	
22.00 -		**Paleo-party** *Lemon – bar & club / terrace of the Archaeological Museum, Gajeva 10, Zagreb*	

Friday 29.8.2014			
8.00 - 9.00		**Registration**	
		Paleodontology (dental bioarchaeology) 3 *Chairpersons: Mario Novak and Svend Richter*	
9.00 - 9.10	O34	Sinodonty in Mesoamerica and its relationship with the initial settlement of Americas (13.750-500 BP)	Carlos David Rodriguez-Florez
9.10 - 9.20	O35	Possible causes of tooth wear in medieval Icelanders	Svend Richter, Sigfus Thor Eliasson
9.20 - 9.30	O36	Odontobiography – the science and art of reading teeth and mouths	Marin Vodanović
9.30 - 9.40	O37	Cultural dental modification among the prehistoric population in Indonesia	Toetik Koesbardiati, Rusyad Adi Suriyanto, Delta Bayu Murti
9.40 - 9.50	O38	Paleoradiological analysis of dental remains from ancient cremated urns	Mislav Čavka, Anja Petaros, Marija Mihaljević, Boris Brkljačić, Hrvoje Kalafatić

9.50 - 10.00	O39	The use of skeletal data for interpreting dental development in fossil hominins	Maja Šešelj
10.00 - 10.10	O40	Congenital syphilis cases among population of Old Russian cities	Irina Reshetova
10.10 - 10.20		Discussion	
10.20 - 10.30		**Coffee break**	
		Dental evolution *Chairpersons: Tomislav Lauc and Ling-xia Zhao*	
10.30 - 10.50	O41	New discovery of early Pleistocene orangutan fossils from Chongzuo in southern China	Lingxia Zhao, Changzhu Jin, Wenshi Pan
10.50 - 11.00	O42	Taxonomic differences in deciduous upper second molar crown outlines of H. sapiens, H. neanderthalensis, and H. erectus	Shara E. Bailey, Stefano Benazzi, Caroline Souday, Claudia Astorino, Kathleen Paul, Jean-Jacques Hublin
11.00 - 11.10	O43	Testing developmental biology predictions with fossils – dental complexity and evolutionary rates of the Multituberculata	Ian Corfe, Gregory Wilson, Alistair Evans, Jukka Jernvall
11.10 - 11.20	O44	Dental developmental pattern of the Neanderthal children from Dederiyeh Cave in Syria	Osamu Kondo, Hitoshi Fukase, Hajime Ishida
11.20 - 11.30	O45	Evolutionary transition in molar function in Eocene primate Cantius	Ulrike Menz
11.30 - 11.40	O46	Periodic incremental markings in the enamel of cynodonts and mammaliaforms: the origin of mammalian growth patterns	Rachel O'Meara, Wendy Dirks
11.40 - 11.50	O47	Experimental taphonomy: fossil record implications with paleoenvironmental interpretation	Yasemin Tulu
11.50 - 12.00		Discussion	
12.00 - 12.50		**Lunch**	
		Forensic dentistry 1 *Chairpersons: Vilma Pinchi and Tore Solheim*	
12.50 - 13.10	O48	Dental age assessment in adults	Hrvoje Brkić, Miroslav Miličević, Mladen Petrovečki
13.10 - 13.30	O49	The frequency of dental anatomical features for the evaluation of tooth marks in a criminal case	Tore Solheim
13.30 - 13.40	O50	A look at forensic dentistry in Bosnia and Herzegovina	Lejla Ibrahimkadic, Nermin Sarajlić
13.40 - 13.50	O51	Estimating chronological age using cervical vertebrae and dental maturation	Scheila Manica, Helen Liversidge, Ferranti Wong
13.50 - 14.00	O52	Buccal enamel to dentine thickness ratios: Estimating the percentage of crown height lost in worn human mandibular canines	Gina McFarlane , Bruce Floyd
14.00 - 14.10	O53	Age estimation by dental developmental stages in children and adolescents in Iceland	Sigríður Rósa Víðisdóttir, Svend Richter

14.10 - 14.20	O54	Anthropometric analysis of sexual dimorphism in mandibles of Bosnian and Herzegovinian population	Selma Zukić, Amela Kulenović, Amra Vuković, Anita Bajsman, Lejla Kazazić
14.20 - 14.30		Discussion	
14.30 - 14.40		**Coffee break**	
		Forensic dentistry 2 *Chairpersons: Hrvoje Brkić and Roberto Cameriere*	
14.40 - 15.00	O55	A new software for age estimation in adults by pulp/tooth ratio in canines using periapical X-rays: preliminary results	Roberto Cameriere, Stefano De Luca, Nadaniela Egidi, Mauro Bacaloni, Pier Luigi Maponi, Luigi Ferrante, Mariano Cingolani
15.00 - 15.10	O56	A project on age determination of medieval human samples from Italy: traditional anthropological techniques vs dental age estimation methods	Francesca Bertoldi, Francesco Pagliara, F. Bestetti, Roberto Cameriere
15.10 - 15.20	O57	A recently excavated Copper Age human sample from Italy and dental age estimation results	Francesco Pagliara, Francesca Bertoldi, Roberto Cameriere, F. Bestetti
15.20 - 15.30	O58	Age estimation in Brazilian adults using periapical radiographs	Maria G H Biazevic, Edgard Michel-Crosato, Alana C S Azevedo, Marcos Rocha, Roberto Cameriere
15.30 - 15.40	O59	The Monti'e Prama (Cabras, Sardinia) necropolis, X- IX sec. A.C.: the age at death by teeth as a contribution to an archaeological question	Roberto Cameriere, Stefano De Luca, Domenico Basile, Donatella Croci, Ornella Fonzo, Elsa Pacciani
15.40 - 15.50	O60	Age estimation in a sample of adults Neolithic skeletons from Italy by tooth/pulp ratio in canines by X-rays	Serena Viva, Pier Francesco Fabbri, Luigi Ferrante, Norma Lonoce, Roberto Cameriere
15.50 - 16.00		Discussion	
14.30 - 18.00		**Poster session 2** *Chairpersons: Renata Chalas and Dean Konjević*	
	P36	Incremental structures of wild boar (Sus scrofa) enamel	Friederike Breuer, Uwe Kierdorf, Alan Richards, Horst Kierdorf
	P37	Time of mineralization of permanent teeth in children and adolescents in Gaborone, Botswana	Jelena Cavrić, Ivan Galić, Marin Vodanović
	P38	A radiographic study of mandibular deciduous root resorption	Andrew Fulton, Helen Liversidge
	P39	Assessment of dental age in African children aged 5-16 years in Botswana: a comparison of methods by Demirjian, Willems and Chaillet	Jelena Cavrić, Ivan Galić, Marin Vodanović
	P40	Histological examination of dental development in a juvenile mountain gorilla from Volcanoes National Park, Rwanda	Shannon C. McFarlin, Donald J. Reid, Keely Arbenz-Smith, Michael R. Cranfield, Felicia Nutter, Tara S. Stoinski, Christopher Whittier, Timothy G. Bromage, Antoine Mudakikwa

	P41	The deciduous human dentition around birth	Simon Oldfield, Helen Liversidge
	P42	Bilateral agenesis of permanent maxillary canines in a female patient: a case report	Marija Pejakić, Mateja Pejakić, Jelena Dumančić
	P43	Timing of eruption of the first primary tooth in preterm and full-term delivered infants	Ivana Savić Pavičin, Jelena Dumančić, Tomislav Badel, Marin Vodanović
	P44	Variation in age at M1 emergence and life history in wild chimpanzees	Jay Kelley, Gary T Schwartz, Tanya M Smith
	P45	Study of mineralization of second and third mandibular molars: cross-sectional study of children and adolescents in Bosnia and Herzegovina	Aida Selmanagić, Enita Nakaš, Samir Prohić, Oliver Božić, Omer Pinjić, Ivan Galić
	P46	Mandibular range of motion and pain intensity in patients with temporomandibular joint disc displacement without reduction	Iva Z. Alajbeg, Marijana Gikić, Melita Valentić-Peruzović
	P47	Centric slide in different Angle classes of occlusion	Samir Čimić, Tomislav Badel, Sonja Kraljević Šimunković, Ivana Savić Pavičin, Amir Ćatić
	P48	The assessment of dental and bone age in children with somatotropin hypopituitarism	Małgorzata Partyka, Renata Chalas, Maria Klatka
	P49	Size of anterior teeth in patients with gaps in the upper dental arch	Anna Sękowska, Renata Chalas, Izabella Dunin-Wilczyńska
	P50	Bone Regeneration, in the different technique. Immuno-histo-chemical exam (in vivo)	Galina Ciobanu, Massimo Corigliano, E Baldoni, G Pompa
	P51	Intelligence at 4 years and dental wear patterns in primary and mixed dentitions	Tuomo Heikkinen, Koshi Sato, Jaana Rusanen, Virpi Harila, Lassi Alvesalo
	P52	Permanent mandibular first molar with a radix entomolaris: A report of five cases	Tomaž Hitij, Iztok Štamfelj
	P53	Biological and habitual aspects of the dentition in early modern Japanese from the dental anthropological point of view	Eisaku Kanazawa
	P54	Mild hypodontia is associated with reduced tooth dimensions and cusp numbers compared to controls in a Romanian sample	Bernadette Kerekes-Máthé, Alan Brook, Krisztina Mártha, Melinda Székely, Richard N Smith
	P55	Severe tooth wear due to dental erosion and abrasion: a case report	Eva Klarić
	P56	Protuberance or fossa on the lateral surface of the mandible in primates	Shintaro Kondo, Munetaka Naitoh, Masanobu Matsuno, Eisaku Kanazawa
	P57	An overview of dental pathology in roe deer (Capreolus capreolus) from central Slovenia	Tajma Trupec, Ida Jelenko, Krešimir Severin, Helena Poličnik, Zdravko Janicki, Boštjan Pokorny, Dean Konjević
	P58	Concrescence of permanent maxillary second and third molar: case report	Ines Kovačić, Ivor Erak

	P59	Oral hygiene status of patients receiving hemodialysis	Bojana Križan Smojver, Karmela Altabas, Jelena Petričević, Andrej Aurer
	P60	Prenatal factors associated with the neonatal line thickness in human deciduous incisors	Marta Kurek , Elżbieta Zadzinska, Aneta Sitek, Beata Borowska-Struginska, Iwona Rosset, Wiesław Lorkiewicz
	P61	Factors for the expression of Carabelli's trait in 46,X,i(Xq)females	Mitsuko Nakayama, Raija Lähdesmäki, Ahti Niinimaa, Lassi Alvesalo
	P62	Dental metrics in Central African Pygmies	Alejandro Romero, Fernando V. Ramirez Rozzi, Alejandro Pérez-Pérez
	P63	Using a dental ecology approach to assess dental health in a wild population of ring-tailed Lemurs (Lemur catta) at the Bezà Mahafaly special reserve and Tsimanampesotse National Park Madagascar	Michelle L. Sauther, Frank P. Cuozzo, James P. Millette
	P64	µCT analysis of rodent hypsodont dentitions - new insights into infundibula and enamel islets	Anne Schubert, Irina Ruf, Wighart von Koenigswald
	P65	Inferring jaw movement from molar wear facets in cercopithecid monkeys	Daisuke Shimizu, Tomohiko Sasaki, Gen Suwa
	P66	Permanent maxillary molars with two palatal root canals: A report of four cases	Iztok Štamfelj, Tomaž Hitij
	P67	Gender estimation by odontometrics: preliminary report	Jana Barić, Kim Jelena Varga
	P68	Biomehanical stress analysis of mandibular first premolar - Finite element study	Selma Jakupović, Amra Vuković, Muhamed Ajanović, Edin Cerjaković
	P69	Non-metric dental trait variation among Eastern Europe and Western Siberia forest-steppe Neolithic populations	Alisa Zubova
	P70	Several cases of hypodontia and oligodontia: from dental anomaly to clinical implications	Selma Zukić , Amila Zukanović, Amela Džonlagić Dardagan, Anita Bajsman
19.45 - 20.00		**All together photo** *Mimara Museum - Rooseveltov trg 5, Zagreb*	
20.00 - 23.00		**Gala dinner** *Mimara Museum - Rooseveltov trg 5, Zagreb*	

Saturday 30.8.2014			
8.00 - 9.00		**Registration**	
		Craniofacial development & dental growth *Chairpersons: Wendy Dirks and Jelena Dumančić*	
9.00 - 9.20	O61	Dental development and life history: progress, pitfalls and a perspective	Wendy Dirks
9.20 - 9.40	O62	The X value in the craniofacial equation: X chromosome effects on oral and	Jelena Dumančić

		craniofacial development	
9.40 -9.50	O63	Mapping life stages in the mammalian dentition	Holly Smith
9.50 - 10.00	O64	Dental growth in Baka Pygmies	Fernando Ramirez Rozzi
10.00 - 10.10	O65	Biomechanical constraints on molar emergence	Halszka Glowacka, Gary T. Schwartz a
10.10 - 10.20	O66	IGF-2 and IGFBP-6 in human odontogenesis and jaw development	W Götz, A Konermann,N Miosge, A Jäger
10.20 - 10.30	O67	Sphenoid sinus variations among different sinus types	Nikola Stoković, Tomislav Lauc, Ivana Čuković-Bagić, Lovorka Grgurević
10.30 - 10.40	O68	Posterior body height of the third cervical vertebra as a predictor of mandibular rotation	Enita Nakaš, Mirza Glušac, Ivana Rupić, Ivan Galić, Tomislav Lauc
10.40 - 10.50	O69	Crowding defects of enamel: Will we ever understand them?	Mark Skinner
10.50 - 11.00	O70	A radiographic study of pulp crown dimensions of the mandibular deciduous second molar	Shakeel Kazmi, Paul Anderson, Helen M. Liversidge
11.00 - 11.10	O71	Morphogenetic variables of reaching and maintaining a functional occlusal relief in molars of Soay sheep	Carsten Witzel, Uwe Kierdorf, Kai Frölich, Horst Kierdorf
11.10 - 11.20		Discussion	
11.20 - 11.30		**Coffee break**	
		Dental genetics & dental tissues *Chairpersons: Horst Kierdorf and Huw Thomas*	
11.30 - 11.40	O72	Reconstructing temporal variation in fluoride intake of eastern grey kangaroos (Macropus giganteus) from a fluoride-polluted area by electron microprobe analysis of fluoride concentration in dentine	Horst Kierdorf, Dieter Rhede, Clare Death, Jasmin Hufschmid, Uwe Kierdorf
11.40 - 11.50	O73	X-Ray microtomography evaluation of the human variation in dental tissue proportions of the deciduous maxillary central incisor in a broad Middle Age sample	Elsa Garot, Patrick Rouas, Priscilla Bayle
11.50 - 12.00	O74	The inhibitory cascade as a general mechanism for integration in the mammalian primary dentition	Alistair Evans
12.00 - 12.10	O75	Three-dimensional relationships of enamel prisms, and enamel- and dentine-tubules, studied with synchrotron radiation holotomography	Aki Kallonen, Ian Corfe, Keijo Hämäläinen, Jukka Jernvall
12.10 - 12.20	O76	Appositional crystal growth control by biomineralization proteins in sea urchin tooth biomineralization	Thomas G.H. Diekwisch
12.20 - 12.30	O77	Large-scale biomonitoring of dental fluorosis in roe deer (Capreolus capreolus L.) in Slovenia to assess fluoride loads on the environment	Ida Jelenko, Klemen Jerina, Horst Kierdorf, Uwe Kierdorf, Boštjan Pokorny

12.30 - 12.40	O78	Mineralization front and elemental composition of the denticle in human permanent teeth	Masashi Takahashi, Shin-ichi Goto, Kazuhisa Mori, Izumi Mataga
12.40 - 12.50	O79	Genetic modularity and the evolution of the old world monkey dentition	Leslea J. Hlusko, Michael C. Mahaney
12.50 - 13.00	O80	Dynamics of Shh signalling during first molar development in mouse	Kateřina Lochovská, Renata Peterková, Lucie Smrčková, Mária Hovořáková
13.00 - 13.10		Discussion	
13.10 - 13.30		**Closing**	

Group photograph

A group photograph of all participants and accompanying persons will be taken on Friday August 29, 2014 at 19.45 in front of the Mimara Museum before gala dinner. Photograph will be e-mailed to all participants after the meeting.

Meals

Refreshments will be available during coffee breaks (included in the registration fee).

Coffee shops and restaurants are available in the hotel Westin or at walking distance.

Smoking

Smoking is not permitted at congress venue.

Wi-Fi

Free Wi-Fi is available at congress venue.

Social events

All social events are included in the registration fee for ISDM IAPO 2014 participants and accompanying persons.

Please remember that the ISDM IAPO 2014 badge is OBLIGATORY to enter events.

Zagreb intro walking tour

WHERE: starts in the lobby of the Hotel Westin (congress venue), Zagreb

ADDRESS: Izidora Kršnjavog 1, Zagreb

WHEN: Tuesday 26. 8. 2014 18.00 - 19.30

Welcome reception

WHERE: Croatian National Theatre in Zagreb

ADDRESS: Trg maršala Tita 15, Zagreb

WHEN: Wednesday 27.8. 2014, 19.00 - 21.00

Half day bus-trip to Krapina and the Neanderthal Museum

WHERE: starts in the lobby of the Hotel Westin, Zagreb

ADDRESS: Izidora Kršnjavog 1, Zagreb

WHEN: Thursday 28.8. 2014 12.30 – 18.00

Paleo-party

WHERE: Lemon – bar & club / terrace of the Archaeological Museum*

ADDRESS: Gajeva 10, Zagreb

WHEN: Thursday 28.8. 2014 22.00 - .....

**Welcome drink (available from 22.00 – 23.00) is included in the registration fee.*

Gala dinner

WHERE: Mimara Museum – Zagreb**

ADDRESS: Rooseveltov trg 5, Zagreb

WHEN: Friday 29.8. 2014 20.00 – 23.00

***Mimara Museum tours are not included in the registration fee and can be purchased separately at the Museum ticket office. Groups of ISDM IAPO 2014 participants qualify for a reduced ticket price.*

Registration

Registration for the meeting should be done in advance by the online registration system available at the meeting web page (www.paleodontology.com).

Early registration until 31 May, 2014 – 230 EUR;

Registration from June 1 – July 31, 2014 – 300 EUR;

Registration after August 1, 2014 and on-site registration – 400 EUR.

For all questions about registration and payment, please mail to: paleodontology@ulixtravel.com

The registration fee includes:

- Participation at the 16th International Symposium on Dental Morphology and 1st Congress of the International Association for Paleodontology, 26 – 30 August 2014, Zagreb, Croatia
- Congress materials, bag and badge
- Certificate of attendance
- Refreshments provided during congress sessions
- Zagreb intro tour (guided walking tour)
- Welcome cocktail reception - Croatian National Theatre in Zagreb
- Half-day trip to Krapina and the Neanderthal Museum
- Paleo party – Lemon – bar & club / terrace of the Archaeological Museum - Zagreb
- Gala dinner - Mimara Museum - Zagreb

The accompanying person fee includes:

- Zagreb intro tour (guided walking tour)
- Welcome cocktail reception - Croatian National Theatre in Zagreb
- Half-day trip to Krapina and the Neanderthal Museum
- Paleo party – Lemon – bar & club / terrace of the Archaeological Museum - Zagreb
- Gala dinner - Mimara Museum - Zagreb

Presenter instructions

The official congress language is English.

ORAL PRESENTATIONS

- Presentation software is Windows PowerPoint (other formats are not accepted).
- Please do not bring your own laptops.
- Speakers are asked to hand in their presentations to the attendant in advance (latest before the beginning of the appropriate session).
- Time limit: 10 minutes (board members are allowed 20 minutes).
- Discussions will be only at the end of each session.

POSTER PRESENTATIONS

- Poster board will be used VERTICALLY.
- Maximum dimensions of the poster are 90 cm (width) x 200 cm (height).
- Mounting of heavy posters might be difficult.
- Material for mounting the posters will be available on site.
- Posters should be displayed before 10.00 am in the morning of your allotted poster session. Poster boards will have abstract numbers placed on them to facilitate you finding the correct board. Posters should be taken down before 1.00 pm of the next day.
- You are required to be at your poster board during the poster session time.
- The poster presenters should be prepared to give a short talk.
- Posters will be evaluated by committee of board members.

Christy G. Turner II best poster award

Each registered participant receives a ballot necessary for voting for the best poster.

One participant = one vote.

Boxes for ballots will be available at registration desk.

Total of three posters with highest number of votes will be awarded with a certificate and a book.

The winners will be announced at gala-dinner.

Publishing of abstracts

All accepted abstracts will be published in the Bulletin of the International Association for Paleodontology.

Selected full text papers from the meeting will be published in Annals of Anatomy - Anatomischer Anzeiger. Deadline for full text papers submission is November 30, 2014.

Presenting authors will also have an opportunity to submit their full text papers to Acta stomatologica Croatica (www.ascro.hr) and Bulletin of the International Association for Paleodontology (www.paleodontology.com). Deadline for full text papers submission is November 30, 2014. For all further information please mail to vodanovic@sfzg.hr.

General information

WEATHER

Zagreb has a continental climate with an average temperature of up to 30°C in summer and down to -10°C in winter. The month of August is characterized by gradually falling daily high temperatures, with daily highs ranging from 28°C to 25°C over the course of the month, exceeding 32°C or dropping below 20°C only one day in ten. There is a small probability of some form of precipitation.

ELECTRICITY

220V; 50Hz

TIME DIFFERENCES

GTM + 1 hour (during summer: GTM + 2 hours)

CROATIAN CURRENCY

is the CROATIAN KUNA (HRK)

Nominal values are:

COINS: 1, 2, 5, 10, 20, 50 lipa; 1, 2, 5 kuna

NOTES: 10, 20, 50, 100, 200, 500, 1000 kuna

1 kuna = 100 lipas

Exchange rates on June 22, 2014

1 AUD = 5,2 HRK

1 CAD = 5,2 HRK

1 CZK = 0,2 HRK

100 HUF = 2,4 HRK

100 JPY = 5,4 HRK

1 NOK = 0,9 HRK

1 CHF = 6,2 HRK

1 GBP = 9,5 HRK

1 USD = 5,5 HRK

1 EUR = 7,6 HRK

1 PLN = 1,8 HRK

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11981 General Information

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LOST AND FOUND

For lost items you should first go to the closes police station and inquire there, or go to the

Lost and Found Office in Heinzelova St. 98, tel. 63-33-439, 8:30am-3:30pm

ZAGREB MUNICIPAL TRANSIT SYSTEM (ZET)

The ZET ticket system uses the following types of tickets: single tickets (15 HRK), day tickets (40 kn), 3-day tickets (100 HRK), 7-day tickets (200 HRK). The passengers should validate their single or daily tickets when entering the vehicle and present to the driver their travel pass or other document serving as a ticket according to the ZET Tariff Regulation. Passengers in the vehicle are obliged to present their tickets at the request of a ZET official.

Contact

For queries about:

- registration and payment
- airline tickets
- hotel accommodation
- tourist arrangements
- travel insurance, health insurance
- rent-a-car booking

please contact Ulix d.o.o.

E-mail: paleodontology@ulixtravel.com

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Mobile phone: +385 99 6077 707

Fax: +385 1 6154 092

Postal address: Miramarska cesta 26 , HR–10000 Zagreb, Croatia

Web: www.ulixtravel.com, www.facebook.com/ULIXtravel

For all other information and/or questions please write to Marin Vodanović: vodanovic@sfzg.hr.

Book of abstracts of the 16th International Symposium on Dental Morphology and 1st Congress of the International Association for Paleodontology, August, 26 – 30, 2014, Zagreb, Croatia

This Book of abstracts is an integral part of the Bulletin of the International Association for Paleodontology

Year: 2014, Volume: 8, Number: 1.

Abstracts should be cited as follows:

Bull Int Assoc Paleodont. 2014;8(1): insert page number from Book of abstracts

Abstracts are ordered as in the meeting programme. Oral presentations are followed by poster presentations.

Disclaimer

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Oral presentations

Abstracts are ordered as in the meeting programme.

Ridges, roots, wrinkles and ranks: the origins and evolution of the Arizona State University Dental Anthropology System

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In 1968, I was a first year graduate student at Arizona State University working under a young assistant professor named Christy G. Turner II. Dr. Turner had recently defended his dissertation entitled The Dentition of Arctic Peoples in which he used A.A. Dahlberg's standard plaques for morphological crown traits to characterize dental variation among Eskimo and Aleut populations. Although Dahlberg's plaques were useful, they covered a limited range of traits. Turner felt that if dental morphology was to take its place among other biological variables to characterize human variation, more traits were needed to complement the original Dahlberg inventory. Toward that end, the first two traits he focused on were cusps 6 and 7 of the lower molars. One of my earliest tasks as a graduate student was to make the plastic replicas for six grades of expression for each trait and glue them on clear plastic bases. After working on these plaques for a year, I developed additional standards, with emphasis on traits of the anterior dentition. After my departure in 1973, Turner and his graduate students continued adding to the inventory of crown and root traits. By 1991, three of us collaborated on an article that codified the Arizona State University Dental Anthropology System. Prior to the development of the ASUDAS, papers on dental morphology were highly diverse as they focused on different traits scored by different methods. In science, standardization leads to more consistent observations, allowing researchers to delve into more interesting questions. Based on the research papers and graduate theses that have used the ASUDAS over the past 20 years, Turner's original germ of an idea has sprouted into a beanstalk. The evolution of this beanstalk, with its many twists and turns, are addressed in terms of both its past and future.

Keywords: Arizona State University Dental Anthropology System

Krapina Neandertal Collection: 115 years of active research

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The Krapina Neandertal Collection encompasses the world's largest collection of Neandertal remains from a single site. The Krapina site was excavated by the renowned Croatian paleontologist Dragutin Gorjanović-Kramberger at the turn of the 20th century. The collection consists of more than 900 Neandertal skeletal fragments, representing around eighty individuals, dated to about 130,000 years before present. The sample encompasses almost 200 individual teeth, with additional teeth found in maxillary and mandibular fragments. Due to the abundance of the material and the preservation of almost all the skeletal elements in multiple numbers, including extraordinary elements such as teeth germs, the collection gives an invaluable insight to our understanding of the morphological and biological variation of Late Pleistocene population. The richness and the nature of the collection have made it possible to test numerous hypotheses concerning crucial paleoanthropological questions about Late Pleistocene fossil populations. The continuous and relevant research being done on the collection has resulted in the publication of over 3,000 scientific journal articles to date. This presentation will briefly summarize the history of research on this collection, highlighting important milestones. It will end with a description of the most recent studies based on Krapina remains, many of which have been based on the rich Krapina dental material. These studies demonstrate that this particular Neandertal fossil collection is still very relevant to paleoanthropology, and emphasizes the importance of preserving this collection for future generations.

Keywords: Krapina; Neandertal

International Association for Paleodontology – past, present and future perspectives

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The International Association for Paleodontology (IAPO) was founded in Zagreb in 2007 by a group of researchers from Europe, Russia and India interested in ancient teeth. The vision of the first members was to connect scientists and researchers interested in ancient human and animal teeth, to find new possibilities for cooperation, to promote paleodontological and bioarchaeological research and finally to make new friendships. Today the IAPO has more than 400 members from 57 countries, and over 200 institutions. Soon after its establishment, the official website of the IAPO (www.paleodontology.com) was registered. The website has more than 50,000 visits yearly from all parts of the globe. In 2007 IAPO started to publish the Bulletin of the International Association for Paleodontology - an interdisciplinary open access online journal inviting and welcoming contributions from anthropology, bioarchaeology, paleodontology and related fields. According to different journal databases, this was the only journal in the world focused primarily on ancient teeth and the mouth. Today we have a high-quality, indexed, peer-reviewed journal, with a wide audience. The reviewing process was significantly improved at the end of 2011 when the journal started to use the Open journal system – a professional journal management and publishing system. IAPO members are very active on a scientific and professional level and the IAPO has supported numerous projects, books and papers. This includes the 1st Congress of the International Association for Paleodontology in Zagreb, organized in August 2014 as a joint meeting with 16th International Symposium on Dental Morphology in cooperation with School of Dental Medicine University of Zagreb. This meeting will provide an exciting scientific and social program and will be a great platform for the exchange of Ideas and the foundation of future interdisciplinary collaborations.

Keywords: International Association for Paleodontology; Bulletin of the International Association for Paleodontology

Season of birth and selected maternal factors affecting enamel thickness in human deciduous teeth

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Development of human tooth enamel is a part of a foetus's development; its correctness is the outcome of genetic and maternal factors shaping its prenatal environment. Many authors reported that individuals born in different seasons experience different early developmental conditions during pregnancy. In this study, we investigated the effects of season of birth and selected maternal factors on enamel thickness of deciduous incisors. Dental sample comprises 60 deciduous incisors. The parents who handed over their children's teeth for research fill in questionnaires containing questions about the course of pregnancy. All teeth were sectioned in the labio-linqual plane using diamond blade (Buechler IsoMet 1000). The final specimens were observed by way of scanning electron microscopy at magnifications 80x and 320x. The thickness of total enamel (TE), prenatally (PE) and postnatally (PSE) formed enamel was measured. Children born in summer and in spring (whose first and second foetal life fall on autumn and winter) have the thinnest enamel. Season of birth, number of children in family, diseases and spasmolytic medicines using by mother during pregnancy explained almost 13% of the variability of TE. Regression analysis proved a significant influence of the season of birth and selected maternal factors on the PE thickness – these factors explained over 17% of its variability. Neither of analysed variables had influenced PSE. Our findings suggest that the thickness of enamel of deciduous incisors depends on the season of birth and some maternal factors. The differences were observed only in the prenatally formed enamel.

Keywords: enamel thickness; deciduous incisors; season of birth; prenatal enamel; postnatal enamel

The impact of dental impairment on health and nutrition in a wild primate population

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The impact of dental impairment on health and survival among living and fossil organisms has received much attention in the dental literature. King et al. (2005) hypothesized that tooth wear in times of nutritional stress leads to increased infant mortality in wild primates. The assumption is that tooth wear in its later and more extreme conditions leads to female lemurs being nutritionally compromised when environmental perturbations disrupt food availability thus impacting lactation. However, the actual impact of dental impairment on health and nutrition has not been tested among wild primates. In 2011, 51 wild ring-tailed lemurs (Lemur catta) of varying ages, with over a decade of known feeding ecology and behavior, and with different levels of tooth wear and antemortem tooth loss were captured. Nutrient levels, health, and dental impairment were assessed for each lemur. Individual tooth loss ranged from 0% to 81%. Regression analyses revealed that two of the 10 nutrients and/or health measures assessed (Blood Urea Nitrogen and BUN/Creatinine ratio) showed a significant ($p < 0.05$) correlation with increased tooth loss. Three of the ten measures (K, Hct, Hb) showed a significant correlation with increased post-canine tooth wear. Of the five variables showing a correlation with dental impairment, only K showed a relationship to both increased dental impairment and age. Thus, age, tooth wear and tooth loss are not strongly correlated with impaired health measures. Therefore, the proximate cause of increased infant mortality among older primates with dental impairment remains elusive. These data have implications for understanding how dental impairment affects infant survival, reproductive fitness, and survival among wild primates. This information also provides a framework for interpreting dental impairment and tooth loss among fossil humans, for which dental impairment has been assumed to require conspecific care and complex social relations for these impaired individuals to survive.

Keywords: tooth wear; antemortem tooth loss; nutritional stress; dental ecology; Madagascar

Virtual close-up view on occlusal contacts reveals functional variability in hominid molars

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2 - Department of Cultural Heritage, University of Bologna, Italy
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Comprehensive knowledge of the occlusal relationship in antagonistic teeth is essential to understand tooth function and dental evolutionary adaptations. In dentitions of extinct species we can only hypothesize occlusal dynamics. Therefore, scholars revert to comparisons with modern analogue species to extract signals of masticatory movements, e.g. encoded in the tooth wear patterns. Mostly, we are not able to test and comparably render dental occlusal reconstructions. This fact inspired us to develop a virtual software tool, the Occlusal Fingerprint Analyser (OFA), for the analysis and quantification of occlusal kinematics derived from collision data of virtual crown surface models. The OFA records the antagonistic tooth contacts of chewing movements, simulating and visualizing relief guidance during incursive and excursive occlusal pathways. Here we illustrate the potentiality of the OFA software to achieve major advances in dental studies. OFA was applied to upper P4 and M1 and lower M1 antagonistic crown pairs from various hominid species, differing in relief morphology and tooth wear. Data from occlusal parameters such as sequential occlusal contact area size, inclination and direction angles of crown contacts reflect individual bite situations. Powerstroke trajectories and sequential occlusal patterns imply a variable mechanical capability in hominid molars for comminuting food, depending on the occlusal relationship, relief topography and position of guiding contacts in unworn and worn crowns. Moreover, we show how OFA provides fundamental information to explore dental biomechanics using finite element analysis (FEA). OFA and FEA are combined to apply individual loading scenarios at various occlusal moments in molars and premolars. Our results show that the occlusal contacts, crown structures (mainly the external architecture) and wear stage are crucial for the pattern of stress distribution during chewing.

Keywords: tooth function; occlusal fingerprint; hominid molar; dental adaptation; virtual analysis

Jaw gape and biomechanics in grazing and/or browsing cervids, bovids and equids

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There is a considerable amount of interest in the feeding adaptations of browsing and grazing mammals. Numerous workers have noted that among cervids and bovids, browsers tend to have more gracile mandibles and much smaller attachment areas for their masticatory muscles, as well as other important differences, such as in salivary gland size and tongue morphology. Surprisingly (at least to me), it has been found that actual masseter muscle size (mass) in grazers and browsers is either about the same, or (more likely) only slightly larger in grazers. These results suggest that the overall geometry and/or internal architecture of the jaw muscles are quite different between these grazers and browsers. If so, there are important biomechanical consequences associated with these different morphologies. More specifically, I hypothesized that overall, grazers must have relatively small gapes compared to browsers. If so, apparently grazers have sacrificed gape so as to maximize bite force by increasing the physiological cross-section of their jaw muscles and/or by increasing the moment arm of the resultant jaw muscle force during chewing. For browsers, the reverse must be true. That is, relative to grazers, browsers have sacrificed muscle force so as to increase gape. As a test of this hypothesis, I measured jaw gape, jaw length and masseter mass in a large number of recently killed cervids and bovids. I was able to do so by visiting various slaughterhouses or accompanying game hunters, in both South Africa and the USA. In summary, the data from this study provides strong support for the above hypothesis, and that these differences in gape between grazers and browsers are functionally linked to feeding behaviors, as well as other morphologies.

Keywords: jaw gape; grazers and browsers; jaw mechanics

The 'Sialo-Microbial-Dental-Complex' in oral health and disease

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Biofilms are naturally found in all wet environments including the oral structures of nearly all species. Human oral biofilms have always existed since our earliest ancestors and have evolved symbiotically with the dentition over many millennia within a Paleolithic, hunter-gatherer setting. Irrespective of the plant-animal ratio, it can be argued that the Paleolithic diet was essentially acidic, and acted as a selective force for much of the evolution of the stomatognathic system. The relationship between saliva, biofilm and teeth, the 'sialo-microbial-dental complex', provides oral health benefits and offers a different perspective to the old dental paradigm that only associated oral biofilms (plaque) with disease (caries). This new paradigm emphasises that oral biofilms are essential for the 'mineral maintenance' of teeth. Oral biofilms provide physical protection from dietary acid and together with bacterial metabolic acids cause the resting pH of the biofilm to fall below neutral. This is then followed by the re-establishment of a neutral environment by chemical interactions mediated by the saliva within the biofilm. Such pH fluctuations are often responsible for the cyclic demineralization, then remineralisation of teeth, a process necessary for tooth maturation. However, since the advent of farming and especially since the industrial revolution, the increase in consumption of carbohydrates, refined sugars and acidic drinks has changed the ecology of biofilms. Biofilm biodiversity is significantly reduced together with a proliferation of acidogenic and aciduric organisms, tipping the balance of the demin-remin cycle towards net mineral loss and hence caries. In addition, the consumption of acidic drinks in today's societies has removed the protective nature of the biofilm, leading to erosion. Erosion and caries are 'modern-day' diseases and reflect an imbalance within the biofilm resulting in the demineralisation of teeth.

Keywords: oral biofilms; Paleolithic diet; caries; erosion

Anatomical Evaluation of Root Apex Morphology

Cena Dimova (1), Ivona Kovacevska (2), Lidija Popovska (3), Julija Zarkova (4), Kiro Papakoca (1), Katerina Zlatanovska (4)

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Introduction: The success of root canal therapy is dependent on the clinician's knowledge of root canal morphology with goal to precisely locate all canals, properly clean, shape and obturate the canal space. Aim: The aim in our study was to to determine the morphologic shape and position of the root apex and the major foramen in maxillary teeth. Material and method: A total of 120 maxillary human teeth were evaluated. Central and lateral incisors, canines, premolars, and molars with completely formed apices were used. These teeth were obtained from the Dental Medicine at our institution. The dental specimens were collected and analyzed in accordance to the guidelines set forth by our institution's Ethics Committee. Each root specimen was measured at each root apex by using a calibrated microscope at magnification of 20X. The anatomic parameters evaluated were the shapes of peripheral contours of major apical foramen (rounded, oval, asymmetric, semilunar) and the root apex (rounded, flat, beveled, elliptical). The location was recorded and classified as center, buccal, lingual, mesial, or distal surface for both root apex and the major apical foramen. Results: The most common morphology of the root apex in incisives, canines, and premolars group was the round shape, followed by the elliptical shape in maxillary molars. The most common shape of the major foramen in all groups was round, followed by oval. The root apex was most commonly located in the center in all groups followed by distal and buccal locations. Conclusion: The predominant morphology of the root apex in incisors and premolars was the round shape. The morphology of the apical foramen showed a predominance of the rounded shape followed by the oval shape. The prevalent location of the root apex and the foramen was the central position followed by the distal position.

Keywords: anatomic root apex; dental anatomy; morphology

The first moderns in Anatolia: Üçağızlı Cave

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Üçağızlı Cave is located on the Mediterranean coast in the Hatay Province, about 10km South of the point where the Asi River empties into the sea. The cave is on a steep slope at about 18m above the current sea level and was discovered and first investigated in the late 1980s by Angela Minzoni-Deroche. The current excavation began in 1997 and has been led by Prof.Dr. Erksin Savaş Güleç, from the University of Ankara, Turkey. Two principal cultural components are represented in Üçağızlı Cave. The first, more recent component closely resembles the Ahmarian complex known from other sites in the Levant. The second, earliest of these, corresponds to the so-called Initial Upper Paleolithic phase. The Initial Upper Paleolithic is considered a techno complex transitional between Middle and Upper Paleolithic. Paleolithic deposits preserved within Üçağızlı Cave span a period of approximately 12,000 years; Accelerator Mass Spectrometry (AMS) radiocarbon dates indicate ages between 29,000 and 41,000 radiocarbon years (circa31,000 to 43,000 calendar years). Advanced lithic technology and coordinated ornament use found in the cave indicate the presence of the first modern humans in Anatolia. This paper mainly focuses on the human teeth findings and their morphological variability in the cave and provides some information about the dispersal of via of early modern Homo sapiens.

Keywords: Üçağızlı cave; Hatay province; early moderns; ornament using; Upper Paleolithic

Lobodontia: genetic entity with specific pattern of dental dysmorphology

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The condition of multiple dental anomalies with trituberculate and pointed crowns of canine and premolars was first described by Robbins and Keene in 1964. Characteristic pattern of dental anomalies includes cone-shaped premolars, multitubercular molar crowns, pyramidal molar roots with single root canals, shovel-shaped incisors with palatal invaginations and hypodontia. Very few family reports on this condition have been published since now. The prevalence of the condition is estimated to be less than 1:1,000.000. In the present work we want to delineate and clarify some additional aspects of this rare genetic entity in three families with 17 affected members. This represents the largest number of cases analysed since now. Clinical, radiographic, and genetic evaluation of affected subjects was performed in three families. Analysis of dental morphology, crown-size profile patterns, pedigree analyses, and analysis of digitopalmar dermatoglyphics was performed in all patients. Crown-size profile pattern was calculated for all patients and compared with standard for Croatian population. Most striking features of the condition are conical premolars, trirubercular canines, single pyramidal molar roots, multitubercular molar crowns and invaginated upper incisors. Significant reduction of crown-size was observed for all premolars, particularly in mandible. Alveolar processus in the premolar region was hypoplastic and thin in all probands. Sex ratio of affected individuals was approximately M1:F1. Our data suggest that the prevalence of this condition is less than 1:300.000 in Croatian population what is considerably higher than previously reported in the literature. The analysis of the anomaly in all families showed slight variability of clinical picture and autosomal dominant (AD) mode of inheritance. It could be concluded that this rare condition described as lobodontia represents a true genetic entity which follows AD mode of inheritance and displays variability in its expression.

Keywords: lobodontia; dental anomalies; pyramidal roots; prevalence

Christy G. Turner II: the life and times of a roving dental anthropologist

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The traits that best describe Christy G. Turner II are charismatic, driven, productive, imaginative, and far sighted. Although best known for his work in dental anthropology, he had wide ranging interests, from rock art in the American Southwest to cave hyena taphonomy in Siberia. He travelled the world over and made dental observations on over 30,000 human skeletons. He knew the insides of about every museum in North America and many in South America, Siberia, North Asia, Southeast Asia, and Europe. But he did not just describe teeth; he developed the methods that are the foundation of modern dental comparative studies and formulated models that addressed long-standing historical issues, including the three-wave model for the peopling of the Americas and the dental division between North Asians (Sinodonts) and Southeast Asians (Sundadonts). On another front, Christy started a new field of inquiry when he examined a "secondary burial" near the abandoned Hopi village of Awatovi. His first thought was that this collection of broken and burned bones could hardly be a secondary burial. After an analysis of cut marks, anvil abrasions, burned bone, etc., he wrote his first paper on Southwest cannibalism. Subsequently, he found over 30 skeletal collections from the Anasazi region that could most parsimoniously be explained by cannibalism, culminating in the volume Man Corn: Cannibalism and Violence in the Prehistoric American Southwest (1999). Even with failing health, he completed another book in 2013 -- Animal Teeth and Human Tools: A Taphonomic Odyssey in Ice Age Siberia. He made significant marks in dental anthropology and the taphonomy of human cannibalism but kept pressing on to the end. A quote from Ralph Waldo Emerson captures the essence of Christy's career: "Do not go where the path may lead, go instead where there is no path and leave a trail."

Keywords: dental anthropology; Christy G. Turner II

A performance analysis of deciduous morphology in the detection of biological siblings

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Permanent dental morphology is commonly used in small-scale biodistance analyses for identifying relatives within mortuary contexts. Deciduous data, however, are often systematically omitted from kinship analyses, leaving bioarchaeologists ill-equipped to detect genetic relationships among deceased subadults. This is surprising, as some scholars have suggested deciduous teeth should strongly reflect an individual's underlying genotype given their limited exposure to environmental influences during their relatively rapid (mainly in-utero) development (Saunders and Mayhall, 1982; Smith and Tillier, 1989; Smith et al., 1997). One reason for the omission of deciduous data from bioarchaeological kinship studies is the lack of pedigree-based research focusing on primary crown morphology. To address this issue and assess the performance of deciduous morphology in the detection of biological relatives, we scored crown features from dental casts of individuals of known genealogical affiliation. These casts are part of a long-term craniofacial growth study curated at the Burlington Growth Centre at the University of Toronto, Canada. Data collection adhered to standards outlined by several sources, including Dahlberg (1949), Hanihara (1963), Grine (1986), Turner et al. (1991), and Sciulli (1998). Euclidean distances were generated for 78 sibling pairs using 20 morphological traits with distance ordination via multidimensional scaling. Results indicate an average distance between related individuals of 0.264, which is significantly less than the average of 78 resampled pseudo-distances generated from 999 replicates of non-relative pairs ($p=0.001$). We explore our results in relation to potential environmental factors affecting the correspondence of deciduous crown morphology among siblings. Finally, we discuss the bioarchaeological implications of our findings, particularly the potential for incorporating deciduous phenotypic data into small-scale biodistance research.

Keywords: deciduous teeth; dental morphology; biodistance analysis; kinship; dental development

Analysis of skeletal components of temporomandibular joint of an early medieval Croatian population

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The temporomandibular joint (TMJ) is one of the most complex joints in the human body. Anatomical configuration of TMJ allows a large range of mandibular movements and transmission of masticatory forces and loads onto the skull base. The measurements of TMJ's anatomical structures and their interpretations contribute to understanding of how the pathological changes, tooth loss, and the type of diet (changed through human history) can affect biomechanical conditions of masticatory system and the TMJ. The human TMJ and its constituent parts are still subject of extensive investigation and affords are made in order to determine the most precise and suitable measuring method. The aim of this study was to examine the morphology of skeletal components of TMJ of early medieval population in Croatia. For that task different measurement methods were used in order to reveal differences between the methods and their (dis)advantages. The study was performed on 30 specimens – human dry skulls, aged from 15 to 55 years. The selected skulls were a part of bigger collection from early medieval period from which only fully preserved specimens in measured areas were included. Articular-eminence inclination in relation to the Frankfurt horizontal was measured using two methods. Also, the height of the articular-eminence (glenoid fossa depth) and the length of curved line – highest to the lowest point of the articular-eminence were measured. Measurements were performed on lateral skulls' photographs, orthopantomographs and lateral cephalograms using VistaMetrix software on skulls' images. Results obtained were statistically analyzed using SPSS statistical software. Statistically significant ($p<0.05$) differences were revealed when comparing results of different measurement methods. Results of this study indicate that the used measurement methods are not equally precise. Some methods have limitations due to the fact that some measuring points are difficult to determine and/or they are not bright enough to be precisely determined.

Keywords: temporomandibular joint; articular-eminence; inclination; medieval

Mineral integrity of human and animal teeth and bones using FTIR – new perspectives for characterizing diagenetic alteration

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Diagenetic alteration may limit the potential use of bones and teeth in stable isotope analysis as a reliable source of information about the origin, movements and diet of ancient people. Animals are treated as a background to the environment a given population inhabits on condition that no biogenic mineral structure of bone was disturbed. Fourier transform infrared spectroscopy (FTIR) has been applied to determine the general state of preservation of ancient bone by using two diagenetic indices: crystallinity index (CI) and carbonate-phosphate (CO3/PO4) index. The aim of this work was to verify if there is an inter-tissue variation between the enamel and the bone with regard to CI and CO3/PO4 indices in terms of assessing diagenesis. The method was applied to two different modern animals: sheep and pigs. The findings were compared to archaeological representatives of both species as well as to two human groups: one from the Neolithic excavation site in Bronocice and another from an early-medieval cemetery at the Market Square in Krakow. The findings show that in case of both contemporary and archaeological animals the enamel receives significantly higher values of the CI index and lower values of the CO3/PO4 index when compared to bones. In addition, the difference of both analysed indices between the two species was observed for enamel. In case of human enamel and bone samples the tendency is similar to that in animals but smaller differences between mean index values for enamel and bones are noticed in the Neolithic samples than in the early-medieval samples. The scales of indices applied so far for both bones and enamel were based only on bone analysis. Our findings demonstrate that the assessment of the extent of diagenesis ought to be carried out based on the criteria of the CI and CO3/PO4 index values, separately for teeth and bones owing to their diversified biogenic chemical structure.

Keywords: enamel; bone; mineral structure; diagenesis; FTIR

Morphological differences between two gingival biotypes, Croatian cross-sectional study

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Two gingival tissue biotypes have been differentiated: thin or flat and thick. Thick biotypes, characterized by a thin scalloped gingival margin and slender teeth, are more prevalent in the general population. They are associated with more favorable outcomes, and fewer complications in implantology, periodontal surgery, dental extractions and orthodontics. Objective of this study was to describe morphological differences between two gingival biotypes. This cross sectional study has been nested within the prospective cohort study. The results presented here are the baseline characteristics of different gingival biotypes. Total of 41 patients were included. Biotype was defined by the transparency of periodontal probe. Undoubtedly thin biotype of the upper jaw was presented in 5/41 (12.2%) of cases, probable thin in 6/41 (14.6%), probable thick in 12/41 (29.3%), and thick in 18/41 (43.9%). Undoubtedly thin biotype of the lower jaw was presented in 14/38 (36.8%) of cases, probable thin in 12/38 (31.6%), probable thick in 8/38 (21.1%), and thick in 4/38 (10.5%). Biotypes of the upper and lower jaw were statistically significantly associated (P=0.003). Teeth height and width ratio was statistically significantly lower in thin upper jaw biotype than in probable thin, probable thick and thick biotypes (P=0.014). We have not found statistically significant differences in papilla height, in attached gingiva width between different biotypes nor in the prevalence of Stillman's cleft.

Keywords: Gingival biotype; morphology; teeth width/height ratio; Croatia

Variation in the expression of a derived molar trait in Papionini relative to other Old World Monkeys

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Much of the variation in dental morphology is heritable, and characterizing this variation can provide information about the adaptive strategy and evolutionary history of a mammalian lineage. Here, we assess variation in the expression of a maxillary molar trait (the interconulus) across the Old World Monkeys (Primates: Cercopithecidae) with the aim of investigating phylogenetic and/or dietary affinity. The cercopithecids underwent an adaptive radiation in the Plio-Pleistocene and are characterized by a wide geographic range (Asia and Africa) and diverse diets. While all cercopithecids possess derived bilophodont molars, the cercopithecines have retained bunodont cusps. This is in contrast with the evolution of high, columnar cusps in the colobines, interpreted as a dietary adaptation. We characterize variation in interconulus expression in 522 specimens representing 7 species of cercopithecid (Cercopithecus mitis, n=78; Colobus guereza, n=76; Macaca fascicularis, n=85; Macaca mulatta, n=70; Papio hamadryas, n=55; Presbytis melalophos, n=82; Presbytis rubicunda, n=76). Results indicate that Tribe Papionini has the highest interconulus frequency and exhibits ordered metameric variation with greatest expression of the trait in the third molars. Given that the interconulus is morphologically distinct from other allegedly homologous traits and absent in closely related taxa, we interpret expression of the interconulus to be a trait derived in papionins that appeared in the Miocene papionin ancestor.

Keywords: cercopithecidae; dentition; metameric variation; interconulus

Dental studies of the Krapina Neandertals

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The Krapina Neandertals were discovered between 1899-1905 by Dragutin Gorjanović-Kramberger and are dated to about 130,000 years ago. Isolated teeth and teeth in mandibles and maxillas constitute the largest dental sample of Neandertals in Europe Many researchers, beginning with Gorjanović, have studied these teeth and have documented features like taurodontism and dental hypoplasia. Our work has focused on striations, which appear on the labial faces of canines and incisors. These oblique scratches were produced when items were held between the teeth and a stone tool occasionally raked across the labial surface, leaving a permanent mark. Cross-overs and abrasions indicate these striations occurred in different episodes over the lifetime of the individual, but the key feature is the obliquity of the scratches. From this we can estimate a frequency of 9 right handers : 2 left handers in the Krapina Neandertal dental sample. Combined with other European Neandertals the right : left ratio is 30 : 3, identical to the 9 : 1 modern pattern. This ratio indicates that Neandertals were left brain lateralized like modern Homo sapiens and has implications for language ability. In previous work we have also documented toothpick use at Krapina. Here, we present a possible case of “prehistoric dentistry” involving four mandibular teeth, two of which show toothpick grooves. A mesial wear facet on the P4 shows that the P3 was displaced lingually and the M3 is tilted lingually so that the buccal face is the functioning occlusal face. All three of the molars have chips removed from their lingual/occlusal face, which may indicate a dental intervention to address problems of malocclusion.

Keywords: Krapina; Neandertals; dental studies

An example of supernumerary tooth from Ancient Patara, Turkey

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Supernumerary teeth is described as extra tooth formation which is in excess of normal dental formula and also known as polydontia. Although it is usually observed in permanent dentition, it is possible to see in decidious dentition but very rare. They can be seen in upper and lower jaws as erupted or unerupted (mostly in the maxilla). Although their size and shape are generally same with their adjacent teeth, they also could be amorphous. The cause of this anomaly is unknown but aetiology of supernumerary teeth may be genetic and/or environmental. Supernumerary teeth is known as one of the causes of malocclusion. In our case, supernumerary tooth is seen as third premolar in mandibular jaw of ancient Patara, Turkey. Patara Excavations have started in 1988 on behalf of Turkish Republic Ministry of Culture and Tourism, and carried out by the team under the presidency of Prof. Dr. Fahri IŞIK until 2008; and since 2009, it has been carried out by the team under the presidency of Prof. Dr. Havva IŞIK. Patara is located in the east of Eşen Stream on the provincial border of Antalya-Muğla and it is Gelemiş Village of Kaş district of Antalya province. The material of our study is consisted of human skeleton remains which are obtained from the Church and grave pits of 2010-2011 Patara Excavations. Anthropological analyses have been carried out on human skeletons taken out of two different excavation sites. As a result of these analyses, approximately 150 human skeleton remains belonging to Ancient period people are defined.

Keywords: Patara; supernumerary teeth; variation,

Hypercementosis: definition, frequency and aetiologies in two medieval samples from France and the application of these results to Neanderthal teeth

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The term "cementum" refers to all mineralised connective tissue found on the external surface of a tooth root. It pertains to two functional units, the tooth and the periodontium, and together with the alveolar bone, it forms an essential point of attachment for the periodontal ligament. In certain conditions yet to be clarified, synthesis of one variety of cement, cellular mixed stratified cementum, is excessive, going beyond "normal" levels: this results in hypercementosis. From a review of the literature, we identified questions relating to the definition, frequency and aetiology of this condition. To address these questions, we set up a study protocol (macroscopic and photographic observations) on material consisting of two medieval samples from France: (1) Sains-en-Gohelle sample-SG (AD 7th-17th century; 407 individuals; 5,756 teeth observed), which was used to develop the different criteria for defining hypercementosis; and (2) Jau-Dignac-et-Loirac sample-JDL (AD 7th-8th century; 65 individuals; 709 teeth observed). These samples were used to test the reproducibility of the criteria and to discuss the relationships between hypercementosis and proposed aetiologies. From this approach, we produced a definition of hypercementosis based on reproducible criteria (k intra-observer ≥ 0.96; k inter-observer ≥ 0.63), we assessed frequency variation in two large samples (5,54 % of teeth in SG and in 3,38 % in JDL), and determined the main aetiologies (continuous eruption associated with the loss of opposing teeth, apical periodontitis, periodontal injuries, dental inclusions). When our results were applied to Neanderthal teeth, we had to reconsider the hypothesis that occlusal stress is the main cause of hypercementosis in this taxon.

Keywords: hypercementosis; cementum; Neanderthal; dental anthropology

A closer examination of childhood diet and physiology using stable isotope analysis of incremental human dentine

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The reconstruction of the diet of past populations using the stable isotope analysis of bone collagen has become a well-established tool for examining their lifeways. For example, variations in foods ingested can demonstrate differences in the foods available to individuals of different sex, age, status and in some cases identifying migrants. However, because of the remodelling of bone throughout life, this produces average values which have been incorporated in the tissues over a period of time and gives a blurred picture of the diet. The analysis of the stable isotope ratios of carbon (δ13C) and nitrogen (δ15N) from tiny increments of dentine utilizes tissue that does not remodel and that permits comparison, at the same age, of those who survived infancy with those who did not at high temporal resolution. Here, we present a study of teeth from a Great Famine period workhouse cemetery in Kilkenny, Ireland, and a contemporary 19th-century cemetery in London, England and compare these with published data from early Neolithic individuals from Sumburgh, Shetland, Scotland. Covariation in δ13C and δ15N values suggests that even small variations have a physiological basis. We show that high-resolution intra-dentine isotope profiles can pinpoint short-duration events such as dietary change, and in the historical populations these can be related to known periods of nutritional deprivation in the juvenile years of life. We further suggest that the data from the Famine cemetery individuals suggest a physiological marker within these isotope profiles for a period of nutritional deprivation which could be utilised in other periods and geographical areas, particularly where there is a catastrophic cemetery assemblage with no known aetiology. This technique could also have applications in a forensic setting.

Keywords: palaeodiet; carbon; nitrogen; incremental dentine; Famine

Parafacets in Middle Paleolithic dentitions: questioning their usefulness for behavior reconstruction

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It is commonly assumed that dental wear in general and parafacets in particular can reflect on cultural and behavioral activities in prehistoric populations. Parafacets were defined as nonmasticatory wear areas that have no antagonist matching wear facets. Recently, a study on parafacets in Middle Paleolithic populations has drawn conclusions regarding differences in cultural behavior between different human groups from the Levant. This study aimed to re-examine the identification of parafacets in some of the early modern humans from Qafzeh (Qafzeh 9, Qafzeh 15 and Qafzeh 11) for whom full dentition of both the upper and lower jaws is preserved. In order to evaluate the presence of the parafacets, the jaws were first articulated into maximal intracuspation relation. Occlusion relationship was evaluated in both antero-posterior and transverse dimensions. Once this was accomplished, lateral excursion movements of the mandible were performed until edge to edge contact was achieved in the canines. In problematic situations, where difficulty was met in attempt to evaluate occlusion status, i.e. the mandible could not be fitted to the maxilla properly; a setup was used to evaluate occlusion. Based on findings of our research we suggest that the attrition facets mistakenly considered as parafacets are in fact the result of the static and dynamic occlusion. We here propose several guidelines to ensure proper identification of parafacets in skeletal material.

Keywords: parafacets; Paleolithic; paleodontology

Serial founder effects, population isolation and migration, and rare incisor variants in Mexico and the U.S. Southwest

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Human maxillary lateral incisors exhibit a broad range of variation in form and number. In terms of form, they can be barrel-shaped, pegged, or reduced in size and exhibit mesial marginal bending or talon formation. In terms of number, they can exhibit hypodontia (congenital absence) or hyperodontia (supernumerary laterals). We examined 900 dentitions from pre- and post-European contact samples from Mexico and the American Southwest to estimate the prevalence of anomalous incisors. We compared the frequencies of these variants among regions to determine which forms were most common, which anomalous variants were correlated, and the extent to which frequencies of variants reflected population histories. The most common variant overall was peg-shaped lateral incisors (2.9%). The most common trait in a single sample was the talon tooth, with a frequency of 12.5% in a Veracruz sample. This is the highest frequency of talon form yet documented. Samples from Highland Maya and Huasteca regions have the highest frequencies of incisor variants, with 6.2% and 6.7% of dentitions affected, respectively. Higher frequencies of single unusual traits are commonly found in samples from smaller populations, while samples from larger population centers show a greater range of rare lateral incisor variants. We investigate whether serial founder effect coupled with population isolation may have led to the relatively high frequencies of maxillary lateral incisor variants.

Keywords: maxillary lateral incisors; talon tooth; mesial bending; rare variants; serial founder effects

Amelogenesis Imperfecta (AI) in Crocuta crocuta spelaea

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A hereditary, autosomal dominant defect of enamelin, well known in humans, is diagnosed and described in a fossilized, and a recent predator, in comparison. The studied material consists of the left, permanent mandibular canine of an extinct, adult cave hyena (Crocuta crocuta spelaea), and the entire dentition of a recent Asiatic lion (Panthera leo persica) – both suffering from Amelogenesis Imperfecta (AI). The carnassial tooth came from the pleistocene deposits of Onceasa cave, Transylvania, the lion, originates from Gir Forest, India. Comparative macroscopic morphological description had been performed on the canines of both individuals, with the support of stereo-photography. We studied the incremental growth lines of enamel, as well the dentine structure, on thin sections, with Scanning Electron Microscope (SEM). Symptoms caused by AI are remarkably alike in both specimens. Statical instability of the crown region, dilated apical foramen. Protrusions and invaginations of the enamel, leading to pulp exposure. Advanced attrition, due to malocclusion. The oral abscesses, and purulent fistulas of the lion, simulate the possible outcome of the disease in the hyena. Although dentine remains unaltered, incremental growth lines are showing radial distortions caused by enamel hypoplasia. Our case, one of the earliest documentations of AI, is a proof of genetic lability in Ice Age mammals, potentially caused by inbreeding, in isolated populations. The same can be experienced in reclused prides of Asiatic Lion.

Keywords: Amelogenesis Imperfecta; paleodonthology; Crocuta crocuta spelaea; evolution; Asiatic lion

Biological proximity and dental heritability from internal tooth structure analysis of early agriculturalists from the Neolithic necropolis of Gurgy (France)

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Studies on dental heritability focused on tooth crown size and external structure while studies of enamel thickness and dental tissue proportions permit discussion of taxonomy, phylogenetic relationships or dietary habits. Here we employ a microtomographic (microCT)-based record of teeth from Neolithic individuals of the necropolis of Gurgy (France) to assess biological proximity and heritability from internal tooth structure. Second upper permanent molars from 21 immature and adult individuals of both sexes were scanned using high-resolution microCT at the MRI platform (Univ. Montpellier II, France) on a Skyscan 1076 X-ray equipment. Acquisitions were performed with an isotropic voxel size ranging from 17.93 to 36.18 µm. Semi-automatic threshold-based segmentation was conducted using Avizo v.7 (VSG) and crowns were digitally isolated from roots. For each crown, 15 linear, surface, and volumetric 2D and 3D variables describing enamel thickness and dental tissue proportions were digitally measured or calculated. We performed centered principal component analysis and cluster analysis according to Ward's method. Results show biological proximity in enamel thickness and dental tissue proportions for individuals buried at Gurgy. Clusters correspond to individuals who mainly share same location in the necropolis, same burial structure and orientation in the burial. Also, sexual dimorphism affects crown dimensions and dental tissue proportions. Interindividual biological proximity shown in the Neolithic necropolis of Gurgy suggests that the characterization of internal tooth structure could be used to discuss biological proximity and dental heritability. As the human sexual chromosomes differently impact enamel and dentine growth, we expect sexually-linked variation in enamel thickness and dental tissue proportions between family members.

Keywords: enamel thickness; dental proportions; Neolithic; microtomography

Dental caries and ante-mortem tooth loss in an early medieval population from western Ireland

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Study of alveo-dental pathologies such as caries and ante-mortem tooth loss may reveal previously unknown details about the diet and general health of past populations and as such provide an extremely useful insight into the lifestyles of our ancestors, especially in cases when written historic sources are scarce.This study presents the results of analysis of dental caries and ante-mortem tooth loss (AMTL) in the early medieval skeletal sample (7th-10th c. AD) from Omey Island, co. Galway in western Ireland. The total analysed sample includes 77 adult individuals (over 15 years of age): 37 males and 40 females. The total caries frequency per tooth is 4.5% (55/1218) with a somewhat higher prevalence in males than in females (5.1% vs. 3.9%). Caries is more frequent in maxillary teeth compared to mandibular (5.5% vs. 3.2%). Regarding the position, over two thirds (67.2%) of the recorded carious lesions are located on the interproximal tooth surfaces. ATML is recorded in 14.3% of the analysed alveoli (260/1814) with a somewhat higher frequency in males (16.4% vs. 11.6%). AMTL is, similar to caries, more frequent in the maxilla compared to the mandible (16.4% vs. 11.6%). In order to gain a better insight into the diet of the analysed population the results obtained by this analysis are compared with several studies conducted on early medieval skeletal samples from Ireland and Europe, but also with the Irish medieval written sources testifying about the nutritional habits of early medieval inhabitants of this region.

Keywords: caries; ante-mortem tooth loss; early medieval period; Ireland

Review of paleodontological analyses carried out at the Anthropological centre of the Croatian Academy of Sciences and Arts

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Oral pathologies are strongly correlated to subsistence patterns, and as such have been used by numerous researchers to asses diet, food-preparation techniques and through these the quality of life of past populations. For this reason dento-alveolar pathologies such as caries, ante mortem tooth loss, abscesses, calculus, alveolar resorption, and tooth wear, have been extensively analyzed in Croatian skeletal series ranging temporally from Prehistoric to Early Modern times. Other disease processes such as leprosy, syphilis, scurvy and neoplastic disease also affect dento-alveolar tissue and can be used to potentially identify past epidemics and migrations, as well as mortality and morbidity patterns. An example of the type of paleodontological analysis carried out at the Anthropological centre of the Croatian Academy of Sciences and Arts concerns the analysis of dental health during the Late Antique/Early Medieval transition in Dalmatia. Previous bioarhaeological studies have shown a significant increase of disease loads and trauma frequencies in Dalmatia during the Early Medieval period so the aim of the paleodontological analysis was to investigate whether dental health was equally adversely affected by this transition. Two composite skeletal series were analyzed – one consisting of 103 skeletons from Late Antique sites, and the other of 151 skeletons from Early Medieval sites. The results showed that the frequencies of carious lesions, ante mortem tooth loss, abscesses, and alveolar resorption increased significantly during the Early Medieval period, as did the degree of heavy occlusal wear on posterior teeth. These data suggest a fundamental change in alimentary habits, with a significantly higher dependence on carbohydrates and a greater reliance on hard, fibrous foods requiring vigorous mastication in the Early Medieval diet.

Keywords: Paleodontology; Late Antique; Early Medieval; Croatia

Analysis of interaction between indexes of physiological stress in mediaeval population from city of Wrocław and village Sypniewo

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Fluctuating asymmetry (FA) is used as an indicator of developmental stability. It reflects small accidents during development, sometimes called "noise"(Rasmuson, 2002, Polak, 2003, Żądzińska, 2003, 2004). A high level of fluctuating asymmetry reflects stress during intrauterine development (Gawlikowska et al., 2010; Özener, 2010a, 2010b, 2011). Dental enamel hypoplasia is described as a non-specific index of stress acting during childhood (Hillson, 1996; Hoover and Matsumura, 2008, Krenz-Niedbała and Kozłowski, 2011; Tomczyk,Komarnitki, Olczak-Kowalczyk 2013). In the study we assessed the relationship between fluctuating asymmetry and hypoplasia in two medieval populations representing different socioeconomic conditions. In the paper we test the hypothesis that a greater degree of fluctuating asymmetry shall be accompanied by more intense enamel hypoplasia as a result of declining strength of the organism in buffering of developmental stress. The studied material consisted of two mediaeval sample - 58 skulls from reach area of Wrocław- city series and 126 skulls from the village Sypniewo. Radiographs were taken in postero-anterior (P-A) and base projections. Images were scanned and calibrated by means of MicroStation 95 Academic Edition software. Measurements of the skull images were used to estimate fluctuating asymmetry. Hypoplasia presence were assessed using standard anthropological methods. All data were analysed statistically. Measurement error and directional asymmetry were excluded. The highest levels of fluctuating asymmetry were observed in the region of skull base in both groups. Hypoplasia was observed in 40% in city series and 29 % in rural series. Differences in the level of fluctuating asymmetry in relationship to presence or absence of hypoplasia were noted in city populations. Fluctuating asymmetry and hypoplasia reached a higher levels in groups of people who died at younger age (adultus) so we suppose that a higher level of fluctuating asymmtry reflects a decline in the buffering capacity and predisposes to enamel hypoplasia.

Keywords: fluctuating asymmetry; enamel hypoplasia; developmental instability; physiological stress

Stable isotopes in human teeth and bone as indicators of breastfeeding practices in the Neolithic period – a collective grave from Bronocice (Poland)

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Analysis of stable isotopes of oxygen, strontium, carbon and nitrogen occupies an important place among bioarchaeological and paleoodontological studies performed on skeletal material. Stable isotope analyses are an established method of reconstructing diet and migration of ancient people as well as examining infant feeding and weaning. Investigations of infant breastfeeding and weaning process involve a combination of three stable isotopes: nitrogen, carbon and oxygen in human archaeological teeth and bones. The aim of this research attempt was to determine the breastfeeding practices individuals buried in a collective grave in Bronocice; the individuals inhabited the settlement during the Funnel Beaker-Baden Phase 5 (3100–2900 cal. BC). Femur samples from adults and children as well as root dentin and enamel from deciduous teeth were subjected to Sr, O, C and N isotope analysis. The analysis was also performed on animal bone samples. The isotopic composition of the analysed elements corresponding to the life environment of individuals from the collective grave and from the graves scattered around the settlement was determined on the basis of measurements of isotopic ratios in phosphates and collagen isolated from animal bones found at this site. The reconstruction of the weaning process was carried out based on O, C and N isotope levels in children's bones and teeth. The findings were compared to adult individuals classified based on the Sr and O concentration as representatives of the local community. Our findings show that breast feeding practices were diverse; they were not linked with the age of the child. In the case of four children, it was determined that they were breastfed over different periods of time ranging from about eight months to two years. It seems that at Bronocice there was not any single child-feeding strategy.

Keywods: stable isotopes; weaning process; neolithic period; collective grave

Reliability of novel light-induced fluorescence measurements in detection of occlusal caries lesion in historical material

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Diagnosis of occlusal enamel caries in historical collections remains a controversial problem, as the accumulation of calculus, plaque or other contaminants in pits and fissures can interfere with diagnosis. A combination of visual examination and probing has been the primary means of occlusal caries diagnosis, but this method alone may leave many dental caries in their early stages undetected. Certain novel light-induced fluorescence methods, such as the DIAGNODent pen 2190 (DD) and VistaCam iX Proof (VC), have been used to detect dental caries. In this study, the abilities of DD and VC to detect initial enamel caries in historical material will be determined and compared with those of other methods (visual inspection, histology and micro-CT, the latter being the gold standard). We analyzed the dental remains of 58 individuals, consisting of a total of 380 teeth from Tell Masaikh and Terqa (Syria). The series represented three different historical periods: modern Islamic (AD 1850–1950), Islamic (AD 600–1200) and late Roman (AD 200–400). VC has shown excellent sensitivity at detecting disease in its early stages. A statistical correlation was found between the micro-CT and VC results ($p=0.0001$). In contrast, the correlation between the micro-CT and DD results did not reach statistical significance ($p=0.5844$). The correlations between the visual and micro-CT results and the visual and VC results were statistically significant ($p<0.0001$), while that between the visual and DD results was not ($p=0.568$). A combination of visual, VC and micro-CT methods would be the ideal method for detecting caries in historical collections.

Keywords: caries; paleodontology; Syria

Dental analysis of Miocene Lufengpithecus fossils from Yunnan, south China

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Miocene large-bodied hominoid fossils play an important role in the study of the origin and early evolution of humans. Lufengpithecus specimens from Yunnan Province, China are highly significant fossils. So far, Lufengpithecus fossils have been found in five areas in Yunnan. The genus Lufengpithecus contains three species: Lufengpithecus lufengensis, Lufengpithecus hudienensis, and Lufengpithecus keiyuanensis. Fauna analysis and paleomagnetic investigation show that they are range from 11 to 6 Ma. This paper focuses on Lufengpithecus teeth fossils and tries to understand the morphological difference and metric variation among them, which will hopefully provide some information for the taxonomy and phylogeny of Lufengpithecus. The three species are nearly similar in dental morphology. As previous studies have indicated, the more distinctive tooth in these three fossil apes is lower P3. The lower P3 of Lufengpithecus lufengensis is bicuspid, while the other two are all unicuspid. Comparing with Lufengpithecus hudienensis, the molar cusps of Lufengpithecus lufengensis are relatively steeper and the occlusal basinsare broader. Lufengpithecus keiyuanensis is closer in dental morphology to Lufengpithecus hudienensis than Lufengpithecus lufengensis. Here we also analyze tooth crown size (MD×LB) in the three species by line chart. From metric comparison, we have found that Lufengpithecus lufengensis is larger than Lufengpithecus keiyuanensis and Lufengpithecus hudienensisas a whole. The lower molars of Lufengpithecus keiyuanensis are close in size to those of Lufengpithecus lufengensis, but larger than those of Lufengpithecus hudienensis. The lower premolars (especially P3) are more robust in Lufengpithecus lufengensis than in the other two species, in which the lower molars are about equally robust. The size proportion of the anterior teeth and postcanine teeth are much larger in Lufengpithecus lufengensisis than in Lufengpithecus hudienensis. We consider that the dental variations seen among these species may be related to their respective geological ages, habitats, and perhaps diets.

Keywords: Miocene hominoid fossils; Lufengpithecus; dental morphology; tooth crown size

Favourable preservation of fossil dire wolf teeth in anaerobic/anhydrous petroleum seeps: hydrocarbon impregnation maintains apatite integrity without interfering with histological analysis

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Histological analysis of teeth can yield information on an organism's growth and development, facilitating investigations of diet, health, environment, and long-term responses to selective pressures. In the Americas, an extraordinary abundance of Late Pleistocene fossils has been preserved in seeps of natural petroleum. These fossil assemblies constitute a major source of information about biotic changes and adaptations at the end of the last glacial period, although the usefulness of the fossils for histological studies is unclear, due to the unknown taphonomic effects of long-term deposition in petroleum. To address this question, we here conducted histological and spectroscopic (XRD, FTIR, and SEM-EDS) analyses of teeth from a) ancient dire wolves (Canis dirus) from Rancholabrean age fossil deposits in petroleum seep (Rancho La Brea tar pits, California) and non-petroleum (Cutler Hammock sinkhole, Florida) environments, and b) modern gray wolves (Canis lupus) from North America. Compared with the modern sample, spectroscopic analysis revealed a high molecular integrity of the tooth apatite in the seep sample, while optical and electron microscopy images revealed excellent preservation of dental microstructure. The petroleum-induced discoloration was found not to interfere with the histological examination. In comparison, teeth from the non-seep sample showed severe degradation and compositional heterogeneity, arguably resulting from chemical interaction with exogenous substances. These results indicate that hydrocarbon impregnation counteracts chemical degradation of fossil teeth without interfering with histological analysis. Thus, petroleum seep assemblages appear to be almost ideal fossil resources for dental histology and studies of mammalian life history.

Keywords: dental histology; dental taphonomy; tooth microsctructure; fossils; dire wolves

Oral history in highland Ethiopia: Dental health and livelihood changes

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Because dental health status mirrors overall body health, we conducted a visual inspection of missing, decayed, and filled teeth among all individuals within 351 households of highland Ethiopia. The dental health status check was part of a more comprehensive assessment of household food security that incorporated surveys, interviews, and anthropometric measurements. In all we examined 1446 individuals living within three agro-ecological zones of Eastern and North Central Ethiopia. Our research sites, located in drought-prone areas, are home to relatively young populations, about half of whom are less than 20 years of age. Although 50% of adults have completed some level of education or training, few in either region are able to read and write in the common languages, Amhara or Oromifa. Most households are reliant upon rain-fed agriculture as a livelihood strategy; however food crops dominate in the South Wollo region while cash crops predominate in Harar. Overall, rates of dental decay and total numbers of missing teeth are high (57%) among adults from South Wollo but comparatively low for adults from Harar (18%). While 47.5% of males and 52.5% of females in the South Wollo sample have either missing or decayed teeth, just 21% of men and 15% of women from the Harar region have teeth which are missing or decayed. We examine possible reasons for declining dental health in South Wollo, e.g., number of pregnancies, rates of malnutrition and disease, dental hygiene practices, and use of khat. Results reflect a population in transition, whereby multiple factors correlate with poor dental health status. Among the highest correlates of declining health status are factors such as (1) expansion into marginal areas for farming, (2) larger family size, (3) heavier consumption of refined sugar and carbohydrate-rich foods, (4) growth stunting, and (5) increased use of the stimulant khat, Catha edulis.

Key Words: DMFT rates; dental health status; food security and health; Ethiopia

Sinodonty in Mesoamerica and its relationship with the initial settlement of Americas (13.750-500BP)

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This abstract gathers information about the frequency of 13 non-metric dental traits observed on 16.403 individuals (10.382 pre-Hispanics, and 6.021 contemporaries) distributed in 196 oseous collections from Southern United States, Central America and Caribean. The main of this research is determinate if Sinodonty is the exclusive dental pattern of pre-Hispanic groups in this region of America. A function discriminant analysis was carried out to observing the inclusion of the samples into Sinodont or Sundadont categories. A data base with the records reporting in Rodriguez Florez and Tabarev 2012, 2014 (Modelo 1), and Turner 1990 (Model 2) ware used. Results demonstrate that Final Late Pleistocene (13.700 – 7.000 BP) human groups shows a clear Sundadont dental pattern similar to Southest Asia dental pattern. During the Middle Holoceno (7.000 – 3.000 BP), Sinodonty is an emerging pattern and its influence direction from North to South follow the Pacific coast, and to East follow the Gulf of Mexico to some near Caribean islands. During the Late Holocene (3.000 – 500 BP) Sinodonty is the main dental pattern in this region of America. It is found that Sinodonty is not the unique dental pattern in pre-Hispanic groups in southern United States, Central America and the Caribbean, and its progressively replaces by the older Sundadonte dental pattern. These findings have implications for understanding the process of settlement in this region of America, because it suggests that the first groups had a dental pattern from Southeast Asia, Northeast Asia and not as previously thought.

Keywords: sinodonty; Mesoamerica

Possible causes of tooth wear in medieval Icelanders

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The Icelandic Sagas are an important source of information on the way of life in Iceland and possibly other Nordic countries 1000 years ago. Archaeological human skull material worldwide has revealed extensive tooth wear with the main cause believed to be consumption of course and rough diet. Dental erosion is generally thought of as a modern phenomenon, but there is emerging evidence that the condition has always been present to some degree. Skulls from Þjórsárdalur in the south of Iceland, dating from before 1104, were evaluated for tooth wear. An attempt was made to determine main causes of tooth wear from the wear pattern and also in the light of likely diet and beverage consumption according to data search on food and drink customs described in the Icelandic Sagas and manuscripts. Fifty-one skulls with 1001 teeth were available for research. Two methods were used to evaluate tooth wear and five for age estimation. Tooth wear was extensive in all age groups but significantly more in the older age groups with the highest score on first molar, with no difference between sexes. It had all the similarities seen in wear from coarse and rough diet. In some instances it has similar characteristics as seen in erosion in modern Icelanders consuming excessive amounts of soft drinks and other acidic beverages. According to the Icelandic Sagas and annals, a mixture of acidic whey and water was a daily drink in Iceland until the 20th century and whey was used for preservation of food. It is postulated that consumption of acidic drinks and food in addition to coarse diet has played a significant role in the dental wear of medieval Icelanders. It is concluded that acidic whey has considerable high dental erosive potential.

Keywords: paleodontology; tooth wear; Iceland

Odontobiography – the science and art of reading teeth and mouths

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A biography can be defined as a detailed description of a person's life. It includes facts about the birth, education, work, relationships, health and death of the subject. Some biographies also give us insight into a subject's experience of these events. Biography presents a subject's life story and it is usually non-fiction. When gaps exist, fiction may be used to portray certain aspects of that person's life. Odontobiography is a kind of biography based on analysis of the teeth and mouths of living or dead people. In method, odontobiography is quite similar to dental profiling in forensic dentistry, but with a significant difference in the aim. The aim of dental profiling is to establish somebody's identity. The aim of making somebody's odontobiography is to reconstruct the life of an individual and to provide as many details as possible from her/his life by analysis of the oral environment. The purpose of this paper is to give a brief insight into odontobiography as way of meta-interpretation of results of forensic and bioarcheological research.

Keywords: paleodontology; forensic dentistry; odontobiography

Cultural dental modification among the prehistoric population in Indonesia

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Cultural dental modification can provide clue about the history of human migration. When a migrant population entered a new region, it does not mean that only biological body entered to the new region but also their culture. The human remains from prehistoric time which is found in some archaeological sites in Indonesia (Flores, Java, Bali) show the intentional cultural dental modification. It is documented that there are four categories of dental modification. These include ablation, extraction, filing, and colorization. The purpose of this paper is to describe the variation of dental modification related to the history of human migration in Indonesia. It is assumed that the variation of dental modification was influenced by culture that was brought by migrant population, or it could be, there was a mix-culture between migrant's and indigenous population. Furthermore, the variation of dental modification indicates the in-migration from different time and different group of migrant people. The pattern of dental modification that disappeared earlier is the oldest pattern that has ever been practiced in Indonesia. In the other hand, the youngest patterns or the newest influence is the patterns that existed in longer time. This information is suitable with pattern of migration of Austronesia people into Indonesia. Anthropometric data, epigenetic, and DNA data show that Austronesia people entered Indonesia mainly from western Indonesia. They moved further to eastern part Indonesia and pushed the indigenous inhabitants. The existence of dental modification in nowadays population in eastern part of Indonesia is an evidence of the influence of the latest migrant population.

Keywords: dental modification; Indonesia; Neolithic; human migration

Paleoradiological analysis of dental remains from ancient cremated urns

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Since the invention of x-rays, paleoradiology, or paleoimaging, has played a significant role in the scientific study of ancient remains. Although x-ray units are used regularly, clinical computed tomography (CT) has been used only few times in the study of Bronze Age urns. At the University Department of Diagnostic and Interventional Radiology of the University Hospital Dubrava, we scanned dental remains found in 11 cinerary graves from the Late Bronze Age with a digitalized X-ray unit, (RAD Speed, Shimadzu Europe GmbH, Duisburg, Germany), an MDCT unit (Sensation 16; Siemens Healthcare, Erlangen, Germany) and a digital mammograph (Mammomat Nova, Siemens AG Medical Solutions, Erlangen, Germany). 3D reconstructions were made using Leonardo (Siemens AG Medical Solutions, Erlangen, Germany) and Aquarius (Terarecon Inc, San Mateo, SAD) workstations with OsiriX Imaging Software (Pixmeo, Geneve, Switzerland). CT scans allowed visualization of dental elements with better spatial and contrast resolution than mammography or plain x-ray images. The shape of the teeth has been evidently visualized on images and after 3D reconstructions, using volume rendering technique (VRT), maximal intensity projection (MIP), and surface rendering (SSD). Thermal modification following incineration presents a new challenge in paleoradiology as numerous differences exist between non cremated dental remains and thermally altered teeth. All techniques present limitations based on sample size. Although CT provides a spatial resoulution below 1 mm, it is still inadequate when it comes to differentiating small-scale elements. In spite of modest results, we strongly suggest a continuation of radiological analyses as they should help to form a wider evidence-based foundation for paleopathology.

Keywords: radiology; CT; archaeology; cremains; paleopathology

The use of skeletal data for interpreting dental development in fossil hominins

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A large body of research suggests that dental development was accelerated in fossil Homo, e.g., Homo erectus, Neanderthals and possibly early anatomically modern humans. However, dental development (specifically, dental formation) and skeletal growth are not conditionally independent given age, meaning that subadults who are tall for their age tend to exhibit accelerated dental formation,and vice versa. Therefore, it is important to determine whether the proposed faster rates of dental development in fossil Homo reflect faster rates of skeletal growth (and thus faster ontogeny overall), or if faster dental development in fossils is independent of their skeletal growth rates given age. To this end, I use comparative data from recent modern human subadults (N=181) of known age with associated dental and skeletal elements to develop predictive models to which fossil hominins can then be compared. There are only five fossil Homo subadults of known chronological age (estimated from dental microstructure) with associated permanent dentition and skeletal elements: KNM-WT 15000 H. erectus/ergaster, Dederiyeh 1 and Le Moustier 1 Neanderthals, and Qafzeh 10 and Lagar Velho 1 modern humans. The results suggest that dental formation in KNM-WT 15000 matches the expectations, or is even slightly delayed, given its age-at-death and skeletal growth. Molar development in Dederiyeh 1 is as expected, whereas Le Moustier 1 exhibits more advanced stages of molar development, given their age and skeletal growth. This may suggest that ontogenetic differences between Neanderthals and recent modern humans emerge later in ontogeny. Both Qafzeh 10and Lagar Velho 1 show unique differences in predicted relative to observed stages of dental development when both age and skeletal growth are taken into account. Considered jointly, these results suggest that a consideration of skeletal growth together with chronological age can provide valuable additional information for interpreting dental development in fossil hominins.

Keywords: dental development; skeletal growth; Homo erectus; Neanderthals; modern humans

Congenital syphilis cases among population of Old Russian cities

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Introduction. Differential diagnosis of congenital syphilis from skeletal remains should consider all bone and dental manifestations. Preservation and taphonomy often prevented the assessment of the skeletal markers of congenital syphilis. Children's skeletons preservation are very often incomplete or destroyed, in this case tooth structure can become a major source for the reconstruction of lifestyle and pathological manifestations. Materials and Methods. The study presents materials of the End of Middle Ages - Modern Time (XIV- the first half XIX centuries). Materials to take origin from Central Russia Region: Smolensk, Yaroslavl and Suzdal cities - the major urban centers. This period is characterized by rapid development of urban centers, population growth, and expansion of trade. These create a situation of overpopulation, crowding, and entail negative epidemiological situation too. An integrated approach to research and analysis of the material will help recreate life picture of the urban population. It contains not only age and sex determination, but the fixation of pathological manifestations and diagnosis of diseases. Results. Specific infections and diseases: scurvy, tuberculosis, syphilis and congenital forms of the disease were found on the remains of adults and children. The syphiloma (gumma) on the skull, extensive periosteal and hemorrhagic reactions, diaphysis bending of the lower limbs ("saber-shape") and destruction of the epiphysis were detected. This study presents the instances of tooth enamel abnormalities and malformations associated with congenital syphilis – Hutchinson's incisors, Moon's molars or bud molars and Fournier's molars. In the present study, the main role belongs odontological source in determining the correct diagnosis, because children's remains were very fragmentary skeletons presented.

Keywords: congenital syphilis; dental pathologies; Central Russia region; XIV- XIX centuries

New discovery of early Pleistocene orangutan fossils from Chongzuo in southern China

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28 isolated orangutan fossil teeth are reported in this paper, which are newly discovered from Sanhe Cave in Chongzuo Ecological Park of Guangxi in southern China. The geological age is early Pleistocene, approximately 1.2 Ma ago based on the associated mammal fauna and paleomagnetic dating. The tooth crown sizes are within the variation of extant orangutan and subfossil orangutan from Indonesia. However, by comparing the distribution complex of samples, the crown sizes of fossil orangutan from Sanhe Cave move upward from the mean value of extant orangutan and Holocene subfossil orangutan. The distinct difference of tooth morphological between the fossil and subfossil and extant orangutan is difficult to define currently, although the occlusal wrinkles of postcanine teeth of fossil orangutan from Sanhe Cave are less and coarser somehow than that of extant orangutan. We suggest the fossil orangutan teeth of Early Pleistocene from Sanhe Cave are classified as the subspecies Pongo pygmaeus weidenreichi temporarily, and the evolution and taxonomy of fossil orangutan-like hominoids in southern China need to be interpreted with more evidence.

Keywords: orangutan fossil; Pleistocene; Sanhe Cave; hominoid

Taxonomic differences in deciduous upper second molar crown outlines of H. sapiens, H. neanderthalensis, and H. erectus

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A number of Middle-to-Late Pleistocene sites preserve only, or primarily, deciduous teeth. While many studies of the fossil hominin deciduous dentition have focused on standard metrical variation, non-metric and morphometric variation also promise to shed light on long-standing taxonomic questions. This study examines the taxonomic significance of the crown outline of the upper deciduous second molar (dm2) through principal components and linear discriminant analyses. We test whether the crown shape of the upper dm2 separates Homo neanderthalensis from H. sapiens and explore whether it can be used to correctly assign individuals to taxa. This study builds on previous work by focusing on the crown rather than cervical outline and by including a large sample of geographically diverse recent human populations. Our recent human sample includes 80 individuals representing Asia, Africa, Europe and South America. Our fossil samples include 17 H. neanderthalensis, 5 early H. sapiens, and 12 Upper Paleolithic H. sapiens individuals. In addition, we include two H. erectus specimens in order to evaluate the polarity of observed crown shape differences. Our results show that crown outline shape of the upper dm2 distinguishes H. sapiens and H. neanderthalensis quite well. Individuals classify correctly 96.5 percent of the time. The H. erectus specimen Sangiran 7-13 classified ambiguously, which would be expected if it preserves a primitive crown outline. About half the H. sapiens individuals share this shape. The remaining H. sapiens individuals, including all early and nearly all Upper Paleolithic H. sapiens, have an outline that is derived in an opposite direction from that of H. neanderthalensis. Finally, the H. erectus upper dm2 from Tighenif classified as H. sapiens with a posterior probability of .99, tentatively suggesting dental continuity within Africa back to 700,000 years BP.

Keywords: molar; H. sapiens; H. neanderthalensis; H. erectus

Testing developmental biology predictions with fossils – dental complexity and evolutionary rates of the Multituberculata

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The increase in maximum complexity of tooth morphology through evolutionary history across most vertebrates, especially mammals, is marked. However, recent genetic and developmental studies suggest increases in morphological complexity are developmentally constrained and more difficult to achieve than reductions. Thus, over evolutionary time scales, we might expect increases in morphological complexity to occur less frequently than decreases. To address this hypothesis we studied patterns of change of tooth complexity and other parameters in the extinct mammalian order Multituberculata. Multituberculates were the most successful Mesozoic mammal clade and the longest-existing mammalian order known. Recent work suggests an increase in multituberculate species richness, disparity, abundance, and ecological and dietary niche range occurred ca. 20 million years before the K-Pg boundary, continuing until into the Cenozoic, likely linked with the diversification of angiosperm plants and the evolution of multituberculate herbivory. We used diversification rate, phylogenetic comparative, and evolutionary rate analyses, allied with a phylogeny and dataset recording functional parameters including toothrow dental complexity, tooth cusp number, and estimated body mass, to determine patterns and rates of morphological evolution and change in complexity for these animals. Dental complexity was quantified and analysed using 3D digital tooth models produced from laser-/CT-scanning lower toothrows and a recently developed measure of morphological complexity. Results show significantly more increases in dental complexity than decreases across Multituberculata, suggesting selection for higher complexity outweighed developmental constraints. However, within the only clade to acquire sufficient dental complexity to become predominantly herbivorous, equal decreases and increases in complexity occurred. It appears that once selection pressures for further complexity increases were relaxed, reassertion of developmental constraints balanced selection. Results from this fossil clade can be used to test developmental results and predictions regarding rates and direction of change of morphological complexity and offer hope for bridging the gap between micro- and macro-evolutionary studies.

Keywords: evolution; development; morphology; multituberculates

Dental developmental pattern of the Neanderthal children from Dederiyeh Cave in Syria

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Recent developments for assessing the dental maturation sequence and the dental tissue proportions have been providing an opportunity to detect the nature of differences between Neanderthals and modern humans. Bayle et al. reported the dental sequence of Neanderthal child (Roc de Marsal) is advanced in the first molar and delayed in the incisors, compared to the modern comparative standards (Bayle et al., 2009), and also presented inconsistent patterns among Upper Paleolithic children (Lagar Velho 1 and Madeleine 4) (Bayle et al., 2010). We report additional data for Neanderthal children from Dederiyeh cave in Syria, where two child Neanderthal remains have been uncovered from the Mousterian contexts with Tabun B-type Levallois technology. The ages at death for the two children have been assumed both about two years old, although the developmental status for each deciduous and permanent dentitions are inconsistent. Preliminary observation of the maturation sequences for the Dederiyeh dentitions detects an advanced pattern in molars compared to the modern standards, which may follow the Neanderthal pattern found in Roc de Marsal. We will provide a statistical assessment for the dental maturation sequences and absolute and proportional dental tissue volume data for the available teeth.

Keywords: dental maturation; dental tissue proportion; Neanderthal

Evolutionary transition in molar function in Eocene primate Cantius

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Insectivorous eutherians with tribosphenic molars gave rise to primates approximately 55 million years (myr) ago. Early Eocene Cantius represents one of the first true primates and has a well-defined stratigraphic record covering 5 myr. Between the North American land mammal ages Wasatchian 2 and Wasatchian 6 (from 54.84 to 52.71 Ma), a distinctive functional adaptation develops in the first and second molars of Cantius. Morphological studies on upper molars excavated from the Bighorn Basin, Wyoming, have documented the evolution of a hypocone from the postprotocrista. This development and comparison of dental surface structures and wear facet patterns reveals a change in tooth function and masticatory movements with a shift towards more advanced capabilities in specimens from higher and thus younger stratigraphic levels. Differences between first and second molar function is recognizable within individual dentitions from all levels. The trigonid decreases in height from first to second molar. From older to younger stratigraphic levels, the lower second molar paraconid has diminishes and is displaced lingually towards the metaconid. This opens space for the antagonistic upper hypocone mesially, while on the lower first molars the paraconid is preserved even in the highest stratigraphic levels. The relief index decreases from lower to higher stratigraphy. However, the wear facets increase in size and number and the molar crowns enlarge by up to 50%. A comparison with recent strepsirrhine dentition shows that the dietary preference in Cantius species changed from insectivorous to more herbivorous and frugivorous from lower to upper stratigraphic horizons. Presumably this correlates with changes in climate and therefore habitat.

Keywords: Eocene; Cantius; Primates; Hypocone; wear facets

Periodic incremental markings in the enamel of cynodonts and mammaliaforms: the origin of mammalian growth patterns

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The origin of determinate growth in mammals is associated with other important mammalian characters, including diphyodont dentition, lactation and endothermy. These characters likely evolved in the extinct cynodont and basal mammaliaform lineages of the Triassic and early Jurassic, with Morganucodon hypothesised to be the most basal mammaliaform to have both determinate growth and diphyodonty. Histological techniques to assess periodic enamel increments have not previously been applied to cynodonts and mammaliaforms, and are likely to improve understanding of their dental replacement and growth patterns. We prepared histological thin sections of postcanines of three cynodonts (Thrinaxodon, Scalenodon, Diademodon), molars of Morganucodon, and teeth from crown mammals and diapsids (e.g. Crocodylus, Canis, Tupaia). Using polarized light microscopy we assessed measures relating to dental growth patterns, including daily secretion rates of enamel, and crown and root extension rates. Two orders of incremental lines, analogous to daily prism cross-striations and longer period striae of Retzius of mammalian enamel, were observed in all cynodont and mammaliaform specimens. Daily secretion rate was lower in cynodont and mammaliaform enamel than in crown mammal teeth of comparable size. Very high mean crown extension rates were observed, both in diapsids and cynodonts (e.g. Crocodylus: 33.9µm/day; Thrinaxodon: 104.2µm/day), with cynodont extension rates at least double those of crown mammals with comparably sized teeth. Enamel thus extended extremely rapidly in thin 'sheath'-like layers in diapsids and cynodonts. In contrast, crown extension rate in Morganucodon is much lower (7.8µm/day), more closely resembling the crown mammals used for comparison. Low extension- and daily secretion rates suggest lower differentiation rates and secretory function of ameloblasts in Morganucodon. If this is coupled with reduced function of osteoblasts, it may suggest reduced rates of bone growth during molar formation. These patterns would be consistent with the hypothesis of determinate growth patterns in Morganucodon and of more indeterminate growth in cynodont species.

Keywords: cynodont; mammaliaform; dental growth; enamel histology; determinate growth

Experimental taphonomy: fossil record implications with paleoenvironmental interpretation

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Late Cretaceous elasmobranch teeth from two sites in the Judith River Formation (JRF) of Montana, the Woodhawk (WH) and Power Plant Ferry (PPF) bonebeds, show variable states of preservation. The sites are approximately 3 kilometers apart and consist of the same shoreface deposits and stratigraphic horizon, with nearly identical faunal diversity including shark and ray teeth, dermal denticles and centra. Both sites include ca. 14 identifiable species of lamniform and rajiform elasmobranchs, differing in ~2-3 species. Subtle differences between sites are expressed in details of faunal abundances and styles of preservation. WH has a greater abundance and a wider array of preservation, whereas PPF shows less abundance with more uniform preservation. This suggests localized areas of variable energy, with WH representing a higher energy environment bringing in specimens from farther offshore and mixing them with local material, and abrading the specimens to a higher degree than those preserved at PPF, where the material reflects a more autochthonous origin. This creates a mixture of marine and estuarine fossils, which produces mixed interpretations of geology and paleontology of the JRF. These observations prompted a taphonomic experiment on modern elasmobranch teeth intended to serve as a proxy for simulating their post-shedding fate (wear and abrasion). The experiment consisted of tumbling modern shark teeth in a saltwater and JRF sediment mixture. Visual changes in the teeth were quantifiable, with statistically significant (t-tests) changes in height, width, and mass. The experiment shows that when elasmobranch teeth are tumbled for 1000 hours, the cusps, cusplets, and roots are progressively lost in a predictable manner. The pattern seen in the tumbled modern shark teeth allows for interpreting the taphonomic state of comparable teeth in the fossil record. This study reveals intrinsic links between paleodiversity, taphonomy, and the paleoenvironment and is likely applicable to other discrete lag deposits.

Keywords: elasmobranch; taphonomy; Montana; paleoenvironment

Dental age assessment in adults

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Dental age estimation of the adult human remains can often be of great importance in forensic identification cases. There are numerous existing methods for the dental age determination, as well as several statistical methods for estimation of dental age in adults available in contemporary forensic dentistry. The aim of the present study was to compare real dental age with dental age estimation by the method according to three different methods. The research was conducted on the 160 intact extracted human teeth with one and two roots of the known age and sex. The teeth were disinfected, dried and x-rayed. After that the section of the longitudinal cut through the teeth was performed in order to facilitate monitoring of all tissues and morphological characteristics of the teeth. The age was determined in three ways: Method 1 (Bang and Ramm, 1970) – analysis of the translucency of the root dentin, Method 2 (Kvaal and Solheim, 1994)– analysis of the root and the root canal from the x-ray, Method 3 (Johanson, 1971) – analysis of six parameters on each teeth. All data were subject to the correlation and regression analysis which showed the following: all of the three applied methods were in the significant correlation with the real age, and the best of them proved to be Method 3 where the coefficient of correlation was 0.98, $p<0.001$. The teeth of the maxilla are more convenient for the age determination than the teeth of mandible. They are in the significant strong correlation with the known real age, and at the Method 3 the coefficient of correlation is 0.98, $p<0.001$.

Key words: dental age; forensic dentistry; teeth

The frequency of dental anatomical features for the evaluation of tooth marks in a criminal case

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In a murder case from 1957 the victim died close to the time she was bitten around the nipple. Distinctive anatomical features were found in the marks from the teeth. The person, who was sentenced for the crime, partly evidenced by the tooth marks, never admitted. His lawyers have several times tried to have the case reopened. The case has been examined by 6 different Norwegian courts and two times by the so called reopening commission. It has been controversies about the value of the tooth marks from that it could exclude the person to that it was all probability that he did bite the victim. A number of distinct anatomical features were found in the tooth marks. The frequencies of each feature were examined in 220 accidental patients in dental practices, both males and females. The number of individual teeth that could have left the associated mark was assessed. Combined frequencies of three features were found and the value of further inclusion of features was on a theoretical bases, calculated using the multiplication rule. The theoretical frequency of persons who could have left the marks was found to be less than 1 in 1 000 000. However, interrelations between the features would have to be corrected for and of course would have increased the frequency of possible biters. In any case the combined frequency of the anatomical features found in the tooth marks in this case approached those found for modern DNA comparisons.

Keywords: A tooth mark case; anatomical characteristics; frequencies; Norway

A look at forensic dentistry in Bosnia and Herzegovina

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According to ICMP (International Commission on Missing Persons) during the war in Bosnia and Herzegovina (1992-1995), there are 30000 missing persons, 17000 have been exhumed, and 13000 are still not found and identified. There is a great need for identification of human remains from mass graves. Identification for every person begins by forming a biological profile which includes: age at the moment of death, height, sex and race. Case 1: An example of mass grave exhumation of german soldiers from World war II, found near city of Visoko in Bosnia and Herzegovina, is presented as well as methods used in dental profiling and identification. Forensic dentistry has a very important role in criminal and civil cases. It is of extreme importance that the evidence of postmortem findings are correctly reported and presented. Case 2: police fugative (male,between 35 and 40 years of age) jumped in the river Bosna and drowned. His identification represented a challenge due to postmortem changes; Case 3: refugee (male, between 40 and 45 years of age), body was severely burned, and also needed to be identified; Case 4: male (between 40 and 50 years of age) found with a gunshot wound in the head, after a reported missing of a month. His identification was also a challenge since the body was found in the woods and was severly damaged and with notable postmortem changes. These cases are presented to show to what extent the body undergoes changes, challenges forensic medicine and dentistry are faced with and importance of teeth since they survive post mortem events. Conventional and novel methods of identification are presented following each case. In Bosnia and Herzegovina, there is a need to educate more forensic dentists and include them in mass grave exhumation teams and juidical system as well.

Keywords: forensic dentistry; exhumations; mass graves; identification; Bosnia and Herzegovina

Estimating chronological age using cervical vertebrae and dental maturation

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Studies of cervical vertebrae maturation (CVM) are used to predict pubertal growth spurt to target the best timing of orthodontic treatment. Dental maturation is frequently used to estimate age. Changes of shape of cervical vertebrae bodies can be analysed qualitatively or quantitatively but most methods do not discriminate for age. This project aims to create an automated computer program to quantitatively assess the cervical vertebrae change in shape during growth; to compare this with the permanent second molar (M2) and third molar (M3) formation and to explore if this approach might be applied to estimating age. The sample consists of digital dental radiographs, lateral cephalogram (LC) and panoramic (P), taken on the same day, from Brazilian males (N=31) and females (N=34), 9 to 23 years. The body of third cervical vertebrae (C3) was assessed by drawing an outline to quantify shape using 'Image J' software. Tooth formation of the second and third molars (M2 & M3) of the lower left side were analysed according to Moorrees et al (1963). Tooth stage was compared in LC and P for M2 and M3 using Kappa. After calibration, the surfaces of the body of the cervical vertebrae that changed most with age were identified. We are writing a programme to quantify shape. Analysis of the tooth stages in the lateral cephalogram compared with OPG showed that Kappa result was excellent (.802) for M2 and good (.615) for M3. Kappa is poorer for M3 because of angulation of tooth relative to the film and superposition of teeth images, making tooth stage more difficult to assess. The present method needs to be refined to assess change of shape of C3 with growth.

Keywords: cervical vertebrae maturation; dental maturation; quantitative method of CVM analysis; forensic science; age estimation

Buccal enamel to dentine thickness ratios: estimating the percentage of crown height lost in worn human mandibular canines

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This study investigates whether the extent of crown height lost due to occlusal wear can be effectively estimated on worn teeth. It is intended to help resolve limitations commonly faced when analysing worn crowns, such as the position of enamel defects or the number of perikymata per decile of crown height when original crown height is unknown. Because of dentine morphology and the tendency for enamel to become progressively thinner cervically, the amount of dentine visible on occlusal surfaces increases as crowns become progressively worn. We investigated how enamel to dentine thickness ratios may change along the length of a crown and also if these ratios might be useful in gauging the extent of occlusal wear. Enamel-dentine ratios were calculated as the transverse thickness of buccal enamel and dentine at the mid-line for each decile of crown height on 21 cross-sectioned mandibular canines, extracted from a modern New Zealand population. Our results suggest the relationship between ratio values and crown height is most simply explained by an exponential model ($R^2 = 0.8698$, $P < 0.005$) but we explore further hierarchical models that may also be useful. In addition, we found that the tip of the dentine horn most commonly occurred at 0.75 of the first decile. We also identified ranges of ratio values that relate only to specific deciles in the occlusal half of the crowns in our sample, providing a reliable predictor for those deciles. Ratio values outside these ranges could still be associated with certain deciles but were more error prone. We suggest that ratios calculated from buccal enamel and dentine visible on the worn occlusal surface of mandibular canines can provide an estimation of crown height, particularly for establishing if occlusal wear has reached or exceeded 20%, 30%, 40% and 50 % of original crown height.

Key words: dental wear; attrition; occlusal surface

Age estimation by dental developmental stages in children and adolescents in Iceland

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Background: dental age estimation is considered to be highly reliable in children and adolescents. The standard deviation is from a few months to 1 to 2 years. In adults where teeth have reached full development, regression changes are used but the accuracy is much less. Objectives: studies have shown that a database for dental maturity is necessary for every population. This study is the first one for the Icelandic population, for ages 4-25 years. It will create a database for forensic purposes for age estimation. It will also help other professionals who work with developmental age assessment. Material and methods: this retrospective cross-sectional study had a sample of 977 orthopantomograms, 508 of girls and 469 of boys aged 4-25 years. A group of 23 was excluded. A developmental tooth scoring system was used for determination of maturity stages. 200 radiographs were studied on both the left and right sides and the remaining on the right side only. The mean age was 15.00 years. Results: dental maturity was established for all teeth and both genders. Reliability of the study instruments was found by using Cronbach´s Alpha. The R was 0.982. Girls in Iceland reach stage 10 at 17.81 years for tooth 18 and 18.47 years for tooth 48. Boys reach stage 10 at 18.00 years of age for tooth 18 and 17.53 for tooth 48. There was no significant difference between left and right side, r = 0.95-1.00. No difference was between genders, except in root formation in maxillary and mandibular canines where girls reached apex closure earlier. Conclusion: a reliable database has been established for age estimation for the Icelandic population in the age range of 4-25 years. These results will help forensic odontologists and other professionals to estimate with accurately age and maturity in Icelandic children and adolescents.

Keywords: forensic odontology; age estimation; Iceland

Anthropometric analysis of sexual dimorphism in mandibles of Bosnian and Herzegovinian population

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Anthropometric analysis has showed that there are population differences in size and shape of human body parts. Analysis of mandibular linear dimensions has never been done before for population of Bosnia and Herzegovina. The aim of this research was to examine if there is sexual dimorphism of mandibular linear dimensions on the sample of Bosnian Herzegovinian population and to test possibility of use such dimensions in cases where sex estimation is required. The samples were 163 mandibles (78 male and 85 female mandibles) derived from osteology collection from Department of Anatomy, Faculty of Medicine, University of Sarajevo. Mandibles were well preserved with records about age at time of death, sex and origin (Bosnian Herzegovinian population from the 20th century). On each mandible we performed 26 anthropometric measurements of linear dimensions. After the statistical analysis results showed that there is sexual dimorphism of all mandibular linear dimensions, meaning that male mandibles are larger in all dimensions. Discriminant function analysis (DFA) was used to derive formulas for sex estimation based on mandibular dimensions for the Bosnian population. The accuracy of sex estimation was from 82,8 % to 87,1% respectively, depending on number and type of used mandibular dimensions. Derived formulas were also tested on independent sample of mandibles from forensic cases when accuracy of sex estimation was up to 89,47 %. From the results of this research we gained «demarking point» for each mandibular dimension which can be used for sex estimation in fragmented mandibles from Bosnian population. Anthropometric analysis of mandible can be valuable part of protocol in forensic cases of identification of human remains.

Key words: anthropometry; sexual dimorphism; mandibles; Bosnia

A new software for age estimation in adults by pulp/tooth ratio in canines using periapical X-rays: preliminary results

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The age estimation of adult individuals is an important problem in forensic human identification. This is usually performed by methods based on age-related changes of human skeleton. In the present paper, the pulp/tooth ratio in peri-apical X-rays of canine is used for age estimation purposes. An image segmentation method is proposed for the automatic computation of the above mentioned area, and its implementation by a Matlab code is used to obtain a practical study on 70 canine radiographies of distinct known aged individuals.

Keywords: age estimation; adults; X-rays

A project on age determination of medieval human samples from Italy: traditional anthropological techniques vs dental age estimation methods

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In 2000 the Medieval Arcaheology teaching and the Physical Anthropology Laboratory of Venice University Ca' Foscari started a project on the medieval peopling of Italy (Veneto, Emilia-Romagna and Tuscany) that allowed the excavation and analysis of several cemeteries and human samples dating back to Late Antiquity-Early Medieval Age up to Renaissance. The sample is formed by more than 1200 subjects of both sexes and all age categories, coming from various archaeological contexts (urban sites, country villages, cities, monasteries) and each showing peculiar burial practices. Together with the traditional anthropological approach to paleobiological samples, we decided to test a new age determination method (following R. Cameriere suggestions and recommendations) on several of them (Castel S. Pietro-BO, Formigine-MO, Comacchio-FE). Given the problems that can often arise with samples coming form achaeological contexts (incompleteness, fragmentation, poor preservation of the remains) we found this method extremely helpful, considering also the fact that dental remains are often better preserved than others. In addition we have to stress that in traditional paleodemography, the age classes ranging from 45-50 years onwards remain mostly undiagnosed, being grouped into one single class and therefore the mortality pattern of adults is also highly biased. The analysis through traditional skeletal indicators was compared in each case with that offered by Cameriere method for a more precise and statistically useful age determination of the subjects.

Keywords: age determination; age estimation; medieval; Italy

A recently excavated Copper Age human sample from Italy and dental age estimation results

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The copper Age necropolis of Forlì Celletta dei Passeri was discovered in 2009 and excavated under the direction of M. Miari between 2009 and 2010. More than 70 tombs were brought to light and several still wait to be excavated. The area extends over 5.000 square metres and all the burials are simply dug in the ground and mostly W-NW and S-SW oriented. The grave goods are represented by pottery, copper axes, copper daggers and flint artifacts. The record of taphonomical data allowed us to recognize the practice of manipulation and reopening of the graves and peculiar burial practices. The human sample is formed by 40 adults and 10 juveniles (18 males, 7 females and 15 undetermined among the adults) and a major problem in paleobiological study was represented by the fragmentation and incompleteness of the skeletal remains. Several regions couldn't even be taken into consideration (sternal ends of ribs, pubic symphyses, cranial sutures), while as it is well known, the degree of dental wear, especially in prehistoric times, is highly biased by attrition, contaminants in food, extra-alimentary use of teeth. Therefore the use of the Cameriere method represented a good solution to fill the gap in the data collected through traditional age determination diagnosis.

Keywords: age determination; age estimation; Copper Age; Italy

Age estimation in Brazilian adults using periapical radiographs

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Changes in pulp size due to the deposition of secondary dentin observed on radiographic images represent the best morphometric parameter to estimate age in adults. The objectives of the study were: to assess the precision and accuracy of age estimation using periapical radiographs among Brazilian adults, and to compare a formula to estimate age in this population with the original one (Cameriere et al., 2004). The sample comprised 1,772 periapical radiographs of 443 subjects (219 male, 224 female) that were organized into 12 groups according to sex and age (20-29, 30-39, 40-49, 50-59, 60-69 and 70+ years). The x-rays were analyzed as per Cameriere et al. (2004) using Adobe Photoshop® software and the observations were based on 20 points along the contour of the canine structure and 10 points around the pulp cavity. The obtained pixel values were inserted into the formulas for estimating age. The intra-class correlation was of 0.74 (0.6-0.8) and 0.87 (0.7-0.9), respectively, for intra and inter-observer measurements. The application of the age estimation formulas to the Brazilian population revealed a mean error of 8.56 (SD=5.80) years for tooth 13, 7.99 (SD=5.78) years for tooth 23, 8.38 (SD=6.26) years for tooth 33, and 8.20 (SD=6.54) years for tooth 43. The application of the formulas to values obtained with a combination of teeth decreased the mean error and was 7.85 (SD = 5.60) years for the canines on the right side and 7.58 (SD = 5.41) years for the left side. Our findings indicated that slightly higher levels of accuracy could be achieved by estimating the ages using the Brazilian formula compared with the original one. Multiple teeth should be used and more than one method should be applied in order to improve the accuracy of the age estimation. (Funding: CAPES).

Keywords: age estimation; teeth; secondary dentin; periapical radiograph; forensic dentistry

The Monti'e Prama (Cabras, Sardinia) necropolis, X- IX sec. A.C.: the age at death by teeth as a contribution to an archaeological question

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The Monti 'e Prama site, made famous by the discovery of numerous large stone statues "The Monti 'e Prama giants", is a necropolis located in Sardinia, dated to the X - IX BC. The statues, all depicting men: archers, boxers and fencers, were found collapsed and fragmented, in the immediate vicinity of the burials. The sample of inhumated skeletons consists of 41 individuals, almost all males, who died when adolescents, young adults or, more rarely, mature. Neither children nor elders were present. An interesting question is whether the statues depicted the deceased or could have come from a temple located elsewhere. In this regard, the diagnosis of the age at death is an element of considerable importance, but the skeletal age is difficult to determine in this sample because of the bad state of preservation of the bones, while the teeth are well preserved and have allowed us to reconstruct a seriation in order to seniority on the basis of wear. Since tooth wear is a weak indicator of age, we also used a method based on the deposition of secondary dentine, by the pulp area/tooth area ratio calculation, which gets a greater precision. It was found that the correlation between the degree of wear and pulp area/tooth area ratio is somewhat low, indicating that the two processes, although both age-dependent, do not have a very similar trend. It was also noted that the method of pulp area / tooth area ratio tends to "make the individuals grow old" in cases of discrepancy, but in general confirms the young age of many adults and the absence of the elderly. In this sense, it confirms even the possibility of an association between the deceased and the statues of young athletes or warriors. The results of pulp area/tooth area ratio method, by moving the sample as a whole to ages slightly more advanced than those suggested by wear, offers the hypothesis that the community was characterized by alimentary habits involving a little wearing mastication activity.

Keywords: age estimation; paleodontology

Age estimation in a sample of adults Neolithic skeletons from Italy by tooth/pulp ratio in canines by X-rays

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The age at death estimation is one of the main components of the anthropological study and is the basis of demographic studies conducted on ancient peoples. However, the different methods commonly used in anthropology for adult age at death determination provide estimates of the age in the form of wide intervals. This happens regardless of the state of preservation of bones, even if in case of a poorly preserved skeletons we can only determine the individual as an adult. The consequence is the inability to develop demographic studies with a good degree of reliability. Several age estimation methods apply the various forms of tooth modification, including wear, root dentine transparency, tooth cementum annulation, racemization of aspartic acid, and apposition of secondary dentine. Wear and the apposition of secondary dentine are the currently available non-destructive methods. Tooth wear is influenced by various external factors (masticatory function, type of food, timing and sequence of tooth eruption, tooth form, position of teeth, thickness and hardness of enamel, and predisposition to enamel hypoplasia) while the apposition of secondary dentine (Cameriere's method) is a continuing, regular process, which is only modified by caries or particular abrasion. The purpose of this communication was to apply the Cameriere's method on an important sample of 16 adults Neolithic skeletons from three sites in southern Italy (Apulia): Serra Cicora, Masseria della Marina and Carpignano. The estimates derived from the study of the canines were compared with the age ranges obtained with the commonly used anthropological indicators: fusion of cranial sutures, degree of tooth wear, remodelling of the pubic symphysis and the auricular surface of the Ilium. The latter two provide intervals which encompass the ages estimated with Cameriere's method. The results show that we are facing a population with a high presence of persons of advanced age, even beyond the age of 50, hardly distinguishable by other methods.

Keywords: age estimation; Neolithic; tooth/pulp ratio

Dental development and life history: progress, pitfalls and a perspective

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The use of dental development to chart and understand life history evolution has been one of the most fruitful lines of research in palaeontology and biological anthropology for many years. My aim here is to present an overview of the current state of this research using examples from my own research and that of my colleagues. My focus will be on the levels at which we understand life history variation and the appropriate levels at which both our questions and our methods can inform our work. Life history variables, e.g. gestation, age at weaning, age at first reproduction, and lifespan, vary between individuals within populations, between populations within species, between species, and between clades above the species level. Dental development can be seen to operate at two basic levels – the formation of individual teeth and the formation of the dentition. The formation of teeth is one step removed from life history, as the primary purpose of its components (e.g. daily secretion rate of enamel and dentine, angle of the striae of Retzius, combining to form extension rate) is to create a functional unit of a certain size, constrained by the time (life history) in which it develops. The formation of the dentition is more closely related to life history, as the development and eruption of teeth must match the pace of overall growth of the individual. The questions we ask about life history and the measures we make of aspects of dental development need to be aligned in order to be meaningful. Exciting new techniques allow us to look at life history variation between individuals; other methods are required to allow us to look at life history at higher levels, including not just eruption of teeth, particularly molars, but also their development relative to each other across the growth period.

Keywords: dental development; life history

The X value in the craniofacial equation: X chromosome effects on oral and craniofacial development

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The investigation of the X chromosome influence on oral and craniofacial development was the main goal of the research project "Characteristics of the Craniofacial Complex in Gonadal Dysgenesis," conducted at the Department of Dental Anthropology, Zagreb University School of Dental Medicine. This lecture covers project findings combined with those from other relevant studies in the field. Growth and development are simultaneous biological processes leading from an undifferentiated and immature state to the highly organized and specialized state of a mature human. Although development lasts for about two decades, allowing much time for environmental factors to act, it is under strong genetic control. While autosomes are responsible for somatic growth, sex chromosomes are primarily responsible for sex determination. However, studies in individuals with sex chromosome anomalies show that they also influence somatic growth in general and the craniofacial region in particular. Structural aberrations or complete absence of one of the X chromosomes in phenotypic females results in Turner syndrome, while excess X chromosomes in phenotypic males are associated with Klinefelter syndrome. The opposite effects of X gene dosage are exerted in dental development, including tooth crown and root dimensions and morphology, tooth number and eruption. Occlusal patterns include distal molar occlusion, with lateral crossbite and anterior open bite in Turner syndrome and mesial molar occlusion in Klinefelter syndrome. Cephalometric craniofacial morphology is characterized by reduced mandibular dimensions and larger cranial base angle in Turner syndrome while individuals with Klinefelter syndrome show the opposite, with larger mandibles and more acute cranial base angles. Genes on the X chromosome have a significant influence on oral and craniofacial growth, including dental development and growth of the maxilla, mandible and cranial base. The goal of future molecular studies is to identify the loci of the responsible X chromosome genes.

Keywords: X chromosome; craniofacial development; Turner syndrome; Klinefelter syndrome

Mapping life stages in the mammalian dentition

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We now have great potential to unlock life histories of extinct mammals from fine-scale studies of teeth. Microscopic analysis of growth increments can document growth periods and age of death; isotopic analyses can reconstruct water sources, food sources, seasonal cycles and trophic level for skeletal material from archaeological and paleontological contexts, often extending to material millions of years old. Both endeavors would be helped by a general map of the timing of tooth formation in mammals, especially when destructive samples need to be taken. Which tooth should be sampled to document prenatal, nursing or weaned periods? Where is the neonatal line likely to be? How much of the adult dentition is made while drinking mother's milk? The combined factors of altricial to precocial birth, fast to slow growth, seasonality, duration of nursing and phylogenetic jumps give rise to some very different answers to these questions. Indeed, how much of the dentition is mineralized before birth varies from "none" (shrews in the family Soricidae) to very nearly "all" (guinea pigs). To "map" life cycle onto teeth, probable location of the neonatal line is given by images or dissections of the neonatal dentition. Expected location of a weaning zone is more error prone, but a best hypothesis can be presented for well-known taxa. The present study assembles original imaging data and literature sources to propose life-cycle maps for the permanent teeth for examples from Primates, Artiodactyla, Carnivora and Rodentia. Such maps visually document the adaptability of the mammalian dentition, but are also of immediate practical value. All such maps can be tested against the real world as information accrues in the future.

Keywords: life history; dental development; mammals; weaning; neonate

Dental growth in Baka Pygmies

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African pygmies are the most extreme of modern human variation. A deficiency in the GH-IGF1 axis, founded on genetic changes, seems to be responsible of their short average stature, lesser than 1,55 m. African pygmies split from non-pygmies populations 60,000 BP and their phenotype seems to be an adaptation to the humid and rich in pathogens environment of the equatorial rain forest. Living far from villages and the lack of individual chronology are certainly among the main reasons that have excluded any study on dental growth in Pygmies. The relation between somatic and dental growth is thus completely unknown. From 2007, we follow dental growth, as well as somatic one, in around 500 Baka pygmies with known age from 0 to 23 years old in South-East Cameroon. Oral inspection, performed with a yearly frequency, enabled us to obtain, by using Probit analysis, the age of gingival eruption and the attainment of full occlusion for each tooth class. Age of eruption is always earlier in girls than in boys. Lower teeth erupt earlier than upper teeth with the exception of premolars which erupt almost at the same time in girls; in boys upper premolars erupt earlier than lower ones. Ages of gingival eruption are at the lowest extreme of modern humans. The precocity in dental growth contrasts with values for somatic growth in this same population which clearly show a chronology comparable to that observed in non-pygmies groups. Dental growth and somatic growth in Baka pygmies seem to present a weak synchronicity. It is not possible to infer if precocity in dental growth is related to the genetic changes responsible for pygmy phenotype, but our results call to caution about the use of dental age as a proxy for individual growth in groups with reduced body size.

Keywords: Eruption; full occlusion; chronology; Baka pygmies

Biomechanical constraints on molar emergence

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It is well established that the ages at permanent molar emergence are strongly correlated with life history variables across primates. However, an understanding of how molar emergence is modulated during ontogeny is lacking and, as a result, it remains unknown how variation in molar emergence schedules is achieved among primates. As teeth are part of the functionally integrated masticatory system, the key to understanding how molar emergence is regulated may lie in investigating how it is coordinated with the growing masticatory system. In adult anthropoids, all molars sit anterior to the muscle force vector produced by all of the jaw adductors (muscle resultant). This is because biting posterior to the muscle resultant would lead to distraction of the temporomandibular joint. Molars are therefore positioned within a space that is biomechanically appropriate. In this study, we test the hypothesis that molar emergence must also occur within a biomechanically appropriate space and that interspecific variation in emergence schedules is a result of changes in the rate at which that space becomes available. 3D coordinate data were collected on a cross-sectional ontogenetic sample of chimpanzee (n=45) and human (n=36) skulls. These data were used to determine the position of the muscle resultant relative to the posterior most bite point during ontogeny. One-way paired t-tests indicate that all permanent molars emerge in a position that is significantly anterior to the muscle resultant ($p<0.001$) thereby supporting our hypothesis. Humans therefore evolved later molar emergence ages by combining slow facial growth trajectories with prolonged growth duration. This study suggests a biomechanical constraint operates on molar emergence schedules. In particular, it is the rate at which biomechanically appropriate space becomes available that determines the timing of molar emergence. Therefore, variation in molar emergence ages is, in part, a result of altering the rate and duration of facial growth.

Keywords: life history; dental development; facial growth; craniofacial biomechanics; ontogeny

IGF-2 and IGFBP-6 in human odontogenesis and jaw development

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Components of the insulin-like growth factor (IGF) system are involved in orofacial physiology, development and malformation. Recently, we could localize components of the IGF system in oral and dental human and rodent tissues. IGF-2 and its high affinity binding protein, IGFBP-6, are important for developmental processes, where they regulate e.g. proliferation. IGFBP-6 has an inhibitory effect on IGF-II. While we already could show the expression of these factors in the adult periodontal ligament, no data concerning their appearance and distribution during human odontogenesis and jaw development were available. Serial sections of decalcified and paraffin-embedded specimens from the jaw regions of human embryos (6th - 22nd gestational week (gw)) were investigated immunohistochemically using mono- and polyclonal antibodies against IGF-2 and IGFBP-6. The results mainly showed a colocalization and an increasing intensity of immunoreactivity with gestational age. Immunostaining could already be demonstrated in the dental lamina and later in the enamelum organ. Strong staining appeared in the enamelum knot and Hertwig's epithelial sheeth (HERS). With the beginning of the 10th gw both factors could be localized in dental papilla and follicle. While Meckel's cartilage was unstained, strong reactivity could be seen in the jaw blastema and in osteoblasts. The results show that IGF-2 and IGFBP-6 are both involved in odontogenesis and orofacial development. Findings in the enamelum knot and HERS indicate a role of IGF-2 in proliferation. Its appearance in the developing jaw bones reveals a function in osteogenesis. The colocalization with IGFBP-6 demonstrates biological interaction with its ligand, thus probably controlling mitogenesis.

Keywords: odontogenesis; insulin-like growth factors; jaw bone development

Sphenoid sinus variations among different sinus types

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The sphenoid sinus originated from the posterior divisions of the nasal cavity, and during human evolution adapted functionally to other pneumatic cavities. The extent of its pneumatization is very important anthropological characteristic for choosing a proper surgical endoscopic approach in clinical medicine. The aim of this research is to elucidate whether there is a correlation between both, the incidence of pneumatization of different parts of the sphenoid bone and the incidence of protrusion of adjacent neurovascular structures in the aspect of sphenoid sinus type. The study was performed on 51 skulls (=102 sinuses) using Cone Beam Computed Tomography (CBCT). Sphenoid sinuses were classified into 4 types: conchal, presellar, sellar and postsellar. For each type the incidence of pneumatization of greater wings, pterygoid process and planum sphenoidale as well as the incidence of protrusion of maxillary nerve, pterygoid nerve, optic nerve and internal carotid artery were analysed. The prevalence of sinus pneumatization was 2% conchal, 24% presellar, 41% sellar and 33% postsellar. Pneumatization of greater wings occured in 29% postsellar and 5% sellar; pterygoid process in 38% postsellar and 10% sellar; and planum sphenoidale in 79% postsellar, 60% sellar and 42% presellar sinuses. Protrusion of the maxillary nerve was noted in 32% postsellar and 21% sellar sinuses; and pterygoid nerve in 65% postsellar and 33% sellar sinuses. Protrusion of optic nerve was found in 37% postsellar, 30% sellar and 8% presellar sinuses. Internal carotid artery protrusion was noted in 81% postsellar and 14% sellar sinuses. Significant difference in the incidence of all observed anatomic variations among different sphenoid sinus types was found. Findings of this study suggest that type of sphenoid sinus pneumatization can be valuable for estimating protrusion of important anatomical structures in the sinus cavity and of clinical importance for undertaking surgical approaches.

Keywords: sphenoid sinus; CBCT; anatomic variation; pneumatization; hypophyseal surgery

Posterior body height of the third cervical vertebra as a predictor of mandibular rotation

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Evaluation of cervical vertebrae on lateral cephalograms is used for growth assessment and skeletal age evaluation. Most of skeletal age methods are based on assessment of maturation and shape of the third cervical vertebra (C3). On the other hand, morphological analyses of first and second cervical vertebrae indicate their association with mandibular growth direction. In spite of extensive research about cervical vertebral maturation methods, relationship of C3 vertebral shape and skeletal growth patterns are still not evaluated. The aim of the presented pilot study is to indicate if morphology of the body of the third cervical vertebra can be used for estimating skeletal growth patterns in maxilla and mandible. Lateral cephalograms of 100 healthy children with cervical vertebral maturity stage V (peak in mandibular growth has occurred not later than two years before this stage) were analyzed. Skeletal growth patterns have been evaluated using mandibular angle (Ar-Go-Gn), Bjork polygon (N-S-Ar-Go-Gn), linear difference between maxillar (Sna-Snp) and mandibular length (Go-Gn) and maxilla-mandibular angle (Sna-Snp:Go-Gn). Cervico-vertebral morphology was analyzed using linear measurements of anterior height, posterior height and body concavity of C3. Pearson's linear correlation and analysis of variance was used for comparing cervical morphology and skeletal growth patterns. Anterior body height showed negative but insignificant relationship with mandibular angle. Significant ($p < 0.034$) negative correlation ($r = -0.211$) was found between posterior height and mandibular angle but not with other skeletal parameters. This study indicates that the posterior height of the third cervical vertebra cannot be used for estimating positional mandibular rotation and maxilla-mandibular horizontal relationship but only for estimating anatomical mandibular rotation and growth of mandibular ramus. Future research should be focused on linear mandibular measurements and C3 antero-posterior body height ratio in different skeletal developmental stages.

Keywords: cervical maturation; mandibular rotation; cephalometrics; cervical vertebra

Crowding defects of enamel: Will we ever understand them?

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Defects of enamel formation in mammals can be created by crowding in any of the three axes: mesio-distal, labio/bucco-lingual, and vertical. Interproximal and "Darcy's" defects are quite rare and/or do not have a human equivalent, factors that discourage study of their etiology. Only crypt fenestration enamel defects (CFEDs) are common in ancient and modern human as well as nonhuman primates and have clear clinical significance making their study feasible and worthwhile. Recognition that an analogous lesion is created postnatally on maxillary molars of pigs has encouraged us to examine whether an animal model can be developed to better understand this particular form of enamel crowding defect. We compare fenestration defects and CFEDs between 50 Sick Pen pigs, who died naturally, and 20 Controls. Observations were made of the presence, number and size of fenestrations in molar crypts. CFEDs were counted on erupted deciduous last molars and permanent first molars. Signs of being underweight and cranio-dental infection at death were recorded. Sick Pen pigs show significantly more fenestrations at death and CFEDs acquired before death. These conditions co-occur with infection and poor growth. The deep fibers of temporalis muscle lie adjacent to the crypt wall of maxillary molars. We propose that contraction of this muscle during suckling and chewing creates large compressive forces against fenestrated bony surfaces sufficient to have physiological consequences for physically unprotected ameloblasts. While we conclude that a pig model is appropriate to study fenestration-induced enamel defects, this naturalistic experiment leaves unresolved whether osteopenia in pigs, and by extension in human infants, is due to disease and/or malnutrition.

Key words: enamel; crowding defects

A radiographic study of pulp crown dimensions of the mandibular deciduous second molar

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The aim of this study was to assess the difference in crown and pulp dimensions of the mandibular deciduous second molar in males and females using digitized images of bitewing radiographs and image J®. Bitewing radiographs of 48 children (24 males and 24 females) aged 3.69 to 9.46 years were assessed in a retrospective cross sectional study. Bitewings were photographed and Image J® was used to measure crown and pulp area and some linear measurements. A t-test was used to compare the difference between mean dimensions in males and females to zero. There were no statistical differences in the area (hard tissue with pulp and without pulp area) or in the horizontal (mesio distal crown width, pulp and crown width at cervix) or vertical (mesial and distal pulp horn height to occlusal surface) between boys and girls. No difference in the area and measurements of the lower second molar found among boys and girls.

Keywords: bitewing radiographs; crown; pulp; deciduous lower second molars; image J®

Morphogenetic variables of reaching and maintaining a functional occlusal relief in molars of Soay sheep

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The selenodont molars of ruminants erupt with an occlusal morphology that is not yet fully functional and has to be converted to a functional relief by wear. Key variables in functional tooth geometry are the enamel thickness in different locations and the degree of hypsodonty that have evolved in relation to feeding type and the abrasive properties of the diet. To assess morphogenetic variables related to variation of enamel thickness and the degree of hypsodonty in Soay sheep (Ovis ammon f. aries) 27 mandibular and 3 maxillary molars from 11 individuals of known age at death were investigated macroscopically, and by light and scanning electron microscopy. Vital labeling with fluorochromes given at known dates provided a time frame for reconstruction of tooth crown development. An enamel free area is present in unworn cusps on the buccal side of the infundibulum in mandibular and on the palatal side in maxillary molars. Deeper in the infundibulum, enamel is present but its thickness remains much lower buccally/palatally than on the opposite infundibular flank. Enamel thickness at a given crown position is determined by two factors, the mean daily secretion rate and the duration of the secretory lifespan of the respective ameloblasts. The degree of hypsodonty is influenced by variation in enamel extension rate (EER) and crown formation time. In Soay sheep, the cuspal tooth portions exhibit a high EER that also causes a marked advance of the enamel forming front compared to the contemporaneously formed dentine in the cuspal crown portion. Further cervically, the EER markedly decreases, reaching lowest values near the apical enamel border. Both, the differences in enamel thickness and the variation in crown elongation are interpreted as an adaptation to quickly reach a functional occlusal relief post-eruptively, and to maintain it over the remaining life span.

Keywords: selenodont molar; Soay sheep; enamel thickness; enamel extension; enamel free area

Reconstructing temporal variation in fluoride intake of eastern grey kangaroos (Macropus giganteus) from a fluoride-polluted area by electron microprobe analysis of fluoride concentration in dentine

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We studied the spatial variation of fluoride concentration in the dentine of mandibular first and third molars of eastern grey kangaroos from a high fluoride environment in Portland, Victoria, Australia. The main point source of fluoride emissions in this area is an aluminum smelter, while a fertilizer plant is a secondary source. Kangaroos resident in the polluted area exhibited increased bone fluoride concentrations compared to animals from unpolluted (control) areas as well as marked dental fluorosis. Macroscopic inspection of the teeth revealed severe fluorotic enamel changes in the later–formed molars (M2 – M4), while the enamel of the M1 appeared normal. As enamel formation of the M1 takes place completely pre-weaning, we hypothesized that during crown formation of this tooth the fluoride intake (via milk) of the kangaroos is considerably lower than in the case of the later-formed molars. Wavelength-dispersive electron microprobe analysis revealed significantly ($p = 0.012$) lower fluoride concentrations in early-formed dentine (adjacent to the enamel-dentine junction) in M1s (mean 0.014 wt%, SE 0.003 wt%) compared to M3s (mean 0.083 wt%, SE 0.026 wt%), while no significant differences ($p = 0.333$) in fluoride concentration between the teeth were recorded for late-formed (juxtapulpal) dentine (M1: mean 0.630 wt%, SE: 0.095 wt%; M3: mean 0.698 wt%, SE 0.109 wt%). Dentinal fluoride values in M1s and M3s of two animals from unpolluted (control) areas were below detection limit. Our findings indicate that during the period of milk feeding, eastern grey kangaroos living in a fluoride-polluted environment are protected against intake of excessive amounts of fluoride. Teeth whose crowns form before weaning are therefore typically not affected by enamel fluorosis. In contrast, teeth whose crown formation occurs partly or completely after weaning are affected by high fluoride levels and, in consequence, show typical lesions of enamel fluorosis.

Keywords: electron microprobe; fluoride toxicosis; marsupials; Australia

X-Ray microtomography evaluation of the human variation in dental tissue proportions of the deciduous maxillary central incisor in a broad Middle Age sample

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Tooth enamel thickness is an important character in studies of primate and especially hominin phylogeny, taxonomy, and adaptation. No microCT study has been performed on a broad sample of anterior deciduous teeth from a recent human population. The aim of this research is to quantify the intra-populational variation of enamel thickness and dental tissue proportions in a large sample of deciduous maxillary central incisors (di1) from a medieval cemetery (Sains-en-Gohelle, France). 124 di1 from 77 individuals were scanned at the MRI platform (Skyscan 1076 X-ray microtomograph). Volumes were reconstructed with an isotropic voxel size of 17.96 µm. Semi-automatic segmentation was conducted using Avizo v.7 (VSG). Crowns were digitally isolated from roots and virtual cross-sections were realized. We quantified the different dental tissues and their proportions from 2D measurements taken on virtual sections, and 3D measurements. These measures include the volumes and areas of the different dental tissues and the average (AET) and relative (RET) enamel thicknesses. Our results show that there was significant differences in absolute tissue volumes and crown dimensions of the di1 between individuals belonging to an early phase (VIIth-XIth centuries) and those belonging to a recent period (XIIth-XVIth centuries). Children's di1 from the recent phase are larger. However, this difference is not found in 3D RET, showing that the variation between the two phases is size-related. On a comparative purpose, we used 6 teeth from 5 Neanderthals and found statistically higher volumes of coronal dentine and pulp associated with a lower 3D RET in these Late Pleistocene humans than in the individuals from Sains-en-Gohelle ($p=0.0015$), as it has already been observed in permanent teeth and deciduous molars. Studies of tissue proportions and enamel thickness in deciduous incisors from several recent/extant human populations will provide a better framework for comparisons with fossil samples.

Keywords: enamel thickness; dental tissue proportions; microCT; medieval population; France

The inhibitory cascade as a general mechanism for integration in the mammalian primary dentition

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Molar teeth are a defining feature of mammals, not being present in other vertebrates. Two characteristics of molar teeth are responsible for their importance to mammalian ecology and evolution: precise alignment and high complexity. Both of these features enable efficient mechanical breakdown of food to fuel the high metabolic rate of mammals. The precise occlusion of molars is enabled by the very high degree of integration both along the tooth row and between occluding teeth. Earlier work has shown that molar teeth in most mammals develop and evolve according to a strict pattern that controls the relative sizes of the molars, termed the inhibitory cascade (IC). Here this work is extended to show that the IC pattern in molars is part of a more general system of patterning in mammalian teeth. I develop and show support for a number of hypotheses regarding tooth patterning, namely: (1) deciduous premolars also follow the IC pattern, but often in the reverse direction compared to the molars; (2) the IC pattern in upper and lower tooth rows is integrated and varies together in individuals and throughout evolution; (3) polydont postcanines in odontocetes and pinnipeds, and the continuously-replaced molars in the nabarlek (Petrogale concinna), follow the IC pattern; (4) the IC mechanism has greatest influence on the primary dentition, and is reduced in the secondary dentition; (5) there are common developmental controls for the IC pattern and dental complexity; and (6) many reptile dentitions lack the IC pattern. Confirmation of these hypotheses will clarify the organising principles of the sophisticated developmental mechanisms responsible for the highly integrated mammalian dentition, but also add to the limitations on evolutionary potential in mammalian dentitions.

Keywords: molars; mammals; inhibitory cascade; integration; evo-devo

Three-dimensional relationships of enamel prisms, and enamel- and dentine-tubules, studied with synchrotron radiation holotomography

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The three dimensional (3D) relationships between dentine tubules, enamel tubules and enamel prisms is not yet fully understood, nor the function of the tubules, despite knowledge of their presence for centuries. Previous analytical methods have either been in two dimensions, or concern only limited regions of teeth. To address these questions we utilized synchrotron radiation nanotomography at the European Synchrotron Radiation Facility, producing 3D models of dental ultrastructure with voxel resolutions down to 25 nanometres. This allowed quantification of the number, shape and 3D spatial relationships of prisms and tubules in dentine, enamel, and across the enamel-dentine junction of lower third molars of Mus musculus and Sorex minutissimus. Dentine and enamel tubules of these taxa show marked differences as well as some shared features. In both species, there is a sharp change in angle of both enamel and dentine tubules close to the enamel-dentine junction (EDJ). Tubules crossing the EDJ are almost perpendicular to it, whereas they approach the EDJ at an oblique angle. Just dentine-wards of this angle change, dentine tubules split to form two or more smaller diameter tubules that traverse the EDJ and are continuous with equal sized enamel tubules. In Mus, these branched, thinner tubules extend into the enamel from the EDJ for a distance of about ten microns, and then merge and terminate relatively close to the EDJ. In contrast, in Sorex the enamel tubules can be seen throughout the enamel, and some are associated with an enamel prism sheet, though not all prisms contain a tubule. Since enamel and dentine tubules are produced by enamel and dentine forming ameloblast and odontoblast cells respectively, the 2:1 ratio of enamel to dentine tubules suggests either that each odontoblast is connected to more than one ameloblast.

Keywords: dentine tubules; enamel tubules; enamel prisms; holotomography

Appositional crystal growth control by biomineralization proteins in sea urchin tooth biomineralization

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The feeding apparatus of adult sea urchins consists of five independent single teeth arranged in a radially symmetric fashion in a structure called Aristotle's lantern. While vertebrates use extracellular secretory mechanisms to generate hydroxyapatite-rich teeth, sea urchin teeth are fabricated by intracellular mechanisms and are largely composed of magnesium carbonate. The purpose of the present study was to ask the question whether intracellular tooth biomineralization in the sea urchin Strongylocentrotus purpuratus employs strategies of protein-mediated crystal growth similar to those that have been established in vertebrate enamel biomineralization. To test this hypothesis, the compartmental structure of cellular vesicles and the relationship between cells and mineral phase was analyzed using electron microscopy. Immunolocalization of the SM30 glycoprotein and the polyproline-rich embryonic spicule protein SM50 was performed in the growth zone of continuously erupting sea urchin teeth and confirmed by Western blotting. Antibodies against SM30 and SM50 proteins specifically reacted with the cytoplasm of cells associated with the developing tooth mineral as well as remaining mineral crystallites but not with muscles and ligaments. Immunoreactions were confirmed using Western blots. In transmission electron micrographs, vesicles in association with the mineral phase contained a characteristic internal matrix similar to the "stippled materials" found in vertebrate enamel. Electron micrographs documented a series of adjacent events indicative of intracellular mineralization. We conclude that sea urchin tooth mineralization is an intracellular process mediated by organic matrices. Our data suggest that the embryonic spicule proteins SM30 and SM50 may be involved in adult sea urchin tooth mineralization and that sea urchins utilize similar strategies of protein-guided appositional crystal growth as those described in vertebrate teeth.

Keywords: sea urchin; tooth evolution; biomineralization; polyprolines; crystal growth

Large-scale biomonitoring of dental fluorosis in roe deer (Capreolus capreolus L.) in Slovenia to assess fluoride loads on the environment

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Increased exposure to fluorides during tooth development causes an impairment of dental hard tissue formation manifesting as dental fluorosis. We studied prevalence and severity of dental fluorosis in permanent mandibular cheek teeth of roe deer using a previously established macroscopic scoring system. A dental lesion index (DLI) of fluorosis was calculated for all adult roe deer culled in Slovenia in 2007 (n = 14,672). The locality of culling was recorded at a high spatial resolution (1 x 1km grid). The following GIS-based analyses were performed: (i) geographical variation in the prevalence and severity of dental fluorosis in the roe deer sample; (ii) identification of main sources of fluoride pollution; (iii) determination of environmental factors related to the occurrence of dental fluorosis in roe deer. Our data show that Slovenia in general is not polluted with fluorides (as indicated by a low mean DLI of 0.6 for the entire sample). Thus, 84.5% of the mandibular dentitions showed no fluorosis at all, and only 1% exhibited moderate to severe dental fluorosis. A hot spot of fluoride pollution was identified in north-eastern Slovenia near an aluminium smelter. Multivariate statistical analysis revealed that the occurrence of dental fluorosis in the roe deer was influenced primarily by the distance (within a radius of 10 kilometers) of the habitats to this point source of fluoride emission (explaining 73.6% of the total variance). Animal age accounted for 16.1% of the total variance in DLIs, as younger animals were apparently exposed to lower amounts of fluorides, following implementation of emission control measures at the smelter after 2003. A less important factor explaining 0.8% of the total variance was the distance from the nearest forest edge, suggesting intercept of air-borne fluorides by the canopy. Our study underscores the suitability of using roe deer as bioindicators of fluoride pollution.

Keywords: dental fluorosis; roe deer; GIS analyses; Slovenia

Mineralization front and elemental composition of the denticle in human permanent teeth

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In a previous study, we examined and reported the histological structure and elemental composition of the reparative dentin by dental caries in human permanent teeth (Takahashi et al. 2013). In the present study, we examined the mineralization front and elemental composition of the denticle in human permanent teeth. Ten denticles found by X-ray in human permanent molars were used to perform the following procedures. They were taken out from the molars, etched with 10 % NaOCl for an hour, coated with Pt ion and observed under a scanning electron microscope (S-800, Hitachi). Some longitudinal ground sections of them were prepared and observed with polarizing and phase microscopies. The contents of seven elements (mass %) were analysed quantitatively using standard samples with an electron probe microanalyzer/EPMA (JXA-8900, JEOL). Measurements were performed at 10 locations in the center, middle and outer layers of the similar ground sections. Mineralization fronts of the denticles were roughly classified to the solid type and fibrous type. Smooth surfaced, granular and semispheroidal mineralization fronts are included in the solid type. Woven fibers, semispherical structures composed of the radially arranged fine fibers and bundles composed of the fine fibers are included in the fibrous type. It is thought that the fibrous types of the mineralization front of the denticle indicate the forming stage of the denticle, while that the solid types of it indicate the resting stage. It is considered that the middle layer of the denticle is higher calcified than the primary dentin, while that the outer layer of it is lower calcified from the contents of Ca and P. It is thought that the outer layer of the denticle includes significantly more organic matter and significantly more fluorine from the contents of C and F.

Keywords: mineralization front; elemental composition; denticle; human permanent teeth

Genetic modularity and the evolution of the Old World monkey dentition

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Our understanding of the biology of extinct organisms relies significantly on interpreting meaning from variation in skeletal morphology, especially that of the dentition. Given that selection can only operate on phenotypic variation that is heritable, elucidating and characterizing genetic influences on dental variation is an important step towards improving our understanding of evolutionary history. We undertook a quantitative genetic analysis of dental variation in a pedigreed population of baboons (Papio hamadryas) housed at the Southwest National Primate Research Center in San Antonio, Texas. Dental phenotypic data were collected from 632 non-inbred individuals with known familial relationships. Genetic analyses were conducted by means of a maximum-likelihood based variance decomposition approach implemented in the computer package SOLAR. As phenotypic variance can be decomposed into genetic and non-genetic contributions, phenotypic correlations can be as well. We estimated matrices of genetic correlations for this pedigreed baboon population for linear size measurements of the incisors, premolars, and molars. The genetic correlation matrices estimated for the maxilla and mandible yield clusters of higher and lower correlations, the former of which we interpret as evidence of genetic modules. We hypothesize that these genetic modules underlie patterns of phenotypic correlations across the Old World Monkeys. To test this, we sampled six species from across the African and Asian Cercopithecidae (Cercopithecus mitis, Macaca fascicularis, Papio hamadryas, Colobus guereza, Presbytis melalophos, and Presbytis rubicunda). Sample sizes ranged from 80 – 127 for each species, for a total of 608 individuals included in the phenotypic analysis. We find that, as hypothesized, the phenotypic correlation matrices reflect the genetic correlation matrix in all species. However, there are differences in the levels of modular integration that provide insight to each species' evolutionary history.

Keywords: primates; quantitative genetics; heritability; variation; evolution

Dynamics of Shh signalling during first molar development in mouse

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The tooth development is a very complex process and can serve as a general model of organogenesis (e.g. Bei at al., 2009). Developmental studies of tooth are commonly performed on mouse embryos, because their jaws provide a unique insight into two types of tooth primordia. The first type includes progressively developing prospective functional (endogenous) teeth. The second type involves rudimentary tooth primordia, for example, the rudiments called MS and R2 in premolar region of lower jaw. It has been assumed these tooth rudiments are remnants of premolar teeth lost during evolution (Peterkova et al., 2000, Peterkova et al., 2002). It has been shown morphologically, that the posterior rudiment (R2) is incorporated in the developing first molar (M1) (Viriot et al., 2000). Morover each of these tooth primorida (MS, R2 and M1) has its own Sonic hedgehog (Shh) signaling domain (Prochazka et al, 2010). In the present study, we have clearly demonstrated that the Shh expression domain in the early M1 primordium transiently coexisted with the Shh signaling domain of R2 and finally both these domains fused together to form the one typical elongated signaling center called primary enamel knot of the M1 germ at ED 14.5 in control mice. In addition, we have documented that Shh signaling (its beginning as well as duration) in R2 and M1 was influenced by Spry2 and Spry4 genes dosage in Spry2/Spry4 transgenic mice. The non-fusion of R2 and M1 Shh signaling domain was observed with decreasing Spry2 and Spry4 genes dosage and this phenomenon resulted in autonomous development of the R2 bud as a basis of the supernumerary tooth primordium.

Key words: tooth rudiments; mouse; Sprouty genes; Sonic hedgehog; gene dosage

Poster presentations

Abstracts are ordered as in the meeting programme.

Dental development preserves population fluctuations in Wild Ungulates: the present is the key to the past

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Although species abundance is notoriously difficult to ascertain from fossil assemblages because ofbiases in preservation (e.g. body mass or habitat preference), teeth may provide a window into relative population density. Mammalian teeth fossilize exceptionally well and are sensitive to metabolic stress during their formation, yielding an indelible record of an individual's health during development. In particular, the formation of enamel and dentine can be inhibited by food limitation, a condition that often characterizes high-density ungulate populations. To explore the impact of food limitation on dental development, we focused on two exceptionally well-studied populations for which fluctuations in density and environmental factors are known: moose (*Alces alces)* of Isle Royale National Park (IRNP), Michigan (b. 1959 -1998) and elk or wapiti (*Cervus canadensis*) of Yellowstone National Park (YNP), Wyoming (b. 1979-2009). Data from the study of 80 IRNP moose document a significant increase in enamel defects under high-density conditions relative to low-density on the island and mainland Ontario. Post-weaning enamel hypoplasias were unequally distributed across the crowns. Under high-density conditions, variance in mandible length increases as a result of a greater number of individuals with short mandibles in both sexes. A variety of osteological signs point to food limitation in 123 surveyed elk from YNP, albeit at much lower frequencies than IRNP. Elk hypoplasias were not constrained to a particular tooth or cusp. Additionally, the elk teeth are distinguished by enamel that was chipped and subsequently worn during life. Tooth roots from a subset of the surveyed animals were histologically analyzed to examine the relationship between circadian dentine appositional growth rates and population density during the post-weaning period, an approach that generates a higher-resolution record of development. In conjunction with dental attrition data from predators, this two-part approach has the potential to elucidate the relative densities of extinct predators and their prey.

Keywords: paleoecology; nutrition; enamel hypoplasia; dentine growth rates; ungulate

The woman of metropolis

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Archaeology, paleoanthropology and paleodontology can provide much insight in dealing with forensic cases. Experience which forensic osteologists and anthropologists gather from the excavation sites can be helpful in forensic cases. Also, forensic osteologists can give detailed information to the archaeologists about the bones found from the diggings. This article presents a succesful study which was conducted by Council of Forensic Medicine experts, forensic odontologists and archaeologists. Metropolis is an ancient city which is located on the west coast of Turkey, in Smyrna. The first settlement was founded during the Early Bronze Age on the Acropolis, nearly 5000 years ago. In the Hellenistic Period (3rd –1st century BC), Metropolis was a city with heavily fortified walls, and it was the city of Mother Goddess. During the Roman period, the city was extended and modified. With the Byzantine Bishopical reign, the city began to decline. On the excavation site in Metropolis, skeletal remains of a hellenistic woman was retrieved. There were also essences, trinkets and a sheave in her grave. The skeleton was anaylsed by a group of experts from ATK, odontologists and archaeologists. It was found out that the skeletal remains were preserved well, other than some post-mortem fractures and defects. The attention grabbing spots were the alterations on her left clavicle and left humerus. Also the opening between her upper right and lower incisive and canine tooth was remarkable. It was thought that these alterations were caused by her practice of spinning yarn with her mouth. Later, the face of the woman was obtained with a facial reconstruction. The analysis of archaeological remains can give plenty of information on the lives of ancient peoples. As this case an example of it, occupations, diets, illnesses, cultural practices and habits of these people can be learned by such researchs. It is without a doubt that multi-disciplinary approach towards these studies would result in more efficient and succesful results.

Keywords: paleo-anthropology; facial reconstruction; paleoodontology

Dental variation and migration at ancient Alalakh

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Research is currently being conducted on human dentition excavated from the necropolis at the site of the ancient city of Alalakh in Hatay Province, Turkey. As an administrative and economic hub in the Middle and Late Bronze Ages (c. 2000-1000 B.C.), Alalakh is thought to have been ethnically Hurrian, administered by the Mitannian kingdom to the east. Yet military conquest by the Hittites and Egyptians that often wrested control from Mitanni is well documented, as is the material record of long-distance trade among the peoples of Alalakh and other groups in the Mediterranean and Near East. How much this interaction and (often violent) subjugation impacted life (and death) in this ancient city and altered the genetic terrain is not fully understood. Ethnic and cultural variation during this vibrant period of commerce, migration, and military conquest in the northern Levant is problematically inferred from language and material culture but does not address *who* is using either. The physical expression of genetic and behavioral variation (derived from human dentition) can bring archaeologists in the northern Levant closer to understanding the diversity that likely existed at Alalakh during this period. The Arizona State University Dental Anthropology System (Scott et al. 1991), or ASUDAS, will be used with other approaches (wear, pathology, etc.) to assess the morphological and physical characteristics of this population's dentition and determine the scale of physical and genetic variation within this group. Information from the burials, such as position and location of remains, associated artifacts, and grave goods, will supplement the data collected from the dentition. The current ASUDAS data are presented, along with other observations, and compared to four predictive models that accommodate the possible impact that the history of Bronze Age migration may have had on the genetic and cultural fabric of ancient Alalakh.

Keywords: dental morphology; human variation; ethnicity; Bronze Age; Near East

Quantification of tooth wear for age estimation purposes in paleodontology: technical note

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Tooth wear is caused by attrition, abrasion and erosion and it is well known that there is a positive correlation between the degree of tooth wear and chronological age of an individual. There are numerous methods and indices that have been developed for diagnosing, grading and monitoring loss of dental hard tissues. Some of them are based on a qualitative assessment and other on a quantitative measurement. Grading or scoring systems (qualitative approach) can be very subjective. Quantitative techniques are always considered more objective and reliable but in the same time also more complex and time consuming. The aim of this abstract is to present a simple, computer-based method for metric quantification of tooth wear suitable for age estimation purposes in paleodontology. Occlusal surfaces of teeth of upper and lower jaw were photographed by a digital camera under standardized conditions. Images were transferred to the computer software VistaMetrix Inc. Using this software, areas of exposed dentine on occlusal tooth surfaces were outlined and size of areas of exposed dentine was calculated and expressed in square millimeters. Areas of exposed dentine were correlated to chronological age. This method provides simple, user friendly, fast, reliable, precise and inexpensive metric quantification of tooth wear giving data which are objective and comparable.

Keywords: tooth wear; abrasion; age astimation; paleodontology

Investigation of fossil material from the XII century burials in Drutsk town, Vitebsk region (Belarus)

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Investigation findings in fossil materials, from the burials on the territory of Drutsk town in Belarus, collected during the archeological excavations in 2008 – 2010 under the supervision of prof. O.N Levko and A.V. Voitehovich, discussed in the report. A number of 6 male and 2 female skeletons examined. The age of 3skeletons defined as Adultus, 1 – Maturus I, 3 – Maturus II, 1 – Senilis. The level of caries incidence in the excavated examples comprised 75,0% (6 of the 8 objects had carious cavities on their teeth). Caries intensity comprised 2 to 3 carious teeth (in average) in each individual. Antemortem lost of teeth noted in 3 cases of 8 examined (37,5%). Sings of periodontal disease noted in 4 individuals. The level of dental attrition varied from point 2 to point 6 according to the age of individuals. Pathological changes, found in bones are: head of femur hyperostosis, cotyloid cavity porosis, and intervertebral, lumbar, costovertebral arthrosis, vertebral body deformation, vertebral osteophytes (burials №1, № 28, №31), periostitis on the medial surface of tibia, signs of lumbar osteochondrosis (burial №1). Bowing of tibia, possibly, due to the rickets, suffered in the childhood, or probably the male was a horseman. Many bones have signs of antemortem trauma – marks of hard injuries, callus in the places of bone fractures, numerous trauma with traces of healing followed by bone union (burials № 1, № 28, № 31).

Key words: human fossils from Drutsk; dental diseases; pathological changes in bones

Mating systems of the Jomon people from mainland Japan as indicated by dental traits

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Jomon people actively exchanged goods with groups who lived in other areas of mainland Japan. Although strontium analysis can be used to determine who the immigrants were and where people came from, this method requires the destruction of a certain quantity of bone. As Japan is covered by acidic soil, skeletal remains are often in bad condition. Poorly preserved bone has a risk of contamination, and skeletal remains in good condition are invaluable. Therefore, non-destructive methods that allow migration analysis are preferred in Japan. The aims of this study are to determine whether dental measurements and nonmetric dental traits can be used for migration analysis, and to determine patterns of mating during the Jomon period. The results of both dental measurements and nonmetric traits showed that male specimens formed two large clusters according to regions (the Kanto-Tohoku region and the Central region). By contrast, female specimens were found in smaller clusters depending on area and period. These results suggest that males moved longer distances for marriage than females during the Jomon period. The Final Jomon period sites in the Tokai region show a similar pattern of dental trait variation.

Keywords: measurements; non-metrical traits; Jomon; Japan

Radiomorphometric indices of mandibular bones in an 18th century population sample

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Thickness and shape of cortical mandible on orthopantompographs can be expressed using radiomorphometric indices, which reliably reflect the systemic condition associated with sex or age related bone mass loss. The aim of this study was to estimate four radiomorphometric indices of mandible in an 18th century population sample. Thirty six skulls (31m, 5f), recovered from the crypt of Požega Cathedral were chosen for radiomorphometric analysis. Sex was determined based on the shape of osseus structures, and age on abrasion patterns (<25, 25-34, 35-44, 45+). Vertical and horizontal dimensions were reproducible (Eichner classes I and II). The parameters in recording analogue dental orthopantompographs were set to constant current of 16mA, exposure time of 14.1sec, and voltage between 62-78 kV (Sirona model no. 5968573 D3 200; Siemens, Munich, Germany). Radiographic films (ORTHO CP-G PLUS Agfa; Agfa-Gevaert Group, Mortsel, Belgium) were processed in an automatic dark chamber processor (XR 24 Nova; Dürr Dental GmbH u. Co KG, Bietigheim-Bissingen, Germany) for 12 minutes, scanned at 8-bit, 300 DPI, and analysed for: MI- thickness of the mandibular cortex below the mental foramen; AI- thickness at antegonion; GI- thickness at gonion; MCI- mandibular cortex index (1=sharp endosteal margin of the inferior cortex; 2=semilunar defects; 3=thick cortical residues on endosteal margin). Average values of MI, AI and GI were 3.97±0.94 mm, 2.98±0.56 mm, and 1.99±0.55mm, respectievly. Statistically significant differences between males and females were found for AI right ($t=2.601, df=34, p=0.014$), GI left ($t=2.714, df=34, p=0.010$) and GI aveargе ($t=2.963, df=34, p=0.006$), and were in all cases higher in males.There were no statistically significant differences between age groups for either index. Considering MCI, the differences were not significant between males and females ($\chi^2=2.54, df=2, p=0.281$) and age groups ($\chi^2=4.306, df=6, p=0.635$). Considering Eichner classification the differences were not significant for MI ($\chi^2=36, df=35, p=0.422$), AI ($\chi^2=31.02, df=32, p=0.516$), and GI ($\chi^2=33.5, df=33, p=0.443$), but in Eichner classes II, MCI was significantly higher ($\chi^2=7.845, df=2, p=0.02$).

Keywords**:** bone mass loss; mandible; orthopantompograph; adiomorphometric index; 18th century

Relationship between Chinese ethnic minorities and Okhotsk cultural people in dental metric trait

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Okhotsk culture rose in the Sakhalin, northern Hokkaido and the Kurile Islands during the 5th to 12th century A.D. [Kikuchi T. (1978)]. They represent many characteristics in common not with the Ainu, but with the Northern Mongoloids [Yamaguchi B. (1974), Kozintsev A.G. (1992)]. Studies on the cranial morphology and the mitochondrial DNA haplotypes suggest that the people of the lower Amur region were related to the origin of the Okhotsk people [Ishida H. (1988, 1996), Sato T. et al. (2007, 2009)]. Even with considerable research of crown measurement, consensus has not yet been reached about the origin of the Okhotsk people. The purpose of this paper is to disclose dental metrical relationship for the people of the lower Amur region and the Okhotsk people. We have analyzed the characteristics from crown measurements of Chinese ethnic minorities of the Amur River basin. The majority of the groups around the lower Amur region are the Tungusic hunters. To conduct the study, we used the plaster casts of the permanent dentition of the Amur River basin. We compared with the people of the Amur region, the Okhotsk people and the other North Asia ethnics from crown measurements. We carried out the following statistics: (1) The total crown area, (2) The deviation diagram, (3) The Q-mode correlation coefficients and (4) The cluster analysis. We targeted the Oroqen tribe of the Amur River basin. The result shown in the crown total area and the deviation diagram supported the relatedness, whereas the two-dimensional and the three-dimensional diagrams plotted the Oroqen at the upper end of the Central Asian cluster, which lies far down from the Okhotsk. These results suggested a possibility that the Oroqen was origin of the Okhotsk.

Keywords: tooth size; dental anthropology; Okhotsk culture; Northeast Asians; Chinese minorities

Cementoblastoma in a red deer (*Cervus elaphus*) from the Late Pleistocene of Rochedane, France

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Relatively few dental abnormalities in wild animals have thus far been reported in the paleopathological literature. We present a case of cementoblastoma, a benign odontogenic tumor of ectomesenchymal origin in a red deer (*Cervus elaphus*) from the Late Pleistocene of Rochedane, a prehistoric site in the French Jura. The tumor was attached to the root of a heavily worn loose left maxillary third molar. CT imaging revealed several radiolucent (former soft tissue) spaces of varying shape and size within the mineralized tumorous mass. Light microscopic analysis and backscattered electron imaging in the SEM showed that the process of dental wear had reached the tumor and that the tooth and the attached tumor had undergone considerable microbial diagenesis. This is the first case of cementoblastoma described in a prehistoric animal and also the first report of this type of odontogenic tumor in a prehistoric or modern deer.

Keywords: animal paleopathology; dental pathology; odontogenic tumor; cementoblastoma; Late Pleistocene

Enamel pearl anomaly in an archaeological sample from Kranj - Slovenia

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According to Kupietzky and Rozenfarb (1993) the enamel pearl anomaly was first described in 1824 by Linder and Linder. Enamel which is normally restricted to the anatomic crowns of human teeth may be found ectopically on the root, either as cervical enamel projections or enamel pearls (Risnes et al., 2000). Enamel pearl is defined as an ectopic globule of enamel that is firmly attached to the tooth root (Darwazeh and Hamasha, 2000). These developmental aberrations in tooth morphology may predispose the affected area to plaque accumulation and consequently cause periodontal breakdown. Maxillary 2nd and 3rd molars are more commonly involved than the first molars (Saini et al., 2008). The purpose of this poster is to present five archeological cases of enamel pearl anomaly in an archaeological sample from Kranj - Slovenia. The skeleton remains correspond to three males between 30 and 40 years and two females between 25 and 50 years. The common site of location of the enamel pearl is adjacent to the furcation or furrow of the root, especially the bifurcation or trifurcation areas of maxillary and mandibular molars. The phenomenon of ectopic development of enamel on the root surface, variedly referred to as enameloma, enamel pearl, enamel drop or enamel nodule, is not well-understood.

Keywords: enamel pearl; paleodontology; Kranj; Slovenia

Dental morphology of individual with congenital syphilis from 16th century

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Bone deformities and dental stigmata are the main ways in which congenital syphilis can be diagnosed in archaeological human remains. As the teeth are usually better preserved than bones, dental alterations are valuable markers for the diagnosis of this disease. Some of the distinctive characteristics of congenital syphilis are specific hypoplastic defects that influence to morphogenesis and appear in the form of dental anomalies (Hutchinson's incisors, Fournier's canines, Moon's and Mulberry molars) and nonspecific enamel hypoplastic defects that can reflect general health and living conditions and in cases of congenital syphilis appear on the dental structures that calcify within the first year of life. In this paper we present the results of the analysis of dental remains belonging to a female aged 17 to 20 years recovered from the archaeological site Park Grič in Zagreb, dated to 16th century. The dental remains we consider come from a fragmented maxilla and a very well preserved mandible. These teeth display specific changes associated with congenital syphilis. All first molars show significant enamel defects such as multiple rounded rudimentary enamel cusps and hypertrophy of the enamel surrounding the cusp with agglomeration of masses of globules giving it the appearance of a mulberry. The upper right first molar is reduced in all crown dimensions with respect to the adjacent teeth and the lower right first molar is smaller in overall size than the second molar with reduced cusp size and irregular shape. The thin enamel is infolded and marked dentine exposure is evident on the cuspal tips. All upper and lower incisors present enamel defects in the form of notches on buccal surfaces and incisal edges. The tip of the canine cusp is partially hypoplastic in the form of shallow notch.The teeth described in this contribution show clear alterations typical of congenital syphilis. This individual is so far the oldest archaeological specimen affected by congenital syphilis documented in Europe.

Keywords: congenital syphilis; dental morphology; mulberry molar; hypoplasia

Dental caries in human skeletal series from 17th – 18th century archeological sites on south Poland

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Historical series samples provide valuable information about health and lifestyle people in the past. In studies of biological condition, several skeletal indicators are used, including dental carries. The aim of this study was to determine the dental caries in the skeletal human series from a 17th-18th century graveyard excavated in two archeological sites from southern Poland: Kraków and Krasiczyn and compare with studies on other historical populations. The permanent and deciduous dentition of 60 inviduals from Krakow and 36 inviduals from Krasiczyn were examined. Total number of examined teeth was in the population from Krakow 1130 (1047 permanent and 83 deciduous) and in the population from Krasiczyn 500 teeth (351 permanent and 149 deciduous). Teeth were examined macroscopically using a dental probe. Dental carries was scored also according to procedure in which the initiation sites are recorded, with the methodology proposed by Moore and Corbett. In examined skeletal sample, frequency index and intensity index were calculated. The rate of dental carries was high in both population, however, the lower frequency was noted among individuals from Krakow than among indviduals from Krasiczyn. The frequency of carries in the archeological site Krakow was 46.7%, while the intensity rate of dental carries was 22.03%. The frequency of carries in site Krasiczyn was 68.57%, while the intensity rate of dental carries was 27.32%. In both population carries on occlusal surface molar teeth were the most frequently observed. The similar frequency of the dental carries was observed in the other historical Polish population. The results of presented paper and published in scientific literature date showed that dental carries were the prevalent illness in historical population, both among children and adult.

Keywords: dental caries; diet; frequency; intensity; historical population

Frequency and distribution of enamel hypoplasias in an 18th century sample

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Enamel hypoplasias are considered useful indicators of exposure to a health disturbances and stress at the time of the enamel formation. In a historic sample, they may provide a relative measure of that exposure stress. A sample of 104 sculls from an 18th century Požega cathedral crypt was examined for the frequency and distribution of enamel defects ranging from surface pits to linear enamel hypoplastic changes. Data were analyzed by means of descriptive and non-parametric statistical methods. The percentage of enamel hypoplasias was 11.14 % if total possible number of teeth was taken into consideration. However, when only present teeth were accounted for, the percentage of hypoplasias was 22,61 %. The most frequently affected maxillary teeth were canines (left 32,0%, right 35,9%), upper lateral incisives (left 23,3%, right 29,1%), and upper central incisives (left 16,5%, right 20,4%). The most frequently affected mandibular teeth were canines (both left and right 17,5%) and right first lower molar (10,7%). Significant differences in the distribution of hypoplasias between males and females were found for upper premolars (Mann Whitney U test, Z=-2,408, p=0,016), upper canines (Mann Whitney U test, Z= -3,073, p=0,002), upper incisives (Mann Whitney U test, Z= -2,158, p=0,031) as well as total number of hypoplastic teeth in the maxilla (Mann Whitney U test, Z= -3,059, p=0,002) and the mandible (Mann Whitney U test, Z= -2,192, p=0,028). No differences in hypoplasia distribution was found between age groups (Kruskal Wallis test, p>0,05). The high level of stress in this skeletal sample may indicate the susceptibility of children to diseases and systemic disturbances during growth in the early and mid childhood. A big plague epidemic in 1739 in Slavonia region as well as epidemics of chickenpocks, typhus, malaria and dyphteria throughout 18th century could have contributed to a hypoplastic changes observed in presented population.

Key words: 18th century; enamel hypoplasia; stress exposure

Frequency and timing of linear enamel hypoplasia in two early medieval Irish populations - Augherskea and Omey Island

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Teeth, like all other organs in the human body, are sensitive to metabolic disturbances caused by inadequate nutrition and/or various diseases. These disturbances can slow or stop the formation of dental enamel during childhood and since enamel does not have the ability of remodelling this defect known as linear enamel hypoplasia (LEH) will remain recorded until the affected part of the tooth crown is destroyed by abrasion. So, in this regard, linear enamel hypoplasia is a reliable indicator of metabolic stress during childhood, i.e. during formation of dental enamel. The aim of this study was to record frequency, distribution and timing of linear enamel hipoplasia in two early medieval (7^{th}-10^{th} c. AD) skeletal samples from Ireland - Augherskea and Omey Island. The presence of LEH was analysed on the permanent anterior teeth - maxillary and mandibular incisors and canines. The analysis included 61 adult individuals with permanent dentition: 21 from Augherskea and 40 from Omey Island. The frequency of LEH per individual is slightly higher in the Augherskea sample compared to the Omey Island (76.2% vs. 65.0%). The frequency of LEH per individual in both samples combined is 68.8% (42/61). The hypoplastic defects are more frequent in females than in males (85.2% vs. 75.0%). The total frequency of this pathology per tooth is 43.4% (181/417) - the highest frequency was found in canines (57.2%). A slightly higher prevalence was observed in maxillary teeth compared to mandibular (44.2% vs. 42.3%). The age ranges of LEH formation vary between 2.4 and 3.0 years for the central mandibular incisors, and 4.3 and 4.9 years for the mandibular canines. At the end, the results of this study are compared with similar data from other medieval skeletal samples and possible causes for the occurrence of LEH in past populations are discussed.

Keywords: linear enamel hypoplasia; metabolic stress; early medieval period; Ireland

Selected orthodontic anomalies and malocclusions from archeological sites Grodzka 19, Kraków

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Orthodontic anomalies and malocclusions are relatively infrequently analyzed in bioarchaeological and anthropological research. Scientists do not recognized their as an important source of data about the general health and life standard in past populations. The aim of this study is to present selected orthodontic anomalies observed in skeletal series from an 18th century mass grave excavated in Krakow. Total number of individuals was 85 (23 juvenile and 62 adult). Teeth were examined macroscopically and with using X-rays. In study will be present examples of dentition anomalies. Case 1: The skeletal remains of a juvenile individual with abnormal dentition and hypodontia (teeth missing from the normal compliment), the age of the death 13 to 15 years. Case 2: The skeletal remains of adult men (20 – 30 years) with microdontia of second mandibular incisor. Case 3: The skeletal remains which corresponds to a male between 35 – 40 years of age with pathological abrasion. Case 4: The skeletal remains which correspond to a male between 20 – 30 years of age with prognathism.

Keywords: abnormal dentition; hypodontia; microdontia; pathological abrasion; prognathism

Symmetry of mental foramen

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The purpose of this research is to analyze the symmetry of mental foramen due to its size and location. The aim is to obtain data on the size and position of the foramen on skeletal Croatian population and to determine whether there are differences between the left and right side of the jaw or between men and women. The study was conducted on digital photographs of skeletal remains of 54 adult (27 women and 27 men) mandibles recorded in standard lateral projection. Position of mental foramen is defined by the following average values: distance from mental foramen to the alveolar ridge of the mandible 12.33 mm, to the lower edge of mandible 11.03 mm, to mental protuber 11.8 mm, to the angle of the mandible 57.26 mm. Average values for mesiodistal diameters were 2.29 mm, craniocaudal diameter 1.78 mm and scope of mental foramen 5.94 mm. The study did not show any statistically significant difference between the left and right side of the position and dimensions of mental foramen. There is a statistically significant difference between men and women.

Keywords: mental foramen; paleodontology; Croatia

Paleostomatological analysis of a skeletal population from antique period site of Vinkovci - Cibale

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Reconstruction of ancient people's lives can be accomplished by studying their dental remains. They present a valuable source of information about the type of food people ate, illnesses they suffered, and social stratification within a community. Analysed dental remains refer to the period between the 3rd and the 5th century. Romans lived in Cibale, current Vinkovci. The purpose of this study was to collect detailed dental information about Romans who lived in Vinkovci and to evaluate the pathology which included presence of dental caries, antemortem tooth loss and surface wear. Sex determinations were made according to cranial morphology. Age determinations were based on eruption status in children and tooth wear patterns in adults. The analysed sample was well preserved and consisted of the dental remains of 100 individuals with total of 2728 teeth. The prevalence of carious teeth was 4.4%. The prevalence of antemortem tooth loss was 3.9%. Most of the examined teeth showed moderate amount of surface wear. According to recorded pathological changes on jaws, it can be concluded that the ancient inhabitants from Vinkovci were mainly agriculturists with diet based on cereals.

Key words: paleodontology; antique period; Cibale; caries; surface wear

Oval bone cavity in a 4th century mandible

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We report a case of Stafne's defect in a 4th century mandible from a 45-49 year old male recovered from Zmajevac antique site, Croatia. Stafne's defect is a circumscribed, oval bone cavity located below the mandibular canal, above the mandibular base and between the mandibular angle and the third mandibular molar. Many consider it a developmental anomaly, resulting from pressure, erosion or inclusion of a portion of the submandibular salivary gland. However, aetiology and biology of Stafne's defects remains unclear. Other terms that refer to this entity are latent, static or idiopathic defect, cavity or cyst; mandibular salivary gland inclusion; lingual mandibular bone cavity or depression; Stafne cyst or cavity; ectopic or aberrant salivary gland. Studies report an incidence between 0.10 and 0.48%. Skeletons used in this case report are part of the Osteological collection of the Croatian Academy of Sciences and Arts. CT scan was used to analyze and describe the entity. CT scan showed an 11.2 x 8.6 x 6.3 mm unilocular, radiolucent, oval lesion located on the lingual side of the mandible, below the second and third molar and above the inferior margin of the mandible. Floor of the defect is smooth and borders clearly demarcated. Lingual cortex is discontinued while the buccal is thin and slightly widened. We present a case of Stafne's defect rarely presented in anthropological research. CT analysis is suitable for research on dry bone specimens and may be useful for understanding the aetiology of Stafne's defects.

Keywords: Stafne's defect; mandible; bone cyst; X ray; computerized tomography

Hypoplastic defects in two 17th-18th century skeleton series from Krasicznyn and Krakow (southern Poland)

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Enamel hypoplasias constitute the best indicator of mineralization disturbance, resulting from environmental stress. The aim of the study was to determine the frequency of the enamel hypoplasia in historical population and compare the results to date from other research on historical and contemporary groups. The distribution of hypoplasia was determined in complete and partial human dentitions from a two 17th-18th century series: from Krakow and from Krasiczyn. Both sites are located on south of Poland. Thirty four adults and twenty six no adults from Krakow and twenty four adults and eleven no adults from Krasiczyn, divided into five different age groups, were studied. In Krakow population altogether 1130 (1047 permanent and 83 deciduous) were examined macroscopically. The number of examined teeth from the individuals from Krasiczyn was 500 (351 permanent and 149 deciduous). Hypoplastic defects were scored according procedure proposed by Steckel et al. in Global History of Health Project. Among individuals from Krakow the frequency of hypoplastic defects was 42.03% (linear defects 37.96%, pits and grooves 4.07%). In Krasiczyn population the frequency of linear hypoplastic defects was 20.7%. The rate of hypoplastic defects in Krakow was relatively high, a much higher than in Polish contemporary populations. Among individuals from Krasiczyn the hypoplastic defects occur rarely than in other historical samples. The data indicate significantly greater frequencies of enamel hypoplasia in Krakow population compared to the population from Krasiczyn. It can be concluded that the stress level in Krakow population was higher than in Krasiczyn population.

Keywords: stress marker; enamel hypoplasia; frequency; historical population

Teeth morphology of Anatolian Çorakyerler hominoidea and its comparison with other hominoideas

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Çorakyerler vertebrate fossil locality dating to late Miocene is located on the road of Yapraklı district in Çankırı province in Central Anatolia Region of Turkey. The altitude of the locality about 745 metres. Excavations have been held systematically in this region since 2001. Çorakyerler vertebrate fossil locality is between MN11-12 zones (about 8-7 million years) according to faunal comparison and magnetostratigrafic dating. Çankırı-Çorum basin, on which the fossil locality is located, emerged with the low tide of Tetis Sea. Çorakyerler, where so many different species from giraffidae to rhinocerotidae, from carnivora to hominoidea live, has been a significant locality with its faunal diversity and the quality of the findings. The fossils of the animals, which are extinct in Çankırı today but were alive in Çorakyerler in the late Miocene, are found in the excavations. The hominoidea finding in Çorakyerler fauna dating to 7-8 million years is the youngest hominoidea fossil found within the borders of Anatolia. Due to its similarities to Ouranopithecus macedoniencis, it is called as *Ouranopithecus turkae.* The hominoidea of Çorakyerler, which is represented with at least four different individuals, has similarities to early Pliocene hominoideas Australopithecus anamensis and Ardipithecus ramidus as well as its resemblance to Ouranopithecus macedoniensis found in Macedonia and Greece. In the excavations held since 2001, teeth and maxilla pieces are found belonging to four different individuals consisting of two mandible pieces one of which is adult female and the other is adolescent, a maxilla belonging to a young adult individual and lastly the facial zone with a part of maxilla. With the examination of these maxilla and teeth morphologies, important information will be provided about the genus and species. By telling the morphology, tubercular alignment and incisive structure of the canine teeth, genus, species, and diet will be discussed besides sexual dimorphism.

Keywords: Anatolia; Çorakyerler; hominoidea; teeth

Accuracy of the sexual dimorphism evaluation using the goniac angle in a Brazilian sample

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Sex assessment is an importante information when human remains are described. In this regard, skulls and madibles can offer important parameters. The objective of the study was to evaluate the accuracy of the mandibular angle on sex assessment in a Brazilian sample. Sixty six computed tomographies of mandibles from the Guarulhos´ Forensic Anthropology Investigation Center were evaluated, and the goniac angle was measured using the VG Studio Max 2.1® program. The mandibles had known sex, but the observer didn't have access to this information until the end of the measurements. Logistic regression was used and the level of significance was of 5%. The investigation was approved by the Ethics Committee of the University of São Paulo's School of Dentistry (CEP-FOUSP). Thirty three male and 33 female mandibles were evaluated. The mean male goniac angle was 128.3 (± 1.46) and the female was 131.2 (± 1.19) (p=0.13). For male 60.61% of the measurements were correct, and among female mandibles, 48.48%. The values of the goniac angles were lower among male than female mandibles; also, no differences between the groups were found. More studies should be performed using different samples in order to improve the measurements' accuracy.

Keywords: forensic dentistry; anthropology; mandible; tomography; sexual dimorphism

The use of regression formulae derived from daily incremental counts to estimate the chronological age of stressful events occurring during deciduous enamel formation

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Knowledge of deciduous crown formation times is useful in both forensic anthropology and when aging juvenile remains in an archaeological context. Histological techniques for calculating enamel formation times in deciduous teeth are usually completely dependent on being able to visualise clear daily incremental markings. Regression formulae generated from previously published research, and used to estimate deciduous crown formation times, resulted in formation times that corresponded well with those reported in the literature. In order to further test these formulae, we applied them blind to ground sections of two teeth each from two individuals who had experienced 'stress events' during their early lives but who also had well-recorded medical histories. These results were also compared to others derived from the same sections but from daily cross-striation counts. The formulae successfully predicted the times of prenatal and postnatal enamel formation relative to the neonatal line and correctly identified premature birth in both individuals. The formulae were also able to correctly estimate the ages at which accentuated 'stress lines', including 'immunisation lines', occurred during the period of enamel formation according to the medical histories. The use of the formulae developed here to identify 'immunisation lines' resulted in a maximum difference of three days between the estimated day of such an event and the record of it in the medical history and was judged as good as using direct cross-striation counts. The pattern and timing of 'immunisation lines' in deciduous enamel might therefore prove useful in the identification of human juvenile remains if well-documented medical histories are available.

Keywords: age estimation; cross-striations; deciduous teeth; human identification; incremental markings

Training in forensic age estimation using anterior median palatine suture

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Numerous methods of estimating age on the basis of human cranial skeletal remains are used all over the world. The human skull has seventeen unique cranial fusion sites that are positioned on the vault, the lateral-anterior sites, and the maxillary suture. Closure of cranial sutures progresses with age. Due its simplicity and acceptable level of reliability macroscopic assessment of cranial sutures has been used as one method of age estimation in forensic medicine and forensic dentistry. The aim of this research was to test the results of education in forensic age estimation using anterior median palatine suture between students of School of dental medicine, University of Zagreb. Group of dental medicine students interested in forensic dentistry were introduced with basic age estimation methods with special focus on anterior median palatine suture and its time of closure. They learned how to use the Buikstra and Ubelaker cranial suture closure scoring system. After they have undergone training, students got 100 digital images of skeletal remains of upper jaws showing occlusal surfaces of maxillary teeth and palatal bones. Their task was to estimate age using anterior median palatine suture. The results were compared with the actual chronological age of the deceased calculated on the basis of their dates of birth and demise. In 72% their estimation of age was correct. In 20% age was overestimated and in 8% age was underestimated. The majority of mistakes (16%) in age estimation were noticed in the age group 30-40 years. Although the skull sutures are not the best and most accurate method for age estimation they can provide a basic insight in the age at death. Furthermore this method is simple, easy to learn and not time-consuming making it the method of choice in cases where only general remarks on age are necessary.

Keywords: age estimation; cranial sutures; forensic dentistry; education

Cameriere's third molar index in assessing 18 years of age

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Estimation of real age of an individual is one of the main challenges in forensic science. For penal and criminal law, as well as general legislation, it is necessary to determine whether the person is older or younger than 18 years, in other words an adult or a minor? This becomes especially important when an individual lacks personal documents or other means of identification. Aim of this study was to evaluate applicability of third molar in assessing 18 years of age in Croatian individuals. Cameriere's third molar maturity index (I_{3M}) of 0.08, by measuring of the open apices of the teeth, was verified in sample of 1336 Orthopantomograms (OPGs) aged between 14 to 23 years. Chronological age gradually decreases as I_{3M} increases in both genders. Males showed statistically significant advanced maturation when I_{3M} was between 0.0 and 0.3 value. The results show that the sensitivity of the test for 0.08 value was 84.3% (95%CI 80.6%, 87.5%) and 91.2% (95%CI 88.7%, 93.1) in females and males, respectively. Specificity was 95.4% (95%CI 92.5%, 97.5%) and 91.9% (95%CI 88.8%, 94.3%) in females and males, respectively. The proportions of accurately classified males were 88.8% and 91.5% for females. The estimated post-test probabilities, of individuals who scored positive on the test (i.e., $I_{3M} < 0.08$) as having 18 years of age or more, were 94.5% and 96.5% in females and males, respectively. Therefore, the probability that a Croatian individual, positive on the test (i.e., $I_{3M} < 0.08$), was 18 years of age or older were 94.5% and 96.5% in females and males, respectively.

Keywords: age determination; third molar; third molar maturity index; Croatia; accompanied minors; illegal immigration

Finnish legislation on forensic age assessment

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In Finland, the forensic age assessment is strictly regulated by legislation. The main purpose is to assess whether the asylum seeker is at least 18 years of age. The following aspects have to be taken into consideration: protection of the child, exposure to ionizing radiation and right to use native language in the examination. Forensic examination demands educated professionals to perform it. According to the Aliens Act (301/2004) and the amendment of the Act (549/2010) the police authorities, the frontier guard authorities or the immigration authorities have right to refer asylum seekers to the University of Helsinki, Hjelt Institute, Department of Forensic Medicine, for age assessment. The forensic age assessment is always performed by two forensic odontologists who will both sign the statement and at least one of them must be an employee of the Department of Forensic Medicine. The person has to give his/her written consent for the radiography and other examination and if aged under 18, an approval of the Restrict Court imposed representative is required. The forensic odontologist according to Radiation Act (592/1991) and amendment of the Act (1142/1998 Chapter 10) evaluates the legitimacy of forensic procedure. Exposure caused by the use of radiation must be kept as low as reasonably achievable. Radiation and Nuclear Safety Authority (STUK) gives recommendations concerning the methods of radiological examination. The Act on the Status and Rights of Patients (785/1992) determines how the information is saved and stored. The Coercive Measures Act (806/2011 Chapter 8 32§) defines a person's inspection when a crime suspect is to be examined. A prerequisite for such a bodily search is that the forensic age assessment has very important significance for the clarification of the offence. The Convention on the Rights of the Child is the first legally binding international treaty to ensure special care and protection for minors. The current legislation on forensic age assessment has been well received and approved. Radiological and other examinations can be performed in different parts of Finland, but the forensic odontologist at the University of Helsinki, Hjelt Institute is always involved in the process and ensures joint quality standards for forensic age assessment.

Keywords: asylum seekers; forensic age assessment; forensic dentistry; legislation; radiology

Sexual dimorphism in the permanent canines of the Bosnian-Herzegovinian populationand itsimplications in forensic investigations

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Teeth are excellent material for anthropological, genetic, odontological and forensic research and they have great role in forensic practice. They are well preserved after death and they exhibit remarkable sexual dimorphism. Hence, they provide excellent materials for forensic investigations intended for sex assessment. Sexual dimorphism refers to the differences in size, stature and appearance between male and female and is a useful tool to distinguish them, especially in forensic investigations and anthropological assessments. The canines are favoured as ideal teeth to study these differences in view of their durability in the oral cavity. The aim of of this study was to examine the degree of sexual dimorphism in permanent teeth of the Bosnian-Herzegovinian population based on odontometric characteristics of mandibular and maxillary canines. A total of 720 permanent teeth in 180 individuals (90 males and 90 females) were examined. The greatest mesiodistal width of all four canines and intercanine distance were measured directly in the patients' mouth using a digital sliding meter and values were expressed up to the hundredth part of millimetre. Subsequently, canine index was calculated for both sides. Statistical analysis was done to assess sex difference using Students "t" test (paired). It was found that males have bigger teeth than females ($p<0.001$). The mean value of the canines width in males and females on the right and left sides were compared by usingthe t-test and was found to be statistically significant ($p<0.001$). Sexual dimorphism was calculated and maxillary canine was found to be more dimorphic than mandibular canine ($p<0.01$). The right canine was found to be more dimorphic than left canine ($p<0.01$).

Keywords: mandibular canine; maxillary canine; sexual dimorphism

Is the palatal rugae pattern as unique as a fingerprint?

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Determining an individual's identity can be a difficult task in cases of traffic accidents, mass disasters, wars, natural disasters, etc. The information collected from victims for accurate identification must be precise and include all objective findings. If the accident results in a full or partial loss of the jaw and teeth, identity establishing becomes considerably more complex, thus it is necessary to look for alternative identification options. The palatal rugae patterns are widely considered to remain unchanged during an individual's lifetime. Given the invariance and stability of the rugae pattern, the palatal rugae themselves are equivalent to fingerprints and thus considered relevant for the identification of victims. Uniqueness, postmortal resistance and stability of the palatal rugae represent an ideal parameter for forensic identification. The rugae pattern has the potential to remain intact by virtue of their internal position in the head when most other anatomical structures are destroyed or burned. The aim of the study is to establish, individual identity using palatal rugae patterns. The research consisted of 80 study models, 51% were females and 49% were men, separated into three age groups: 10 to 20 years (42%), 21 to 40 years (33%) and over 41 years old (25%). This study treats the shape, length and width of the rugae as well as their distance from both palatine raphe and incisive papilla. Each individual had different rugae patterns including fraternal twins and the rugae patterns were not symmetrical, both in number and in their distribution regardless of the gender and age. This preliminary study has shown that there are no two identical palates in terms of their rugae pattern. The palatal rugae possess unique characteristics as they are absolutely individualistic and therefore, can be used as a personal oral print for identification in forensic cases.

Keywords: palatal rugae; personal identity; rugae pattern

Age estimation of teeth with Raman spectrometry - preliminary study

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Raman spectroscopy is a spectroscopic technique used to observe vibrational, rotational, and other low-frequency modes in a system relying on Raman scattering, of monochromatic light, usually from a laser which interacts with molecular vibrations resulting in the energy of the laser photons being shifted up or down. The aim of this work is to establish a correlation between ageing and Raman spectra imaging of human teeth. For this purpose 37 human extracted molars were analyzed by Raman spectroscopy. Three points were recorded on each tooth: first on enamel, second on the neck of the tooth and third on tooth apex. Each point is recorded with 10 spectrums (100 scans and 500 mW). At the apex of the tooth, the closest to the expected result was achieved, with an error of predicted and measured age of 6.8 years. Recorded spectra were analyzed with principal component regression to establish correlation between age and Raman spectra.

Keywords: Raman spectroscopy; age; tooth; forensics; Croatia

Forensic aspects of lips dimensions in a sample of Croatian population

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Chelioscopy is a forensic research technique that deals with the study of lip prints, their elevations and depressions that form a distinctive pattern on the outer surface of the lips. Importance of cheiloscopy is associated with the fact that individuals differ lip prints. Identification of individuals is one of the most challenging part of modern forensic medicine. The aim of the research is to measure the vertical and horizontal dimension of the lips, and to check the gender differences between males and females. The study was conducted on 31 male and 44 female subjects randomly selected from the Croatian population whose lips were photographed using a digital camera Olympus µ-mini and further measurements were done on digital photograps. Maximal horizontal dimension of lips in males was 48.05 mm and in woman was 44.90 mm. Men had statistically significant higher maximal horizontal dimension (p=0.00014). There wasn't statistically significant difference in maximal vertical dimension between males and females. Results of this research showed that lips dimensions together with lip pattern can have very important role for forensic dental identification.

Keywords: **c**heiloscopy; dimensions of the lips; Croatia

The relationship between skull morphology, masticatory muscle force and cranial response to biting

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During evolution the human skull has become gracile and less able to generate and withstand high masticatory forces. Moreover, it has been shown that compared with other primates, only the morphology of the lower portion of the face correlates with dietary characteristics, suggesting different morpho-functional relationships of the upper and lower face with masticatory parameters. This study aimed to describe the relationship between skull morphology, muscle force and cranial response to biting in virtual simulations, using geometric morphometrics and finite element analysis (FEA). The former is the statistical analysis of shape, and FEA is an engineering technique that assesses the mechanical response of a structure under load. The three-dimensional anatomies of 20 adult individuals were reconstructed based on medical computed tomograms from a Chilean hospital. Maximal contractile muscle forces were calculated from their muscular anatomical cross-sectional areas. Fifty-nine landmarks were selected to represent skull morphology. A partial least squares analysis (PLS) was performed to study the association between skull shape and muscle force, and FEA was used to compare the strains generated in the four most extreme morphological variants during incisor and molar bites. The results showed that the proportion of total muscle CSA represented by the temporalis muscle is most strongly associated with skull morphology (RV=0.22). The individuals with larger temporalis muscle proportion possess a wide face and a narrow, vertically oriented maxilla, and lower positioning of the coronoid process. The FEA showed that despite morphological variation, the simulated bites strain all the crania similarly, with lower strains found in the individuals with the narrowest, most vertically oriented maxillae. Our results suggest that the morphology of the maxilla could play a role in the transmission of forces generated during mastication to the rest of the cranium, by deforming less in individuals with the ability to generate large muscle forces.

Keywords: modern humans; skull morphology; masticatory function; geometric morphometrics; finite element analysis

Function of *Haldanodon* (Docodonta, Mammaliaformes) pseudotribosphenic molar dentition

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In mammalian evolution a talonid-like crushing zone in the lower molars accompanied by a protocone-like cusp in the upper molars was developed up to three times independently before the occurrence of the tribosphenic molar. The most basal mammaliaforms with pseudotribosphenic molars are the docodonts with a mesially situated pseudotalonid. This study focuses on the Late Jurassic docodont *Haldanodon exspectatus* of which a large number of isolated teeth and tooth rows is known from the Guimarota coal mine in Portugal. SEM-images were used to identify wear facets and striations, synchrotron and micro-CT data to create 3D models. Striations and 3D models then served as a basis for an analysis of the mastication cycle with the Occlusal Fingerprint Analyser (OFA). Previous studies could be confirmed which stated that the pseudoprotocone of *Haldanodon* and other docodonts occludes mesiolingually of the pseudotalonid. The upper molars occlude in between the lower molars, so that the mesial part of the upper molar contacts the distal part of the lower molar and the distal part of the upper molar contacts the mesial part of the following lower molar. In contrast to tribosphenic molars, the "pestle and mortar" occlusion in *Haldanodon* lower molars is performed by auxiliary cusp Y on the distal flank of the pseudoprotocone. However, the mesiolingual open pseudotalonid has only limited crushing function. The majority of crushing takes place in the distally situated pseudotrigon of the upper molar and is conducted by cusp b of the lower molar. Additionally, a transversal component is added to this crushing function by a lateral movement of the lower jaw. The OFA analysis also shows that main cusp a of the lower molar occludes beyond the dental crown-root-boundary of the upper molar. This “overbite” is compensated by pits in the maxilla between the upper molars.

Keywords: pseudotribosphenic tooth morphology; docodonts; chewing cycle; crushing function; Occlusal Fingerprint Analyser

Evolution of the occlusal morphology of hominin postcanines as modeled through the inhibitory cascade

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The inhibitory cascade is an experimentally-derived model that describes changes in the relative occlusal area of mammalian postcanines. The inhibitory cascade has been tested in samples of rodents, ungulates, carnivores, and platyrrhines and may be useful for interpreting dental trends observed in fossil hominins. However, the inhibitory cascade has not yet been validated in a comprehensive sample of catarrhines. This study examines relative postcanine sizes in the mandibular dentitions of 11 extant, non-hominin catarrhine genera (N>250), modern humans (N=20), and three fossil hominin genera (N=43). Mesiodistal and buccolingual diameters were measured and used to compute occlusal area, and relative occlusal areas were analyzed in the context of the inhibitory cascade. The results validate the application of the inhibitory cascade to catarrhine postcanines, specifically showing that cercopithecoids are best described by relative occlusal area proportions of $M_1<M_2<M_3$, and hominoids are best described by relative occlusal area proportions of $M_1<M_2\approx M_3$. However, *Paranthropus boisei* does not follow the predictions of the inhibitory cascade. Instead, it has unusually large P_4s and M_2s for catarrhines and differs from its congener *Paranthropus robustus* in this regard. The sort of differences seen between the inhibitory cascades of *P. boisei* and *P. robustus* are not found in extant catarrhine genera for which there is sound evidence of monophyly. Evidence from the inhibitory cascade suggests that we should revisit the hypothesis that the megadontia and hyper-megadontia seen in the taxa presently included in the hominin genus *Paranthropus* are homologous traits.

Keywords: *Paranthropus*; occlusal area; postcanine; inhibitory cascade; developmental modeling

Cusp 6 variation and frequency in non-human apes and hominins

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Due to their preservation in the fossil record and their heritability, dental trait analysis continues to play an important role in studies of the phylogenetic relationships within the hominoid clade. Of particular relevance to hominin systematics is the presence and variation in the tuberculum sextum, or cusp 6, on mandibular molars. Additionally, the application of microtomography to image the enamel-dentine junction of tooth crowns (which is a proxy for the early stage of tooth crown formation) has revealed substantial variation in trait morphology that is often no visible at the enamel crown surface, and which can improve our understanding of trait development. In this study we apply microtomography to examine the enamel surface and enamel-dentine junction expression of cusp 6 in a taxonomically broad sample of extant and fossil apes and fossil hominins (n = 256). Our results demonstrate previously undetected variation in cusp patterning on the distal margin of lower molars and suggest that a sixth cusp (and additional associated cusps) can form in a variety of developmentally distinct ways. Specifically, accessory dentine horns can form in association with the entoconid, hypoconulid or independently. Among apes, *Pongo* (14%) and *Gorilla* (30%) rarely present a cusp 6, while ¬60% of *Pan* molars tend to exhibit a single or double hypoconulid-type. Among hominins, >65% of *Au. robustus*, *Au. afarensis* and *H. neanderthalensis* molars express a cusp 6 with reduced expression in Early Homo and *Au. africanus*. We discuss our results within the context of a patterning cascade model of cusp development and implications for the interpretation of cusp 6 variation within the hominoid clade.

Keywords: discrete traits; tuberculum sextum; accessory cusps; enamel knots

Positive effects of growth hormone treatment on craniofacial morphology in Tuner syndrome patients

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Turner syndrome occurs in phenotypic females with complete or partial absence of X-chromosome. The leading symptom is short stature, while numerous but mild stigmata manifest in the craniofacial region. Turner syndrome patients are commonly treated with growth hormone to improve their final height. The aim of this study was to investigate the influence of long-term growth hormone treatment on craniofacial morphology in patients with Turner syndrome. Cephalometric analysis was performed on 13 lateral cephalograms of patients with 45,X karyotype and the average age of 17.3 years. In all patients growth hormone has been administrated for at least two years. The control group consisted of 13 cephalograms of Turner syndrome patients naïve to growth hormone treatment, matched to study group by age and karyotype. Standard deviation scores were calculated to evaluate the level of growth hormone influence. In patients receiving growth hormone most of linear measurements were significantly larger compared to control group. Growth hormone therapy mostly influenced posterior face height, mandibular ramus height, total mandibular length, anterior face height and maxillary length. All these values were more than two standard deviations larger compared to controls. Cranial base was significantly elongated only in the anterior part. While the increase in linear measurements was evident, angular measurements and facial height ratio did not show statistically significant difference. Results of this study suggest that long-term growth hormone therapy has positive influence on growth and development of craniofacial complex in Turner syndrome patients, with the greatest impact on posterior facial height and mandibular ramus.

Keywords: Turner syndrome; craniofacial morphology; growth hormone; X-chromosome

The application of LA-ICP-MS and SEM-EDS techniques in trace element concentration measurements in human teeth

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In recent years there has been a growing interest in the application of the LA-ICP-MS and SEM-EDS laser ablation techniques. This work was aimed at studying strontium and barium distribution at various locations in the enamel of teeth collected from historical populations from early medieval cemetery in Krakow (11th–12th century). Strontium and barium levels were measured in 3 enamel areas of M1 representative of the stages of their ontogenetic formation. Bone Ash 1600 and SRM 612 served as reference materials. JEOL JSM 5410 (Program SUBIN 94) scanning microscope with an EDS detector by Noran Instruments Inc. were used to determine the concentration of calcium and phosphorus. Then, the calculation of the Ca/P ratio provided information on the extent of diagenetic processes. It was found that strontium is the element whose concentration changes depending on the particular enamel. For males, as for females, strontium concentration varies significantly within analysed regions, the difference being more prominent between the external and central enamel layer of M1. In the case of barium no such dependencies were noticed. This phenomenon can be explained based on the diet and food products of the examined individuals. Changing strontium levels depend on the amount of consumed low- and high-calcium food products. Therefore, low strontium levels at the initial stages of development can indicate that the mother's milk was rich in calcium. The growing levels of this element in the consecutive years proves that low-calcium food products began to be introduced into people's diets. Barium, however, retains similar values regardless of age, which may result from the fact that its accumulation does not depend only on maternal food but also on other diversified food products consumed at consecutive stages of ontogenesis.

Keywords: LA – ICP – MS; SEM – EDS; human teeth; strontium; barium

Incremental structures of wild boar (*Sus scrofa*) enamel

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Using light and scanning electron microscopy, we analyzed enamel incremental markings in mandibular third molars of free-ranging wild boars from two fluoride-polluted areas in Europe. This material was chosen as previous studies have demonstrated an enhanced visibility of incremental enamel markings in fluorosed compared to non-fluorosed teeth. Incremental markings were recorded in axiobuccolingually orientated ground sections through the central lobe. In addition to the total number of incremental markings present in the section plane, we determined the enamel extension rate (EER) along the enamel dentine junction (EDJ) and the daily enamel secretion rate (DSR) in buccal and lingual enamel. In transmitted light microscopy, incremental markings appeared as alternating dark and bright bands/lines that ran at a steep angle from the EDJ towards the outer enamel surface (OES). Outcrop of the incremental markings at the OES was not regularly associated with the presence of a perikyma groove. A mean number of 270 incremental markings was recorded in the section plane, thereby strongly suggesting their daily nature when compared to radiographically determined crown formation time (CFT) in wild boar. Incremental markings with a longer (supradaily) periodicity were not discernible. EER was highest in the cuspal crown area (about 100 µm/day) and decreased rapidly in cervical direction, reaching lowest values around 10 µm/day near the enamel-cementum border. In consequence, the upper two-thirds of the dentine were covered by enamel within the first third of CFT. DSR was lowest near the EDJ where values around 10 µm/day were recorded. In contrast, in outer enamel DSRs of > 20 µm/day were recorded. The results for wild boar enamel closely parallel that previously obtained for the enamel of Hanford minipigs.

Keywords: crown formation time; enamel extension rate; daily secretion rate, incremental markings; laminations

Time of mineralization of permanent teeth in children and adolescents in Gaborone, Botswana

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Mineralization of permanent teeth can be used to assess the development and age of individuals. The most commonly used methods are based on an assessment of the developmental stages of the target group of teeth on one side of the lower jaw. When compared with children of European descent, less research of dental age from Sub Saharan Africa has been done. The aim of this study was to determine the chronology of mineralization of permanent teeth, by evaluation of development stages according to Demirjian and to evaluate the dental age, by using a self-weighted scores by Demirjian from the 1973, using the available sample of ortopantomograms of children and adolescents of African descent from the city of Gaborone, Botswana, with the aim of forming an appropriate sample to compare the evelopment of the teeth of children and adolescents in this socio-geographic environments. The sample consisted of 661 (273 males and 388 females) analyzed panoramic radiographs of individuals aged 5-23 years. Developmental stages of the upper and lower left jaw of all permanent teeth in development were evaluated. Comparing between the sexes, an average age of each stage of development of permanent teeth, including third molars, it is evident that females generally are faster in development of permanent teeth, without statistical significance, for the most of developmental stages. Applying maturity scores of development by Demirjian in the first seven teeth in the lower jaw (167 males and 226 females aged 5 to 16 years) for calculation of dental age, dental age averaged overestimated by 0.62 years for females and 0.90 years for males.

Keywords: permanent teeth; mineralization; Botswana; Demirjian method

A radiographic study of mandibular deciduous root resorption

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Root resorption of deciduous teeth is an important part of the developing dentition, however little is known of the age variation, the factors that influence this or the accuracy of estimating age. The aims of this study were to assess accuracy of estimating age from fractions of root resorbed and compare age of transition with one published report. The sample was 946 dental panoramic radiographs of dental patients aged 3-16. Deciduous mandibular canine and molar roots were staged into levels of resorption (one quarter, one half and three quarters). Reliability of root fractions was assessed using 82 duplicate readings and calculated using Kappa. Age was estimated using Moorrees et al. (1963) and the difference between dental and chronological ages tested using t-test. Accurate was defined as a difference not significant to zero ($P<0.05$). Age of transition was calculated using probit regression. Results show that assessment of levels of root resorption was excellent (Kappa = 0.82). Some root fractions of molars estimated age accurately, however the standard deviation was more than two years. The least accurate tooth was the canine. Root one half resorbed (distal root of first molar) and root half and root three quarters resorbed (distal root of second molar) estimated age accurately. Age of transition was similar for the first molar but slightly later for the canine and second molar. Possible explanations include the high level of caries and early extraction in these children and high level of orthodontic referral of older children. We conclude that root resorption can help to predict age.

Keywords: deciduous tooth; root resorption; age estimation

Assessment of dental age in African children aged 5-16 years in Botswana: a comparison of methods by Demirjian, Willems and Chaillet

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Among all biological processes for determining the age of the individual, assessment of mineralization of permanent teeth is one of the most reliable. Results of dental age calculated by procedure according to Demirjian generally overestimated dental age when compared to the chronological age. Studies of specific dental methods for age estimation in children from sub-Saharan Africa are rare and evaluation of the applicability of Demirjian method from 1973 showed that dental age significantly overestimated dental age when compared to chronological age. The aim of this study was to compare the applicability of procedures by Demirjian, 1976 , Willems, 2001 and Chaillet, 2005 to estimate the age of the African children from the town of Gaborone, Botswana . The study estimated mineralization stages by Demirjian on total sample of 393 panoramic radiographs (167 boys and 226 girls) aged 5-15 years. Results comparing dental and chronological age in boys showed average overestimation of 0.17 years for the method by Chaillet, 2005 ($p = 0.61$), 0.33 years for the method by Willems, 2001 and the greatest overestimation of 0.57 years for the method by Demirjian, 1976. In girls, Willems, 2001 underestimated dental age by -0.02 years ($p = 0.72$), while Chaillet, 2005 and Demirjian, 1976 overestimated age by 0.33 years ($p =0.006$) and 0.67 years, respectively.

Keywords: Demirjian method; Willems method; Chaillet method; African children; Botswana

Histological examination of dental development in a juvenile mountain gorilla from Volcanoes National Park, Rwanda

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The microanatomy of enamel and dentine records important information about the rate and duration of tooth development, and the timing of key developmental milestones and stress events occurring during an individual's life. While much attention has focused on relationships between dental development and life history in great apes, opportunities to examine individuals from well-documented wild populations are exceptionally rare. Further, many taxa remain poorly known. We report on a histological examination of dental development in a young juvenile female mountain gorilla from Volcanoes National Park, Rwanda. This individual died an early death; associated records document the last several months of her life. In first and second mandibular permanent molars, we used histological methods to reconstruct cuspal formation times, daily secretion rates, and age at death, providing the first such data for mountain gorillas. Following a blind protocol, we also charted the timing of stress as recorded by accentuated growth increments. Calculated age at death of this individual was 3.10 years, at which time mandibular M1s were partially erupted through the gingiva. From analyses of daily and long-period growth increments, M1 mesiobuccal cusp calcification initiated 87 days before birth and total cuspal formation time was 2.27 years. Periodicity of long period growth increments was 6 days. A prominent stress line was determined to have formed four months before death, corresponding closely in time to a documented poaching event that left this individual orphaned. Subsequent to this, accentuated increments record repeated incidence of stress during a period of documented reintroduction attempts, injury resulting from aggression by other gorillas and a follow-up surgery. Our observations are consistent with accelerated dental development reported previously for a captive juvenile western gorilla (Schwartz et al. 2006), and demonstrate the value of dental histology for revealing aspects of individual life history and stress in wild great apes.

Keywords: dental development; dental histology; mountain gorillas; life history; stress

The deciduous human dentition around birth

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Developing teeth are used to estimate age but reference data of tooth development are scarce for the prenatal and early postnatal growth periods. One important collection is from Maurice Stack, who documented tooth weight and height for age. The aim of this study was to assess the developing dentition around birth from his autopsy collection. The sample was Stack's collection of teeth from 196 individuals aged 24 to 88 weeks gestational age (mean 43 weeks, SD 10). The methods of assessing developing teeth included tooth length and crown and root stages of developing teeth (Moorrees et al. 1963). Tooth length from incisal edge to developing edge of anterior teeth was measured in the long axis. The tallest cusp of the molars was measured. Reliability of tooth length and tooth stage was calculated from duplicate measures of 29 teeth and showed high reliability for tooth length (mean difference 0.02mm, SD 0.092). Sample sizes of individual tooth types ranged from 53 (mandibular second molar) to 144 (maxillary central incisor). Tooth stages were less reliable (Kappa 0.62) suggesting that early crown stages need clearer descriptions for this age. We conclude from this study that tooth length of incomplete incisors and canines are better suited to predict age than tooth stage.

Keywords: deciduous teeth; development; age estimation

Bilateral agenesis of permanent maxillary canines in a female patient: a case report

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Hypodontia is characterized by the congenital absence of one or more teeth. It is one of the most common developmental anomalies. In the permanent dentition, the most frequently missing teeth are third molars, second premolars, upper lateral incisors and lower central incisors. Agenesis of permanent canines is extremely rare. According to the literature, the prevalence of permanent canine agenesis varies between 0.01% and 0.86% and is more common in the maxilla than the mandible. Studies have shown that females are more affected by this congenital anomaly than males. A case of canine agenesis was observed in an 11 year old Croatian girl who came to the School of Dental Medicine for a dental exam because of diastema mediana. The patient had neither systemic diseases nor hereditary disorders which could potentially influence tooth formation or eruption. An intraoral examination revealed a mixed dentition and a persistent frenulum tectolabiale. An orthopantomograph showed agenesis of the maxillary permanent canines and permanent second molars at a stage of gingival emergence. The first signs of crypt formation were visible only for the right mandibular third molar. A family history of congenitally missing teeth was negative. After the patient underwent a frenulectomy, she had a regular check-up at age 17. At this time, the patient still had retained primary canines. Diastema mediana was present but reduced to 0.5 mm. A control orthopantomograph revealed the presence of all four third molars germs. This unusual case of isolated maxillary canine agenesis in a female patient along with earlier research that found this anomaly to be twice as common in females indicates canine hypodontia may represent a sexually dimorphic characteristic of the human dentition.

Keywords: tooth agenesis; hypodontia; tooth aplasia; canine

Timing of eruption of the first primary tooth in preterm and full-term delivered infants

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Despite extensive research on tooth eruption, understanding this complex biological process remains unclear. Variation in the timing of eruption for primary teeth is under strong genetic control, but there is also a significant contribution from external factors. The aim of this study was to evaluate the influence of preterm birth, birth weight and length, and feeding practices during the first six months of life on the timing of eruption of the first primary tooth. Data on pregnancy duration, birth weight and length, feeding practice, time of eruption and first erupted primary tooth were collected by electronic questionnaires. The study included 409 parents and 592 children of both genders. The sample was divided into two groups according to pregnancy duration (<38 weeks and ≥38 weeks), three groups according to feeding practice (exclusively breastfed, exclusively bottle fed, and a combination of breast feeding and bottle feeding), three groups by birth length (<50, 50-53, >53 cm), and four groups by birth weight (<1500, 1500-2500, 2501-3500,>3500 g). Data were analyzed considering chronological and corrected age – which is the gestational age plus the infant's chronological age at the month of eruption of the first primary tooth. The mean time of first primary tooth eruption was 7.55 ± 2.67 months when chronological age was considered. The first erupted tooth in most cases was a lower incisor (82.33%). There was a statistically significant difference in the timing of first tooth eruption between preterm and full-term groups when chronological age was considered (P<0.005). However, no difference was found when age was corrected. The age of eruption of the first tooth differed significantly when feeding, weight, and length groups (P<0. 05) were taken into account. Age calculation rather than retarded dental development may explain the later eruption of the first primary tooth in low weight, bottle fed, preterm infants.

Keywords: teeth; eruption; birth; preterm; age

Variation in age at M_1 emergence and life history in wild chimpanzees

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Age at first molar (M_1) emergence is commonly used to infer the general pace of life history in extinct ape and human species. However, there is essentially no information on variation in age at M_1 emergence within species to complement the growing body of knowledge on intraspecific variation in life history. Recently reported ages at M_1 emergence in five living subjects from the Kanyawara community of *Pan troglodytes schweinfurthii* in Uganda range from <2.5 to 3.3 years, less than the age from a single deceased *Pan troglodytes verus* individual from the Taï Forest in Côte d'Ivoire (~3.7-3.8 years), the only other reliable M_1 emergence age for wild chimpanzees. Using standard histological methods, we determined ages at death for two wild-shot juveniles of *P. t. verus* from central Liberia, both with erupting M_1s, and estimated their M_1 emergence ages at ~4.2-4.4 and ~4.5-4.6 years, substantially later than those of the *P. t. schweinfurthii* individuals and outside the range of captive chimpanzees (2.1-4.0 years). The combined range of M_1 emergence ages from just the small Kanyawara and Liberian chimpanzee samples thus spans nearly the entire range of values known for captive and wild great apes as a whole, a surprising result. While little is known about Liberian chimpanzee life history, data for *P. t. verus* from the Taï Forest and *P. t. schweinfurthii* from Kanyawara reveal a somewhat longer average interbirth interval in Kanyawara females. This observation is the reverse of what would be expected given the M_1 emergence ages in the two populations and based on the correlation between age at M_1 emergence and various life-history traits in primates as a whole. We examine these results with respect to factors impacting the different populations. Supported by the Institute of Human Origins (JK, GTS) and the USA National Science Foundation (TMS).

Keywords: *Pan troglodytes*; dental development; life history; intraspecific variation

Study of mineralization of second and third mandibular molars: cross-sectional study of children and adolescents in Bosnia and Herzegovina

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Growth and development of second and third molars have a special place in the research of development of permanent teeth. It is important to know when the development of second molars ends for the possibility of using the most common method for estimating the age at a given time span in children. It is also important to take advantage of assessing the development of the second molar to predict agenesis of the third molars. The aim of this study is to show the mean values and ranges of age at developmental stages, by Moorees, Fanning and Hunt (1963), of second and third molars on the left side of the lower jaw, on a representative sample of 2,500 panoramic images of children and adolescents aged 5-23 years from Bosnia and Herzegovina. It will be shown a range of developmental stages of the second molar to the crypt stage of the third molars, and odds ratios of agenesis of third molars to each development stage of the development of the second molar.

Keywords: second molar; third molar; agenesis; mineralization; developmental stage

Mandibular range of motion and pain intensity in patients with temporomandibular joint disc displacement without reduction

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Primary goal in the treatment of temporomandibular joint disc displacement without reduction is to ease pain and to regain mandibular function despite of disrupted anatomical relationship between TMJ structures. The aim of this study was to evaluate the effectiveness of the simultaneous application of physical therapy and stabilization splint on mandibular range of motion and pain intensity in patients with anterior disc displacement without reduction in a 6-month treatment period. Twelve patients (mean age =30.5 y) with anterior disc displacement without reduction (according to RDC/TMD and confirmed by magnetic resonance imaging) were randomly allocated into 2 groups: 6 received stabilization splint only (SS) and 6 received both physical therapy and stabilization splint (SS&PT). Treatment outcomes included pain-free maximal mouth opening (MO), assisted maximal MO, path of MO, asymmetry in lateral excursions and pain as reported on visual analogue scale (VAS). At baseline of treatment there were no significant differences among the groups for VAS scores, as well as for the range of mandibular motion. VAS scores improved significantly across time for the SS&PT group ($F=28.964$, $p=0.0001$, effect size =0.853) and SS group ($F=8.794$, $p=0.001$, effect size =0.638). Pain-free MO improved significantly only in the SS&PT group ($F=20.971$, $p=0.006$, effect size =0.807). Changes in path of MO differ significantly between groups ($p=0.040$). Only one patient in SS&PT group and 5 patients in SS group still presented deviations in mouth opening after completed therapy. The results of this limited study revealed that during 6-month treatment period stabilization splint combined with physical therapy was more effective than stabilization splint delivered without physical therapy in improving pain-free MO and reducing deviations during mouth opening. Both treatment modalities were effective in reducing pain in patients with anterior disc displacement without reduction. Physiological function was restored in spite of objectively diagnosed disruption of functional temporomandibular anatomy.

Keywords: temporomandibular joint; functional anatomy; anterior disc displacement

Centric slide in different Angle classes of occlusion

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Most of the literature states that slide from centric relation occlusion (OCR) to intercuspal position (ICP) occur at approximately 90% of people, and on average is 1 mm long. The purpose of this study was to test the possible differences in OCR-ICP slide between different Angle classes of occlusion. Study included 98 participants (58 class I, 10 class II/1, 14 class II/2, 16 class III). Each participant gave written informed consent, which was approved by the Ethical Committee of the School of Dentistry, University of Zagreb. Recordings were obtained by the electronic ultrasound measuring device (Arcus Digma II, Kavo, Germany), using module "EPA-Electronic Position Analysis". Reference position was ICP, while OCR was achieved with training participants to move mandible posteriorly (no guidance). Data were transferred to the computer, and processed and analyzed with device's software. For every participant, distance between ICP and OCR was measured (x-anteroposterior, y-vertical, z-transversal values). Analysis of variance, followed by Newman-Keuls test was applied. Analysis of variance showed significant differences in vertical values of OCR-ICP slide ($p=0.045$). Newman-Keuls test for vertical distances between tested groups showed significant difference between II/2 and II/1 ($p=0.049$), and between II/2 and I ($p=0.043$). Out of 98 participants, none showed coincidence of OCR and ICP position. Unlike other studies, Angle class II/2 showed smaller movements in vertical direction, in comparison with Angle class I and II/1. Since function and morphology of the TMJ are closely related, it is possible that smaller OCR-ICP slide in vertical direction, as expression of anatomy/function, happens at Angle class II/2. This could be explained by „locked occlusion", and posterior condylar position in Angle class II/2 advocated by some authors. In concordance with novel studies, coincidence of OCR and ICP position is less than 10 %.

Keywords: centric relation; centric slide; occlusion

The assessment of dental and bone age in children with somatotropin hypopituitarism

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The most important role in the endocrine system plays the pituitary gland which is responsible for the production of somatotropin – the growth hormone. The deficiency of somatotropin, caused by hypopituitarism of anterior lobe of pituitary body is the most common cause of dwarfism of hormonal origin. The malfunction of pituitary gland disturbs the growth and development of long bones and may have the adverse effect on the development of maxilla, mandible and dentition in children. The aim of this study was the assessment of dental and bone age in children with diagnosed somatotropin hypopituitarism. The study was conducted on 110 children, hospitalized for somatotropin hypopituitarism (SNP) in the Department of Pediatric Endocrinology and Diabetology. The treatment with growth hormone was started in 47 children (43%) (SNP group which started treatment) and 63 children (57%) in which the treatment was started 2-3 years before (SNP group in the course of treatment). The control group constituted 47 generally healthy children. Methods: Bone age was assessed using Greulich and Pyle atlas, dental age using clinical assessment method by Matiegka and Lukasova. A characteristic feature in children with hypopituitarism is a delayed bone and dental age in relation to their chronological age. Parameters of dental and bone age changed after treatment with growth hormone. The treatment with growth hormone has a beneficial influence on the process of exchange of dentition and skeletal maturity.Dental age in children in the control group was higher than chronological age which is the evidence of acceleration phenomenon.

Keywords: somatotropin hypopituitarism; dwarfism; dental age; bone age

Size of anterior teeth in patients with gaps in the upper dental arch

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The aim of the study was to assess the size of upper incisors and canines in patients with gaps in the upper dental arch especially medium gap between upper central incisors. Diagnostic orthodontic models of 30 adult patients with full permanent dentition with diastema in the upper arch were studied. Patients with severe malocclusion, missing teeth and periodontal disease were excluded. Width to length ratio of the clinical crown of the central, lateral incisors and canines for both sides was measured. Together 180 teeth were tested. The results were compared with the values indicated by Sterrett et al.(1999). In all patients, the clinical crowns of central incisors were symmetrical. In most cases, a higher width/length ratio means that the clinical crowns of medial incisors were too broad in relation to the length. Lateral incisors: In most cases, the rate was the same for the right and the left side, however, a few patients had asymmetry of lateral incisors. Most of the lateral incisors had higher width/length ratio which means that they were wider than long, some had a reduced rate. In individual cases, the ratio was normal. Canines were also asymmetrical, and none of the canines exhibit perfect proportions. The vast majority showed increased ratio of the width to the length of the clinical crown. In several cases, the result was lower. Patients with gaps between the teeth have abnormal width/length ratio of the clinical crowns of the upper front teeth. The values of the majority were increased, which indicates that the front teeth are wider than longer in those patients. Moreover, despite of the disturbed width/length proportions central incisors reminded symmetrical. In contrast, lateral incisors and canines more often exhibited asymmetries.

Keywords**:** gaps in dental arch; teeth size

Bone regeneration, in the different technique. Immuno-histo-chemical exam (in vivo)

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The aim of this research was to evaluate the regeneration of bone tissue extracted at vertical and horizontal mandibular atrophies.Our research was based on 30 patients (15 men and 15 women, age range 35-70) who needed partial or total mandible regeneration, divided in 3 groups (in Vivo). In group I, 10 people were treated with blood Concentration Growth Factors, 5 men and 5 women (age 55±7.7, $p<0.05$) both smokers and non smokers, after that the flap was opened and then a sample was extracted by a mincing cutter (trephine burr) (Implatex; 3 mm inner diameter) for biopsy.; in group II, 10 people were treated with blood Concentration Growth Factors mixed with autologous bone, 5 men and 5 women (56.8 ± 8.4, $p <0.05$), smokers and non smokers with partial or total atrophy who needed implant prosthetic rehabilitation; in group III, patients were treated with Hydroxylapatite, Tricalcium phosphate and bCGF, 5 men and 5 women (56.8 ± 8.4, $p<0.05$), smokers and non smokers. After a 6^{th} month follow-up all the biopsies received from the patients were immediately placed in 10% formalin (formaldehyde) and immersed into 0.5 M EDTA tamponade for demineralization. Extracted tissue after 6^{th} month follow-up was examined histologically and immune-histo-chemically using Anti-RUNX, Anti-Alkaline Phosphatase, Anti-SPARC and Ki67. Each sample was colored with H/E. The sections were examined with a microscope (Nikon Eclipse E 600 microscope and Lucia G software for microscopic image analysis). Histological evaluation (HE) has demonstrated the complete bone formation at the patients of group II, partial ossification for the patients of group I, and moderate ossification with persisting H/A residues of the patients of group III. In an Immune-histo-chemical examination we obtained a different result in the group I, group II, group III (Table 1). The examination of each group showed that the best bone regeneration was detected in group II among the patients treated with the biomaterial of blood Concentration Growth Factors and autologous bone. During immune-histo-chemical examination we obtained significant differences between group I, group II, and group III in terms of the formation of a new bone ($p\leq0.01$).

Keywords: autologous bone; bCGF; osteoblast; osteocytes; immune-histo-chemical examination

Intelligence at 4 years and dental wear patterns in primary and mixed dentitions

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The aim of this study was to explore the relationships between intelligence and dental wear patterns observed among preschool children. Intelligence (IQ, intelligence quota) was measured at 4 years of age using the Stanford- Binet protocol and dental wear was recorded in primary and mixed dentitions. The dental study participants were 864 healthy Euro-American preschool and school children, and the data were collected in a cross-sectional manner at the mean ages of 7.8 years. Worn dentitions were classified as “symmetric” or “right-” and “left-sided”, based on the faceting of the teeth. The results showed that unworn dentitions were associated with slightly higher IQs than those with worn dentitions, but left-side oriented wear was associated with the highest IQs in girls, higher than among those with unworn teeth. Those with right-side oriented wear had the lowest IQs in boys. The results suggest that juvenile bruxism (inducing most of the tooth wear), functional laterality, and mental performance are associated at a very early age. Increased left-side tooth wear and girls´ early advantage in the Stanford – Binet intelligence test is intriguing due to the fact that they reach maturity in verbal articulation, controlled in most cases by the left side of the brain, earlier than boys, who have a more true- right- sided functional pattern in general. The results support the opinion that left oriented dental wear indicates lateralized cranio-facial muscular functioning, and the mechanism simply feeds local brain blood circulation /verbal functions as an “auxiliary pump system”.

Key words: bruxism; attrition; Stanford- Binet IQ; laterality; brain circulation

Permanent mandibular first molars with a radix entomolaris: A report of five cases

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The majority of permanent mandibular first molars (PMM1) possess two roots: one mesial and one distal. Occasionally, there is an additional distolingual root referred to as a radix entomolaris (RE). An RE also occurs on PMM3, but rarely on PMM2. The prevalence of PMM1 with an RE varies significantly among ethnic groups, from European and African populations at the lower end of the spectrum (< 4%) to Asian and Asian-derived populations at the upper end (> 20%) (Scott and Turner II, 1997). The length of the RE is variable; however, those shorter than half the length of the distal root represent a minority of all cases (Song et al., 2010). It is often curved, especially in a radiographically unseen buccolingual direction, and may be separate or partially fused with the distal root. This additional root may be the cause of endodontic failure if not identified before or during treatment. The access cavity should not be triangular or quadrangular, as appropriate for the two-rooted PMM1, but rather trapezoidal with an extended distolingual corner (Abella et al., 2012). In addition, the RE's curvature and relatively thin walls must be taken into account during root canal preparation to avoid complications (straightening and ledging of the root canal, perforation, deformation of the apical foramen or instrument fracture). Moreover, the RE appears to be a local factor that contributes to the progression of advanced periodontal disease (Huang et al., 2007). Our aim is to present endodontic management of PMM1 with an RE in four patients of Slovenian and one patient of Philippine origin, aged 14–40 years. In one of these cases, flap surgery with resection of the RE was performed because the distal furcation was periodontally involved.

Keywords: permanent mandibular molars; radix entomolaris; anatomical variations, endodontic treatment

Biological and habitual aspects of the dentition in early modern Japanese from the dental anthropological point of view

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Skeletal materials including teeth were excavated from Keianji temple, Ikenohata, Ueno in Tokyo, the former Japanese capital Edo from 1603 to 1866. The archaeological site was the graveyard, in which two types of coffins such as wooden coffins and ceramic coffins were identified. The wooden coffin was utilized mainly by the townsman. On the other hand, the lower-middle class of samurai, as hatamoto or hanshi was buried in the ceramic coffin depending on their higher income and social status. Some of the craniofacial and dental measurements of the materials were different between these two groups of the people probably because of the environmental factors such as dietary habit or working posture. For example, subjects having complete set of four third molars were significantly more in wooden coffin group than those in ceramic group. Observation of the teeth also revealed that dental care, oral habits and pathological cases were also different in these people. Tooth polishing sand and tooth brush called “fusayouji” began to be used in Edo era. Because these tools were relatively expensive, they were not extensively prevailed in the townsman class. Polished surfaces by using the tooth brush was significantly more in the higher samurai class than in the townsman class. The traces of “ohaguro” which was a curious custom of dyeing teeth black for married women. This custom was also differently found between these two groups. Thus the dental anthropological study confirmed that there was a dual structure of the society or the population in Edo from the biological and dental habitual point of view.

Keywords: Japanese; tooth morphology; dental care; early moderrn

Mild hypodontia is associated with reduced tooth dimensions and cusp numbers compared to controls in a Romanian sample

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The associations seen clinically between variations in tooth number, size and shape reflect the repetitive genetic interactions occurring between the epithelium and mesenchyme during the initiation and morphogenetic stages of dental development. The aim of this study was to investigate this relationship further by comparing multiple crown parameters, including cusp numbers, between patients with mild hypodontia and controls. Digital images of dental casts of the permanent dentition from 28 Romanian subjects with mild hypodontia and 28 controls were used. Measurements of the vestibular and occlusal surfaces were performed using a 2D image analysis method. Seven dimensions were measured (mesio-distal, occluso-gingival, bucco-lingual, vestibular perimeter, vestibular area, occlusal perimeter and occlusal area) and cusps on premolars and first molars were counted. Multivariate analysis of variance was performed using SPSS V17 software. The results showed teeth in the hypodontia group were smaller than those of controls, with many measurements being significantly different (significance values varied from *p=0.048* to *p=0.0001*). Lower first incisors and upper first premolar teeth presented the most reduced dimensions. Mesio-distal, bucco-lingual and occlusal area and perimeter dimensions were the most affected. Upper first molars presented the Carabelli trait in significantly less subjects in the hypodontia group than in controls. This variation was accompanied by a difference in tooth height. Lower premolars showed reduced cusp numbers in hypodontia subjects, accompanied by variation in tooth width or depth. In conclusion, this study demonstrated differences in multiple parameters of crown size and shape in patients with mild hypodontia compared to controls. The degree of these differences varied between different tooth types and dimensions.

Keywords: tooth dimensions; mild hypodontia; cusp number

Severe tooth wear due to dental erosion and abrasion: a case report

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The mechanisms of attrition, abrasion and erosion act together, each with different intensity and duration to produce a multitude of different wear patterns. The aim of this case report was to present clinical situation and rehabilitation of esthetic and functional concern caused by long-term development of combined erosion and abrasion. 58-years old patients reported to the Department of Endodontics and Restorative Dentistry because of aesthetic need, but without any pain or dentin hypersensitivity. After a detailed dental and medical history, it was determined that the patient was consuming sour fruit and cucumbers in the evening before bedtime as well as pumpkin seeds, daily for the past 30 years. Clinical examination revealed severe form of dental erosion according to Smith and Knight's Tooth wear index (TWI) (4^{th} degree) on all surfaces of frontal teeth. In distal region, erosion was found on occlusal and vestibular surfaces (3^{th} degree) while oral surfaces of the upper and lower teeth were preserved (2^{nd} degree). No history of clenching or grinding was reported by the subject, or partner. The patient's non carious cervical lesions were restored using resin composite (Tetric EvoCeram, Ivoclar Vivadent, Liechtenstein). Central upper incisors were endodontically treated and postendodontical treatment was made with fiber posts and core material (GC Gradia Core & Fiber Post, GC Japan). An eight unit ceramic fused to metal bridge (IPS d.SIGN Ivoclar Vivadent, Liechtenstein) restoration was made for the restoration of upper teeth and another three unit bridge for the restoration of missing molars. Every day long- term oral habits such as constant citrus ingestion or different seeds chewing can lead to serious hard dental tissue loss. This can be difficult to detect, especially in the early stages and without prevention, serious multidisciplinary approach to restore such lesions is needed.

Keywords: tooth wear; erosion; abrasion

Protuberance or fossa on the lateral surface of the mandible in primates

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Some primates have a protuberance on the lateral surface of the mandible, and some have a fossa. We investigated some species of primates in order to clarify morphological characteristics of the protuberance and/or fossa on the lateral surface of the mandible by using computed tomography. Both protuberance and fossa were found in some species of the *Macaca*, and each structure was found about 10%. The protuberance was found in the *Cercocebs* and *Cercopithecus*, and the fossa was found in the *Papio*, *Mandrillus*, *Colobus* and *Hylobates*. The protuberance didn't appear until M3s erupted. Well-developed protuberance was laid from P4 to M3 region. There found 3 types of protuberances; (1) the protuberance continue on the oblique line, (2) the protuberance is localized on the mandibular base, (3) the protuberance is situated the central part of the mandibular body. The 3rd type was often well-developed. The protuberance was composed of compact bone, and was similar to the mandibular tori in humans that were found on the internal surface of the mandible. There were the 3 types of the fossa; (1) the bone width of the mandible was thin in the center of the fossa, (2) the curvature of the external table of the mandible made a fossa, (3) the external surface of the mandible was looked like concave because of the thickened mandibular base. In the 2nd and 3rd types, the mandibular thickness did not change between the area of fossa and the other area. The 1st type of fossa was found in the *Papio* and *Mandrillus,* the 2nd type was found in the *Macaca*, *Cercocebs* and *Cercopithecus*, and the 3rd type was found in the *Hylobates* and *Colobus*.

Keywords: mandible; primates; fossa; protuberance

An overview of dental pathology in roe deer (*Capreolus capreolus*) from central Slovenia

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Roe deer (*Capreolus capreolus*) is a small ruminant species from the family of *Cervidae*. Roe deer possesses heterodont, dyphiodont, semi-hypsodont and selenodont dentition with the following permanent dental formula: I 0/3, C 0/(1), P 3/3, M 3/3. The purpose of this study was to determine presence, prevalence, distribution and nature of roe deer cheek teeth pathology from central part of Slovenia. For that, during 2007 all dead animals were collected and their teeth examined. This included hunting districts of Kamniško (1977 collected animals), Kočevsko (2647), Kozjansko (4245), Novomeško (2012), Pohorsko (3538), Pomursko (3282) and Zasavje (2210). Of them, dental pathologies were observed in 113 (Kamniško; 5.71%), 181 (Kočevsko; 6.83%), 152 (Kozjansko; 3.58%), 87 (Novomeško; 4.32%), 151 (Pohorsko; 4.26%), 152 (Pomursko; 4.63%) and 80 (Zasavje; 3.61%) individuals respectively. When compared on total level significant differences were observed between Kamniško – (- Kozjansko χ^2=15.07, - Novomeško χ^2=4.05, - Pohorsko χ^2=5.83, Zasavje χ^2=10.42), Kočevsko - (- Kozjansko χ^2=37.61, - Novomeško χ^2=13.32, - Pohorsko χ^2=19.68, - Pomursko χ^2=13.45, - Zasavje χ^2=24.52). Observed dental pathologies included chronic periodontitis, missing tooth, supernumerary teeth, fractures, tooth rotation, irregular dental line, dento-alveolar abscess, irregular attrition and tooth discoloration. Most observed alteration was horizontal bone loss (214 cases), followed with missing tooth (92), irregular dental line (90), irregular attrition (55) and vertical bone loss (40). Pathologies were most frequently found on P3 (361) and M3 (344), followed by M2 (263), P2 (211) and P1 (201). M1 was not taken into consideration due to high occurrence of excessive wear as a result of eruption time and position in the jaw, rather than some kind of pathology.

Keywords: Roe deer; dental pathology; Slovenia

Concrescence of permanent maxillary second and third molar: case report

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Dental anomalies can be classified in four main groups: anomalies of number, anomalies of size, anomalies of shape and anomalies of structure. In the group of anomalies of shape gemination, fusion, concrescence, Talon cusps, dens evaginatus, dens invaginatus, dilacerations and taurodontism can be distinguished. Concrescence is a rare developmental anomaly with an overall incidence of 0.8% in the permanent dentition.We present the case of an adult female age 61, without medical antecedents of interest, that goes to consultation for repeated inflammatory accidents at level of the upper molar area. While extracting a tooth 28 under local anaesthesia it became evident that the tooth was attached with tooth 27 between the roots. The union has been observed between the cementum of roots of the teeth. Although there was a risk of damage to a large portion of the alveolar bone near the maxillary sinus and increased likelihood of other complications to occur during a tooth extraction, both teeth were extracted and without any other complications during or after the operation. Healing was uneventful.Concrescence as an uncommon developmental anomaly may influence on tooth extraction as well as periodontal, endodontic, orthodontic and even prosthodontic treatment. In order to minimize the risk and adverse outcome of treatment, doctors of dental medicine should perform a comprehensive clinical and radiological analysis as an integral part of treatment planning.

Keywords: dental anomalies; concrescence; extraction

Oral hygiene status of patients receiving hemodialysis

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Chronic renal failure is a progressive disease characterized by the destruction of the nephrons. Loss of renal function results in accumulation of metabolic waste products affecting various organs. Although renal transplantation is the ideal treatment of choice for patients with chronic renal failure, majority are not healthy enough for such therapy thus most of them are treated with hemodialysis. Periodontal inflammation contributes to generalized inflammation and development of systemic diseases including atherosclerosis, cardiovascular disease, diabetes mellitus, rheumatoid arthitis, and chronic obstructive pulmonary disease. Some studies link chronic periodontitis and chronic renal failure. We examined 53 hemodialyzed patients, including 28 men (52.83%) and 25 women (47.17%). Oral hygiene status was evaluated using approximal plaque index (API). We also examined gingival inflammation using papilla bleeding index (PBI). All patients were given detailed oral hygiene instructions and were advised about the need for further periodontal therapy and referral to further specialist treatment where the need existed. Patients also filled questionnaires which collected data on their education, oral hygiene habits, tobacco and alcohol consumption. As distribution of API statistically significantly deviated from the normal distribution (Kolmogorov-Smirnov test = 0.20; df=53; P<0.001) we have used the median and interquartile range as the measures of central tendency and dispersion. Median API was = 87.5 with interquartile range of 60.4-100.0. Total API range was from 9.09 to 100.0. Median PBI was = 2.14 with interquartile range of 1.83-2.88. Total PBI range on our sample was from 0.4 to 3.82. API and PBI were statistically significantly positively correlated (Spearmen rank correlation, ρ=0.32; P=0.018). Our findings showed that oral health of hemodialyzed patients is very poor with high levels of pathogenic microbial biofilm and severe gingival inflammation. This population needs comprehensive periodontal care and additional education of importance of oral hygiene habits on overall health.

Keywords**:** hemodialysis; oral hygiene; API; PBI

Prenatal factors associated with the neonatal line thickness in human deciduous incisors

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The neonatal line (NNL) is used to distinguish developmental events observed on enamel which occurred before and after birth. However there are few studies reporting relationship between the parameters of the NNL and factors affecting prenatal conditions. The aim of the study was to determine prenatal factors that may influence the NNL thickness in human deciduous teeth. The material consisted of longitudinal ground sections of 60 modern human deciduous incisors obtained from full-term healthy children of reported birth histories and prenatal factors. All teeth were sectioned in the labio-lingual plane using diamond blade (Buechler IsoMet 1000). Final specimens were observed by way of scanning electron microscopy at magnifications 80x and 320x. For each tooth, linear measurements of the NNL thickness were performed on its labial surface at the three levels from the cemento – enamel junction. A multiple regression analysis confirmed influence of two variables on the NNL thickness: the taking of an antispasmodic medicine by the mother during pregnancy and the season of the child's birth. These two variables together explain nearly 17% of the variability of the NNL. Children of mothers taking an antispasmodic medicine during pregnancy were characterised by a thinner NNL compared with children whose mothers did not take such preparations. Children born in the summer and in the spring had a thinner NNL than children born in the winter. These results indicate that the prenatal environment significantly contribute to the thickness of the NNL influencing the pace of reaching the post-delivery homeostasis by the newborn's organism.

Keywords: neonatal line; season of birth; maternal factors; antispasmodic medicines; deciduous teeth

Factors for the expression of Carabelli's trait in 46,X,i(Xq)females

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Turner syndrome is a genetic disorder that affects about 1/2500-1/3000 female infants at birth (Ferguson-Smith., 1965). The most common karyotype is 45,X and there are various kinds of structural variations in the X chromosome in Turner syndrome, e.g. 46,X,i(Xq) females. Previous studies showed that the maxillary first permanent molar in 45, X females has a small crown size, a lower frequency of Carabelli's trait and a high frequency of the three-cusp pattern compared with normal controls (Townsend et al., 1984; Kirveskari et al., 1982; Midtbø et al., 1994, Nakayama et al., 2005). The purpose of this study was to observe the expression of Carabelli's trait and cusp number on maxillary first (M1) and second permanent molars (M2) to consider the role of the lack of one short arm of the human X chromosome in these features during tooth crown development. The data were derived from dental casts belonging to the KVANTTI Research Project on sex chromosome abnormalities headed by professor Alvesalo in Finland. The subjects comprised 6 46,X,i(Xq) females and 150 population control females. Carabelli's trait is divided into three grades and cusp number was classified into two classes in Dahlberg's P12 and P9 (Dahlberg, 1949, 1956) The lower frequency of the expression of Carabelli's trait and the higher frequency of three cusp pattern than population control females in M1 were characteristic of 46,X,i(Xq)females. The expression of Carabelli's trait and cusp number in M2 of the 46,X,i(Xq) females and population control females was of the same magnitude.The shortage of one short arm of X chromosome material in females has an influence on the morphology of the lingual cingulum region of M1 during the tooth crown development.

Keywords: Carabelli's trait; X chromosome; tooth crown development; tooth size; cusp number

Dental metrics in Central African Pygmies

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Pygmy hunter-gatherers coexist in Central Africa with well-established Bantu agriculturalists and both groups differ in culture and phenotypic traits. Previous odontometric studies found that tooth dimensions for upper molars (M^{1-3}) in Pygmies are not different to those in non-pygmies. However, dental phenotypic patterns between populations remain unclear because of the small samples sizes studied. Maximum buccolingual and mesiodistal crown diameters were recorded from high-resolution *in vivo* replicas of upper and lower (I1-M2) teeth in sample of Baka (*n*= 103; Cameroon) and Mbuti (*n*=29; Democratic Republic of Congo) Pygmies and, Bantu speaking individuals, Mvae (*n*=14) and Yassa (*n*=18) from Cameroon. Uni- and multivariate statistical tests were used to evaluate the differences among groups. We found that upper postcanine tooth crowns tended to be larger in Pygmies than in Bantu groups while anterior and lower teeth are shorter. The two first Principal Components obtained account for 50.1% of total variance. The highest loadings (r>0.7) in PC1 (42.93%) are all premolar and molar measurements. In contrast, PC2 (7.14%) appears to be driven by anterior dentition (I1-C) width. In addition, Canonical variate analysis showed significant between-group differences (Wilks´λp<0.0001). The two factors obtained reveal that odontometric patterns differ (ANOVA p<0.001) between Pygmies and Bantu-speaking farmers. No differences were found within Bantu populations but Baka and Mbuti Pygmies showed dissimilar patterns (Tukey's HSDp<0.001). The patterning of dental variation found is consistent with those obtained from recent genetic data where Mbuti Pygmies differ substantially from that of western Pygmies. Dental metrics are often considered less robust than morphological traits, however cross-cultural multivariate studies found significant variation in tooth size among human populations. Since tooth size appears to be strongly heritable, our preliminary odontometrics results support findings based on diversification hypothesis for Central African Pygmies.

Keywords: odontometrics; Pygmy; Bantu; Central Africa

Using a Dental Ecology Approach to Assess Dental Health in a Wild Population of Ring-tailed Lemurs (*Lemur catta*) at the Bezà Mahafaly Special Reserve and Tsimanampesotse National Park Madagascar

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Given the large body of data on wild primate feeding ecology, there is surprisingly little general dental health and dental pathology data available for non-human primates. Using a "Dental Ecology" approach (Cuozzo and Sauther, 2012), defined as the synthetic study of how teeth respond to the environment, we present patterns of dental pathology within the context of feeding behavior, habitat variation and anthropogenic effects. Data are presented for two wild primate populations in Madagascar: the Bezà Mahafaly Special Reserve (BMSR) (2004 – 2010), which is a mosaic habitat with both intact gallery forest and anthropogenically altered areas that include human croplands and, degraded forest, and Tsimanompesotse National Park (TNP) (2006) which contains intact spiny thicket. Wild BMSR lemurs demonstrate a variety of dental pathologies that include a high incidence of toothcomb plaque, heavy canine calculus with gingivitis and, more rarely, cavities. BMSR in 2005 experienced a cyclone that toppled trees and reduced food resources.. Dental pathologies peaked during that year and were higher than other years ((X^2 (DF = 84, N= 127) = 118.37, p < .008). In addition, females had a higher percentage of pathologies that year compared to males ((X^2 (DF = 1, N = 72) = 4.68, p < .03). Behavioral ecology also affected patterns of pathology, with crop-raiding troops exhibiting higher percentages of pathologies ((X^2 (DF = 1, N= 370) = 12.10, p < .0007). Comparing TNP and BMSR, 2006 indicates that different habitats emphasize different pathologies, with caries, molar staining and heavy canine calculus characterizing TNP lemurs, and toothcomb plaque, heavy canine calculus plus gingivitis more prevalent at BMSR. Comparing our results with sub-fossil lemur specimens indicates similar pathologies, and demonstrates the power of the dental ecology approach in providing context for understanding living and fossil pathologies.

Keywords: lemur dental pathology; stochastic events; climate, cyclone; habitat; ecology

µCT analysis of rodent hypsodont dentitions - new insights into infundibula and enamel islets

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Infundibula, forming enamel islets on the occlusal surface, are a common feature in rooted hypsodont cheek teeth of herbivorous mammals, such as rodents. The enamel islets occur when teeth with reentrant folds get worn down. Until now only little is known about their morphology and possible changes in function (associated with e.g., length and angle of shearing blades) of the occlusal surface during ontogeny. With high-resolution computed tomography (µCT) the morphology of the infundibula, as well as functional characters (e.g., angle and length of the enamel ridges, function as shearing blades) were studied on 3D reconstructions and hypothetical future occlusal surfaces in five extant and one extinct rodent. The shearing blade angles show a distribution with a wider or smaller concentration around certain values, with differences in the upper and lower jaw (e.g., in *Cuniculus paca* 91° in upper, 85° in lower jaw). This gives evidence on the orientation of the upper and lower shearing blades during the power stroke. With progressive wear the distribution gets less concentrated with only few changes in the main angle. In correlation with the disappearance of infundibula the shearing blade length remains constant (e.g., *Castor* sp., *Cuniculus paca*, *Mylagaulus elassos*) or reduces continuously (e.g., *Dasyprocta azarae*, *Hystrix* sp.). Though the number of enamel islets increases due to splitting of infundibula, this does not seem to have any effect on shearing blade length. In almost all investigated species infundibula split up apically, often in all tooth positions in upper or lower jaw respectively. In the different species these particular infundibula differ, indicating a more genetically rather than morphological reasons. Despite the variability, infundibula never get fused apically. As the formation of infundibula in ewer growing teeth is problematic, most of this teeth lack this structure.

Keywords: µCT analysis; enamel islets; morphology; function; rodents

Inferring jaw movement from molar wear facets in cercopithecid monkeys

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Jaw movement during mastication is closely related with dental function and diet. If jaw movement can be inferred from dental and skeletal remains, such methods could be applied to extinct species enabling new paleobiological insights. Phase I facets are formed by tooth to tooth contact, and reflect interaction of cusp shape and jaw movement. In this study, we attempted to infer local direction of jaw movement from molar wear facets. For this purpose, crania of *Piliocolobus badius* (n=6) and *Chlorocebus aethiops* (n=6) stored at the Primate Research Institute, Kyoto University, were used. In this pilot study, individuals with little to moderately worn dentitions with well-developed wear facets were chosen for investigation. A high-resolution 3-dimensional model of wear facet location and geometry was obtained as follows: 1) digital surface models of both maxillary and mandibular dental rows were built via whole jaw micro-CT-scans taken at circa 60 micron per voxel resolution, 2) higher resolution surface scans (<10 micron) of individual molars and wear facets were obtained, and 3) these were superimposed to acquire accurately positioned wear facet models spanning M1 to M3. Jaw excursion directions were estimated by planes fitted to adjacent wear facets, with the assumption that the line of intersection potentially represents local direction of movement. Simultaneously occluding facet pairs should exhibit similar directional vectors, within error of measurement. First we investigated technical hypotheses related to the optimal retrieval of direction estimates. Our preliminary analyses show general concordance between intersection vectors, suggesting that they reasonably represent local direction of jaw movement. We also found that, among our examined specimens, cusp function (i.e. supporting or guiding side) or height do not affect accuracy of jaw movement estimate. Moreover the intersection vectors were strongly related to cusp arrangements and also exhibited a helicoidal pattern related to that of the occlusal plane.

Keywords: *Piliocolobus badius*; *Chlorocebus aethiops*; wear facets; Phase I; jaw movement

Permanent maxillary molars with two palatal root canals: a report of four cases

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The permanent maxillary molars (PMMs) occasionally possess 2 palatal (P) roots. One of them is the regular P root that is always present; the other is a supernumerary root. Its presence has clinical implications in endodontics, periodontology and oral surgery. Literature data indicate that the P supernumerary root occurs least frequently on PMM1. Peikoff et al. (1996), Libfeld and Rotstein (1989) and Matsumoto (1986) reported the prevalence of PMM2 with 2P roots between 0.4% and 1.3% and Šutalo (1985) reported the prevalence of 0.5% for PMM1. Christie et al. (1991) have identified 3 morphological types of PMMs with the P supernumerary root: Type I with 2 long, widely divergent P roots, Type II with 4 separate, parallel and approximately equally long roots, and Type III with a separate DB root and fused MB, MP and DP roots. A very pronounced mesiopalatal (MP) and/or distopalatal (DP) part of the crown and a voluminous P enamel extension represent diagnostic clues for the existence of 2 P roots. Another variation is the presence of a double canal system in the P root. Our aim is to present 4 endodontic cases. In Cases 1 and 2, a Type I PMM2 was treated in female patients aged 40 and 42 years, respectively. The referring general dentists have failed to identify the second P root, although it was clearly depicted on the radiograph, and were therefore not able to complete the endodontic treatment. In Case 3, a Type II PMM2 was retreated in the 62-year-old female patient. Radiographical presentation of the roots was unclear and the DP root was identified only during the treatment. In Case 4, a three-rooted PMM1 was retreated in the 57-year-old male patient. A postoperative radiograph has shown bifurcation of the P canal in the apical third of the root.

Keywords: permanent maxillary molars; palatal root; radix mesiopalatinalis; radix distopalatinalis; anatomical variations

Gender estimation by odontometrics: preliminary report

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Teeth are a potential source of information on gender. The aim of this study was to analyze the dimensions of maxillary and mandibular teeth and find differences between males and females. This preliminary research was performed on a sample of plaster casts from the collection of the Department of Orthodontics, School of Dental Medicine University of Zagreb. The sample consisted of 50 casts (25 females and 25 males) 12 to 18 years of age. On each cast bucco-oral and mesio-distal diameter of teeth of upper and lower right jaw side were measured with digital sliding caliper. All teeth used in the analysis were intact, without tooth wear, caries or fillings. Statistically significant differences were found between males and females in the mesio-distal diameter of upper canine (males 7.85±0.56 mm, females 7.54±0.56, $p<0.05$), mesio-distal diameter of lower canine (males 6.99±0.59 mm, females 6.50±0.48, $p<0.05$), mesio-distal diameter of upper first molar (males 10.29±0.89 mm, females 9.81±0.81, $p<0.05$) and bucco-oral diameter of upper second premolar (males 9.62±0.64 mm, females 9.26±0.54, $p<0.05$). Although these are results of a pilot study, data presented could be an important contribution for gender estimation by teeth in a Croatian population when no other data about gender are available.

Keywords: gender estimation by teeth; odontometrics; dental morphology; Croatia

Biomechanical stress analysis of mandibular first premolar - finite element study

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Introduction: Human teeth are composed of different types of tissues which differ in their structure and biomechanical properties. Analysis of the distribution and concentration of stresses along these structures is a complex process. Mandibular first premolar has a specific morphology and occlusal contacts and could be considered as a transition form of anterior and posterior teeth. The aim of this study was to evaluate the distribution and concentration of stress of a lower first premolar using finite element method (FEM) of analysis with the highest possible level of similarity to the anatomic characteristics. Material and methods: A three-dimensional model of the mandibular premolar is gained from a μCT x-ray image. Using the FEM we analyzed straining of the enamel, dentin and periodontal ligament under axial forces. The following software solutions were used in the analysis: CT images processing - *CTAn network program* and FEM analysis -*AnsysWorkbench 14.0.* Results: Stress under occlusal forces is dominantly transferred through the enamel where the highest stress values were measured. High magnitudes of stress were seen in the cervical third of crown. Stress values in the sub-superficial layer of the cervical enamel are almost 5 times higher in relation to superficial enamel. Conclusion: FEM/computational analyses are useful tools in a biomechanical dental research. Once when 3D tooth model is made, it is possible to investigate different clinical situations.

Key words: mandibular first premolar; finite element method; stress distribution

Non-metric dental trait variation among Eastern Europe and Western Siberia forest-steppe Neolithic populations

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The aim of this research is to find a possible link between Neolithic population of Eastern Europe and Western Siberia forest-sreppe zone using dental non-metric traits. Dental characteristics of four European (4 – the end of 3 millennium B.C., 79 individuals) and six Siberian samples (7 – 4 millennium B.C., 179 individuals) was compared, using different kinds of statistics. In total, more than 40 traits were described using ASUDAS and the Russian system of dental analysis. The first result of the analysis demonstrates closer affinities of European samples (Sakhtysh-2, Karavaikha, Fomino burial grounds) with early Siberian groups of C^{14} 7-6 millennium B.C. (Sopka-2, Protoka burials) than with chronologically more closer populations (as Ust'-Isha, Itkul'). Shoveling of upper central incisors is absent in these samples, hypocone reduction is low and frequencies of distal trigonid crest and six-cusped lower first molars are similar among the European and early Siberian series. The differences between these groups are in frequencies of the Carabelli trait of the upper first molars and deflecting wrinkle of lower first molars. The second result of this research is that in the Neolithic population of Western Siberia we can see two components, morphologically differ from each other. One of them is dentally closer to the population of the western part of Eurasia (Sopka-2, Protoka) and the second one is more similar with eastern groups (pooled group from Vengerovo-2, Korchugan, Omskaya stoyanka burials; series from Ust'-Isha and Itkul' burial grounds).

Keywords: Neolithic; paleodontology; Eastern Europe; Western Siberia

Several cases of hypodontia and oligodontia: from dental anomaly to clinical implications

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Hypodontia is one of the most common dental developmental anomalies in humans. Numerous studies examined the incidence and prevalence of hypodontia in different populations. Meta analysis based researches found that prevalence of hypodontia in European Caucasians is 5,5%. Oligodontia, on the other hand, is less common especially if it is a non-syndromic dental anomaly. Theories of evolution suggest that hypodontia is natural part of phylogenetic reduction. Interestingly, some researches have proved that tooth agenesis is more common in females than males. Recent genetic investigations proved certain connection between oligodontia and epithelial ovarial cancer, and hypodontia is suggested to serve as potential risk marker. The purpose of this work is to report several cases of hypodontia or oligodontia in patients treated in our clinics. In all cases the patients were females (girls) age range from 7 to 17. During the routine diagnostic procedures clinical examinations were performed and orthopantomograms were taken. No family history could be established. Clinical implications of these anomalies are numerous, from esthetic and functional to financial. Management of such cases requires multidisciplinary approach. The dental team should include general dental practitioner, orthodontist, pediatric dentist and prosthodontist so that patients could receive full functional and esthetic dental care. Further cooperation with clinical geneticist could be recommended.

Keywords: hypodontia; oligodontia

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