

## H1 A Pilot Study on Postmortem Determination of Drug Abuse on Dental Tissues

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**Learning Overview:** After attending this presentation, attendees will have a better understanding of teeth as an alternative matrix for forensic postmortem toxicology and of the incorporation mechanism of substances in different dental tissues.

**Impact Statement:** This presentation will impact the forensic science community by providing an innovative method for studying different dental tissues as possible matrices for postmortem toxicology in drug-related deaths and promising results to develop the forensic odontology application in the field of postmortem toxicology.

Postmortem toxicology constantly deals with the research of reliable alternative matrices useful for pathologists in cases in which the classic matrices for forensic toxicology are not available (e.g., carbonized or skeletonized corpses, human remains, exhumed bodies, etc.). Teeth can be applied as an alternative matrix since they are highly resistant, available, and stable after death. Dental enamel, dentine, or pulp could disclose acute or chronic drugs consumption, given the different tissues' constitutions.<sup>1</sup>

The previous literature does not provide information on the pharmacokinetics of substances and on the mechanism and site of incorporation of xenobiotics into dental tissues.<sup>2,3</sup>

This pilot research aims to investigate whether in the pulp can be detected the same substances found in the blood in drug-related death cases. Second, the study aims to disclose possible deposits of drugs in the hard tissues of the tooth (dentine and/or enamel), and the related degrees of accumulation in different dental tissue, thus contributing to reconstructing the drug abuse history (e.g., timing).

The study experimented with a novel method to separately analyze enamel, dentin, and pulp tissues, which was applied to ten teeth collected during autopsies of drug-related deaths along with blood and hair samples for classic toxicological analyses. Each tooth was prepared by the same forensic odontologist using diamond and multi-blade burs on a turbine above an amalgam aspirator coated with filter paper. Teeth were dissected into two longitudinal halves, and the pulp was extracted from the chamber and roots. The enamel was separated from the coronal dentin by pulverization. The coronal secondary dentin was separated from the primary dentin pulverizing an inner layer of approximately 1.5mm coronal and 1mm cervical thickness. The residual outer coronal dentin was separated from the roots by pulverization, then the roots were pulverized with a hammer. Each dental tissue was extracted with acid for cocaine, opiates, and metabolites and analyzed by Gas Chromatography (GC) and liquid chromatography with High-Resolution Mass Spectrometry (HRMS). The results were then compared with those obtained from blood and hair samples.

Preliminary results demonstrated that teeth are different from any other classic matrix (blood and hair), and the qualitative correlation in detecting substances between pulp/blood and dental hard tissues/hair suggests that they can be useful in postmortem evaluation for both acute and chronic consumption of drugs. The most significant result is that the mechanism of accumulation of substances in mineralized tissues seems to be influenced by the type of molecule and the method of consumption. The innovative method for dental tissues separation is absolutely promising to study the different accumulation of substances in teeth, possibly disclosing both acute and chronic consumptions in forensic cases of drugs-related cases.

### References:

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Forensic Odontology; GC/MS; UHPLC-HRMS

