H11 Taphonomy and Dentition: Understanding Postmortem Crack Propagation in Teeth

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Attendees will understand the taphonomic nature of crack propagation in teeth and the effects of it on the macro-and microstructure of the tooth. Also to be able to discern perimortem and postmortem cracking in teeth at the microscopic and biomechanical level.

This is a pilot study will impact the forensic community by demon- strating a clear difference in the way a crack propagates in fresh teeth and decomposed or decomposing teeth. The ability of differentiating perimortem and postmortem tooth cracking at the microscopic level is shown in this study.

The goal of this poster presentation is to introduce the preliminary results of a pilot study that examines the role of taphonomy, specifically temperature on the dehydration and subsequent alteration in the macro- and microstructure of human teeth. After attending this poster, attendees will be able to understand how to differentiate between enamel and dentin crack propagation in teeth in the perimortem versus postmortem setting using basic microscopic examination techniques. In addition, they will acquire knowledge on the use of *Sus scrofa* teeth as an appropriate analogue for human teeth.

Background: Taphonomy and it effects on the human body is a pervasive factor in the forensic analysis of skeletal remains. There has been much work on decompositional and taphonomic processes, including the effects of duration, exposure to the elements, and temperature on the appearance and quality of the human skeleton. However, there is a limited amount of research focusing on teeth, one of the most durable elements of the human body. In forensic cases, it is common to have teeth that exhibit vertical cracking, usually visible on the labial portion of the anterior teeth. It is thought that these cracks result from the dehydration process of the organic components of a tooth. Therefore, both temperature and the duration of exposure to a given temperature will influence the occurrence of vertical cracking in teeth.

The majority of the work on vertical cracking in teeth comes from the Journal of Dental Research (Rasmussen et al 1976, Brown et al. 1972, Jacobs et al. 1973, Lloyd et al. 1978). Although studies pertaining to enamel or dentin cracking are present since the 1960s, these articles are of little use to the forensic anthropologist as the primary focus of these studies is simulating *in vivo* cracking in teeth, usually as a result of compressive or tensile forces. Due to the lack of research on *taphonomic* effects on vertical cracking in teeth, the current research works to understand the effect of temperature and exposure duration on tooth structure during the process of decomposition.

Methodology: This pilot study uses a sample of 35 *Sus scrofa* mandibular incisors and premolars. The teeth were removed from the mandibles and divided into three groups, each being exposed to a temperature range of 105-120°F for up to fifteen days. Macroscopic observations were made while the tooth's overall was still intact, while the microscopic obser- vations were made from prepared 300mm thick sections at various portions of each tooth.

Analyses: The macroscopic analysis includes biomechanical influence of tooth shape on the susceptibility to cracking, the variation in types of cracks present on the outer enamel, and the variation of the prevalence of cracks and the amount of time it takes for crack formation in each type of tooth. The microscopic analysis includes an examination of crack propa- gation from the external to internal tooth structures on the dehydrated *Sus scrofa* dentition, and compares this to the previously studied crack propa- gation in *in vivo,* or perimortem dentition. Finally, the usefulness of *Sus scrofa* dentition as an analogue for research on human dentition with the macrostructure and microstructure differences and similarities are discussed.

Results: From this pilot study, it is clear that tooth morphology, duration of exposure, and temperature all influence crack propagation in dentition. Additionally, with minimal variation in structural differences but a general difference in tooth morphology, *Sus scrofa* anterior dentition serves well as an analogue to human dentition when examining microscopic crack propagation, but has no predicative ability for human dentition when studying macroscopic tooth morphology as a factor on crack propagation. Finally, the unique microscopic characteristics of the crack propagation path in postmortem, dehydrated dentition can be used as a way to determine trauma to the teeth as postmortem or perimortem.

Tooth, Crack Propagation, Heat

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