A51 Application of Forensic Palynology in Two Murder Cases

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The goal of this presentation is to show people that are not aware of forensic palynoly how this forensic science can be used and how it works.

This presentation will impact the forensic community by demonstrating a type of forensic science (forensic palynology) that has been neglected in most forensic institutions but in many cases can help to solve some crimes.

In this presentation a computerized semi-automatic 3D forensic cranio facial reconstruction tool is demonstrated. This forensic application is based on a large scale database of facial soft tissue depths of Caucasian adults and a flexible statistical model of face shape used in computerized three dimensional (3D) craniofacial approximations.

This presentation will impact the forensic community by implementing a large scale database of facial soft tissue depths into a 3D forensic cranio facial reconstruction tool which allows for specific correction of gender, age, and body posture.

Mass communication of forensic facial reconstruction models in unsolved identification cases can stimulate recognition by relatives and may provide records to accomplish further comparative analysis. The majority of the reconstruction techniques use earlier published facial soft tissue depth charts collected on cadavers or in vivo. Traditional 3D facial reconstruction techniques apply modeling clay or Play-Doh on a cast of the skull, approximating the estimated tissue depths at the landmarks and interpolating in between. Recent different computerized techniques are evolved to obtain more objective 3D facial soft tissue estimations. In this presentation the application of the implementation of soft tissue thickness described by De Greef et al (2006) into a flexible statistical model of face shape developed by Claes et al (2006) is demonstrated.

De Greef et al performed in vivo facial soft tissue depth measurements on 967 adult Caucasoids employing a user-friendly, fast, mobile and well validated ultrasound measuring device. Data of both sexes, varying in age and body mass index (BMI) were collected at 52 manually indicated facial landmarks. The "A-scan" industrial ultrasound device was selected to perform the tissue dept measurements because of its low weight, compactness, facile transport and its ability to connect a 6mm diameter, 10MHz ultrasound transducer which can easily be pointed to the landmarks during analysis. The repeatability of the ultrasound measurements was tested on a subset of 33 volunteers and their accuracy proved after comparing the ultrasound measurements and the soft tissue thickness calculated from total head CT-scans on 12 patients.

The computer-based combined flexible statistical model for craniofacial reconstruction established by Claes et al requires the achievement of a skin surface and tissue depths database, a statistical face and soft-tissue depth model and a statistical model fitting procedure. The skin surface shape of approximately 350 individuals were captured with a mobile 3D photographic device, after measuring thickness and marking the 52 soft tissue landmarks and registering age, gender and BMI of all the individuals. The constructed statistical facial surface and soft tissue depth tissue model consists of a geometrically averaged facial template together with a correlation-ranked set of modes of principal variations or face-specific deformations that capture the major changes or differences between facial outlooks and their skull- based landmarks in the database. The created elastic mask is subsequently fitted to the external surface of the individual craniofacial skeleton such that all the 52 landmarks of the mask fit the corresponding target skull-landmarks and the estimate of the nose tip.

Multiple reconstructions of the same skull but with different combinations of age, gender and BMI can be made within a few seconds. More specific facial soft tissue changes during aging can be simulated. The automatic adjustment or improvement of the model using face specific modes of variation, results in unbiased and more realistic 3D facial soft tissue reconstructions.

Forensic palynology deals with the application of pollen and spores in solving legal issues, either civil or criminal. The main forensic application is in determining the possibility of associative evidence. Here, two murder cases are shown where forensic palynology helped to link people and objects to the crime scene. In one case, the pollen assemblages from the victim's hair and shoes were compared with soil collected from several places in the crime scene. A very high similarity was observed between the pollen assemblages from the victim's hair and from the soil collected in one of the places sampled from the crime scene. This indicated that the victim fell in that particular spot and was not moved from there. In the other case, pollen assemblages from the suspect's belongings and the victim's hair and shoes, were compared with vegetation (*Adenocarpus complicatus* and *Dittrichia viscosa*) and the pollen assemblage from soil collected in the crime scene. The suspect's shirt and the victim's hair had many *Dittrichia* and *Adenocarpus* pollen (>90%) indicating that they have been in contact with the bushes from the crime scene. The pollen assemblages from the victim's shoes and the soil showed a high similarity with each other. These results very strongly supported the

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contention that the suspect had been at the crime scene and that the victim was not moved from the place where she was found.

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