

# In vitro study on the incorporation of medical and illicit drugs into dental hard tissue

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## Introduction

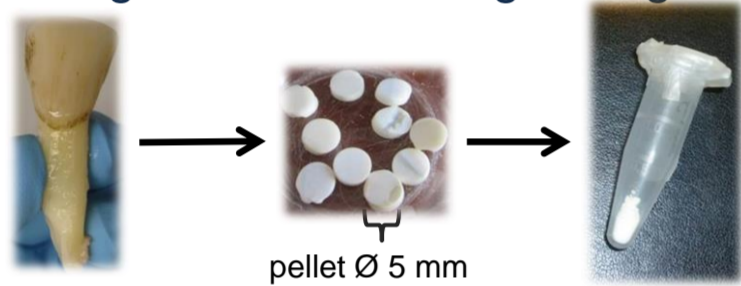


In post mortem toxicology dental hard tissue can be used as an alternative matrix. Until now, relatively little is known about incorporation routes and rates of drugs into components of teeth like enamel and dentin. To investigate incorporation of drugs from oral fluid into these materials, an *in vitro* study was conducted simulating the daily pH cycles in the oral cavity.

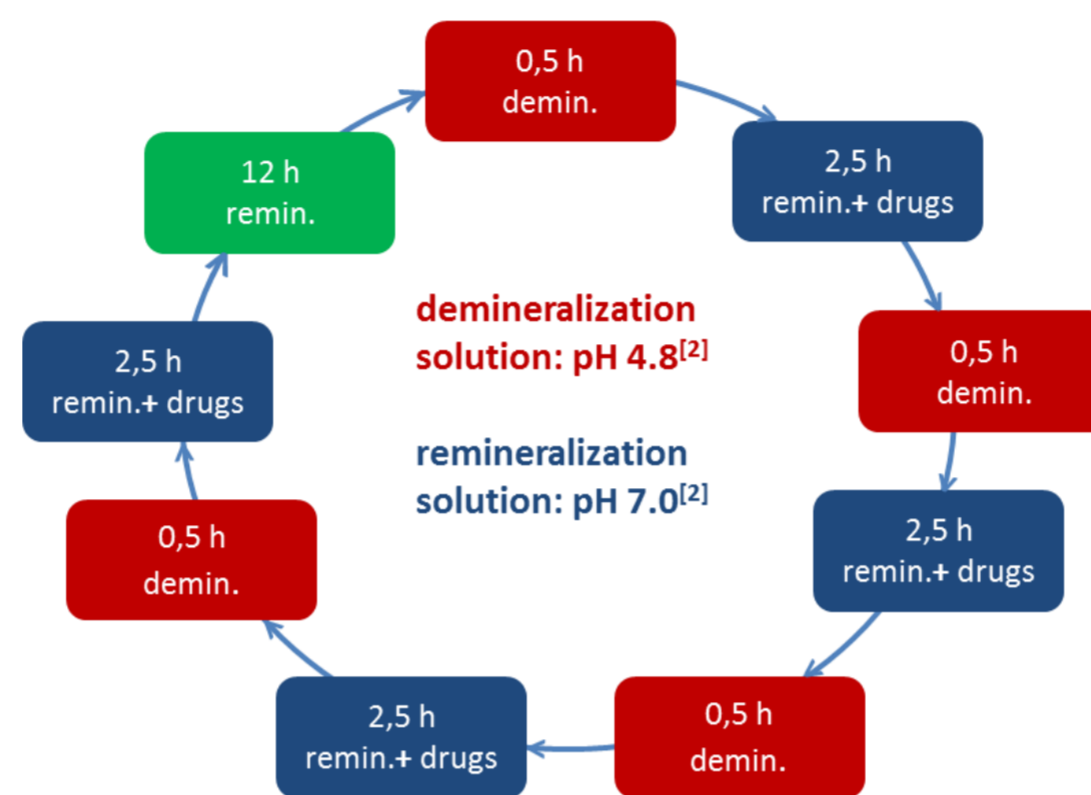


## Materials and methods

- dentin/enamel pellets of bovine teeth
- demineralization for 5 days (pH 5.0)<sup>[1]</sup>
- pH-cycling:
  - duration: 7, 9 and 11 days
  - model drugs: amphetamine, benzoyl-ecgonine, cocaine, codeine, MDA, MDEA, MDMA, methamphetamine, 6-acetylmorphine, morphine
  - concentrations: 0.2 µg/ml, 1 µg/ml, 3 µg/ml
- rinsing with water and grinding



### pH-cycling (per day)



## Analytical method<sup>[3]</sup>

- 50 mg dentin/enamel powder
- addition of deuterated standards
- 3 x 60 min. extraction with methanol and ultrasonication
- evaporation with N<sub>2</sub> at 40 °C
- reconstitution in 100 µl A/B (95:5)

Instruments:

Shimadzu LC-10 + AB Sciex API 5000

Column:

Phenomenex Luna PFP (150 x 2 mm, 5 µm)

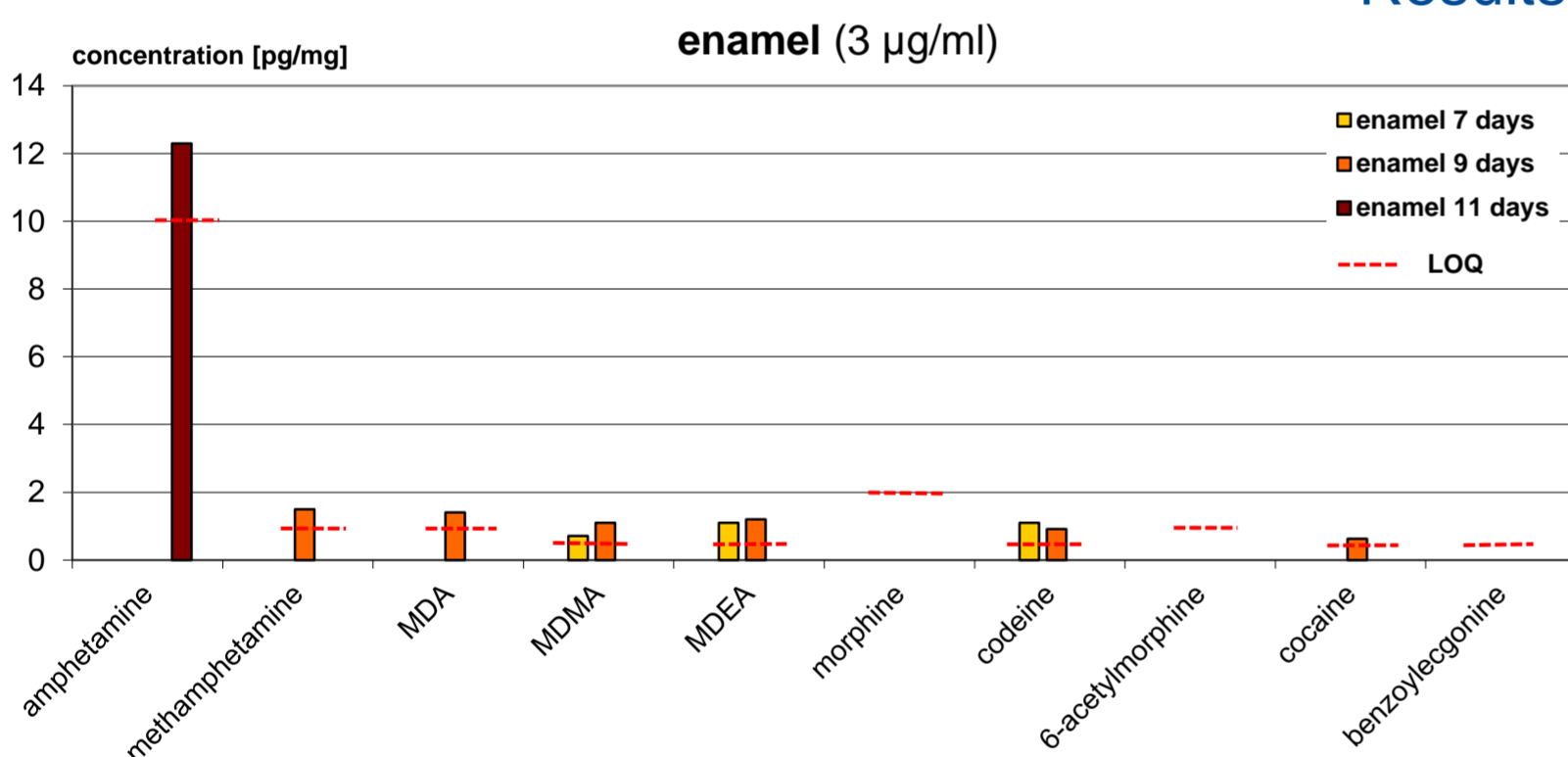
Mobile phase:

A: 2 % HCOOH (v/v) and 20 mM ammonium formate in deionized water

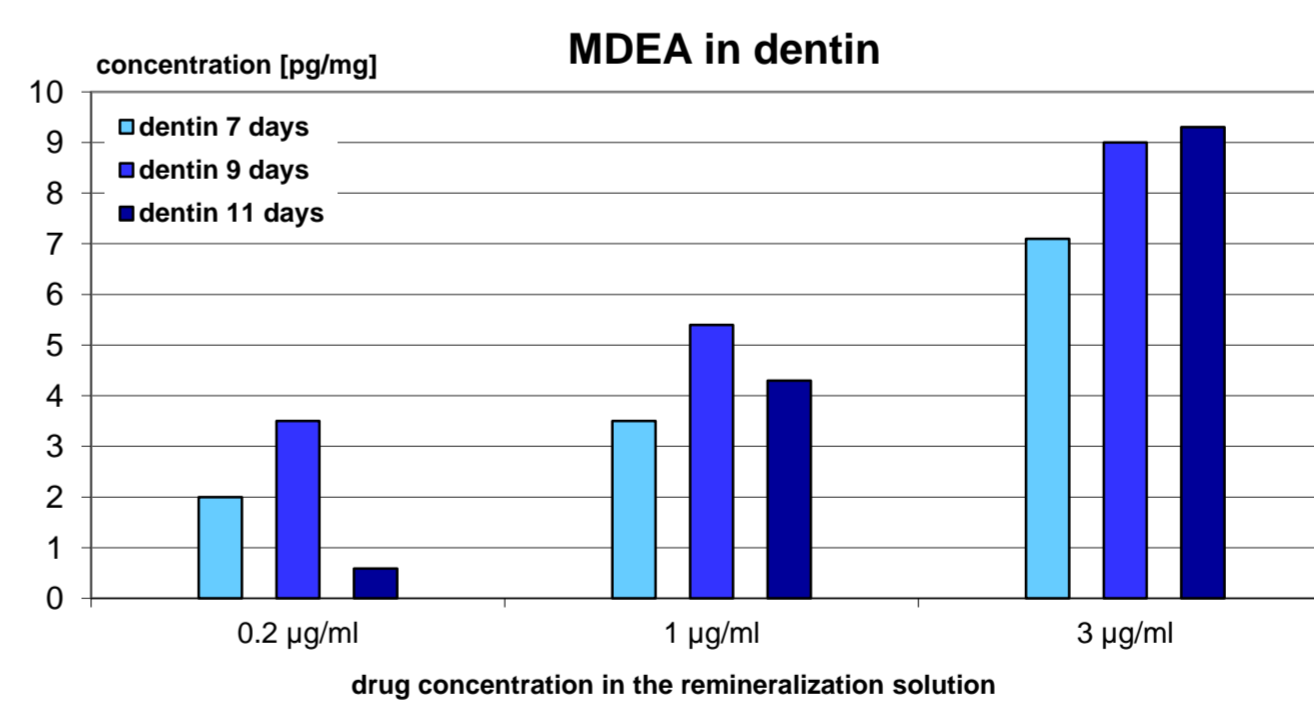
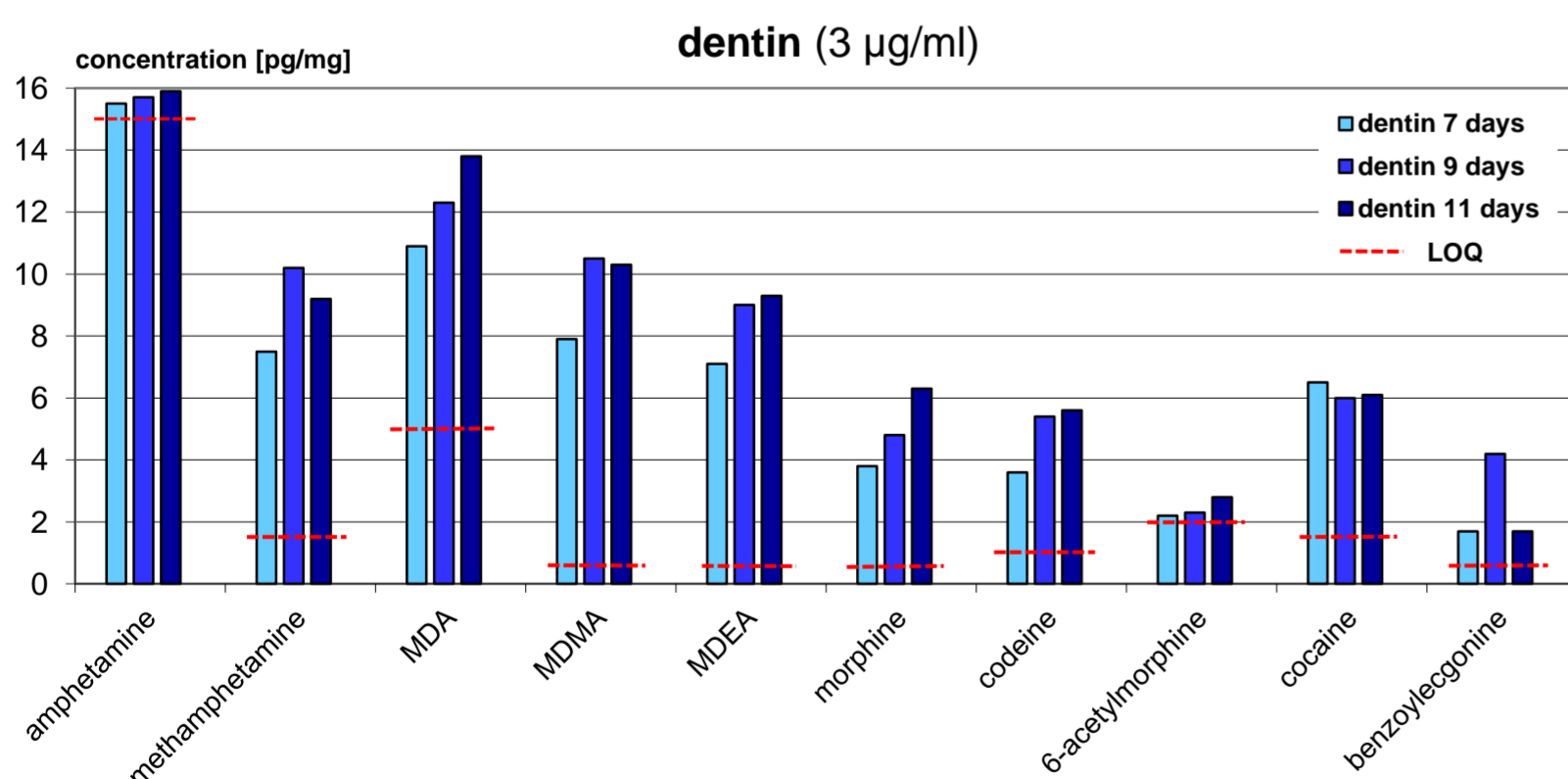
B: 0.1 % HCOOH (v/v) in methanol

C: Isopropanol (post column)

## Results and discussion



Almost all model drugs were detected both in dentin and in enamel. The drugs were detected more often in dentin and in general, the measured concentrations in dentin were about one order of magnitude higher than in enamel. Amphetamine showed the highest incorporation rates in both materials. In almost all dentin samples the measured concentrations of the drugs increase with contact time of the remineralization solutions. Therefore, a time dependency of the incorporated drug amounts can be assumed. Substances containing an amphetamine structure showed higher concentrations than opiates, possibly due to molecule size differences. Comparing morphine to 6-acetylmorphine, the incorporation of polar substances seems to be preferred.



Increase of drug concentrations in the remineralization solution leads to a non-proportional rise of drug concentrations in dentin.

## Conclusions

The detectable amounts of drugs in dentin depend on the physico-chemical properties of the drugs, as well as on their concentrations and on the contact time. The contribution of enamel to the total concentration in teeth seems to play a minor role. Although incorporation rates of drugs from oral fluid into dental hard tissue seems to be low in general, they may lead to detectable concentrations in drug users. Molecule size and polarity seem to play a decisive role in efficiency of incorporation. In addition, other routes of incorporation have to be considered in future studies.

## References

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