



CEITEC
BRNO UNIVERSITY
OF TECHNOLOGY

ADVANCED MATERIALS AND NANOTECHNOLOGY

SEMINAR SERIES 2018

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Diving into the Marianas Trench of human craniofacial development – Using 3D imaging to explore growth of the head in the middle trimester

FEBRUARY, 20

Tuesday, 10:00

Seminar room S2.02
CEITEC BUT, Purkynova 123

Talk will be given with
Dr. Siddhart Vora.

The middle trimester of human prenatal development is an unexplored period. Embryo collections such as the Carnegie or Kyoto collection have provided great insights into development between 3 and 8 weeks. Beyond this time frame it becomes impractical to visualize development at the whole conceptus level, precluding analysis of right-left symmetry. Evaluation of symmetry is an important way to quantify genetic versus environmental control of development. We carried out 3D and traditional morphometrics studies on the mandibular bone plus tooth crypts on a large collection of intact human heads spanning 12-19 weeks (N = 25). Our first question was whether we could detect shape changes in the mandibular bone over this period. Heads were scanned with conventional or contrast enhanced μ Ct, imported into Amira for segmentation and then exported to Landmark to apply landmarks. The landmarks were then imported into MorphoJ and geometric morphometrics was carried out. The mandible increased in volume in a punctuated manner suggesting underlying growth conditions had changed between 14 and 17 weeks gestation. Linear measurements suggested there would be a concomitant shape change. Surprisingly discriminant function analysis between the average of the 12 week specimens and the average of the 19 week specimens did not detect significant changes in shape. The analysis was carried out on intact mandibles as well as hemimandibles. For a subset of mandibles, a landmark-free, computational shape analysis was performed to compare right and left sides. Here we were able to detect slight asymmetries mainly confined to the mylohyoid ridge and posterior buccal aspect of the body of the mandible where muscles will attach. There is a large degree of symmetry indicating a high degree of genetic control of all the intricate boney processes. We will also present data showing that symmetry extends to the details of the tooth bone interface. Our data suggests that complex patterning of human mandible is largely under genetic control and that the majority of shape change in the mandible probably occurs after the 20th week gestation. www.ceitec.eu