

Detection of Opiates in Dentin after Simulated Drug Uptake

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Objective

Incorporation of medicinal and illicit drugs into dental hard tissues has been shown by previously conducted *in vitro* studies^[1] and analysis of post mortem samples^[2]. Aims of the presented *in situ* study were to investigate the drug concentrations in dentin samples after simulation of single or daily opiate uptake and to estimate the window of detection.

Methods

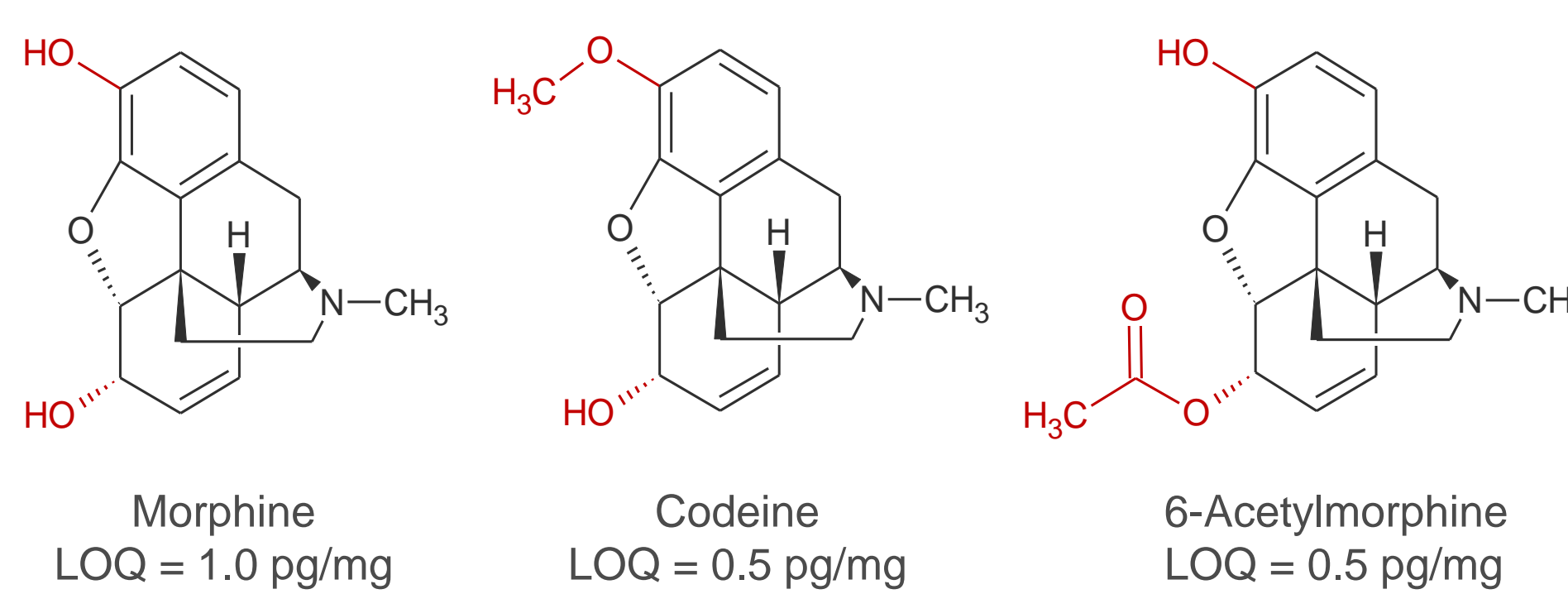


- Five volunteers
- Intraoral appliances with 3 or 4 bovine dentin samples
- Appliances incubated for 30 minutes in drug solution
- Drug solution (10 µg/mL): morphine, codeine, 6-acetylmorphine
- Analytical preparation: rinsing with water, drying, grinding, extracting with methanol → quantitative analysis by LC-MS/MS

Incubation	Sample removal
1 x 1 day	after 16 hours
3 x 7 days	after 16 hours
3 x 7 days	after 40 hours

Results and discussion

- All opiates could be detected in dentin after repeated as well as after single drug exposure.
- Concentrations ranged from approx. 0.25 pg/mg to 5.5 pg/mg (without outliers).
- Only low differences between the concentrations measured after single and repeated drug exposure (see Fig. 1 and 2).
- One volunteer usually showed the highest measured concentrations in dentin.
- Morphine showed the highest incorporation rates.



- Concentrations are given as average of the respective 3 or 4 dentin samples.
- Concentrations of one volunteer were more than one order of magnitude higher than the other concentrations (see Fig. 2) → outliers
- Mean and median were calculated without outliers.
- Concentrations below the limit of quantification (LOQ) were extrapolated.

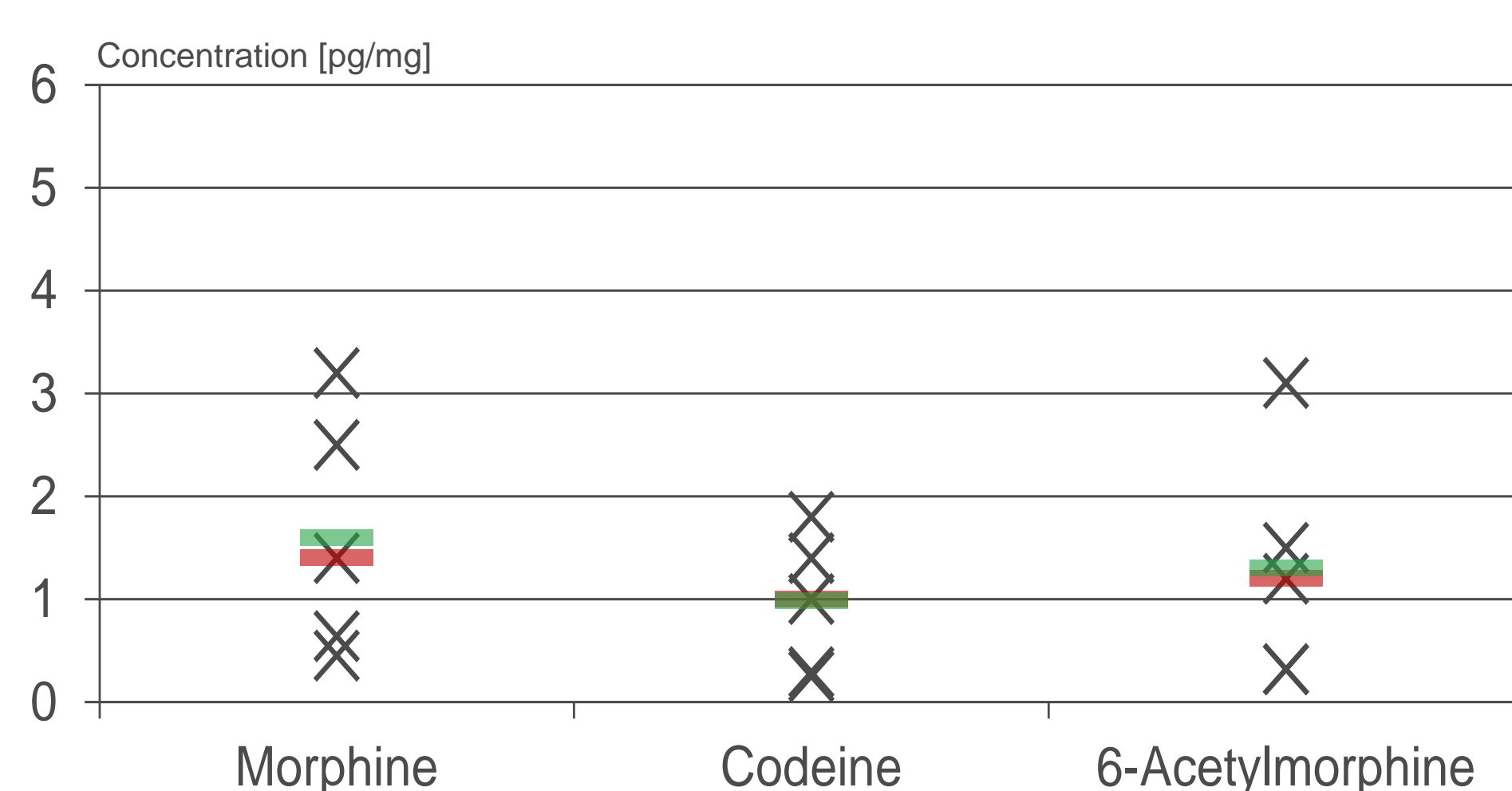


Fig. 1: Results after **one time** incubation, sample removal after **16 h**

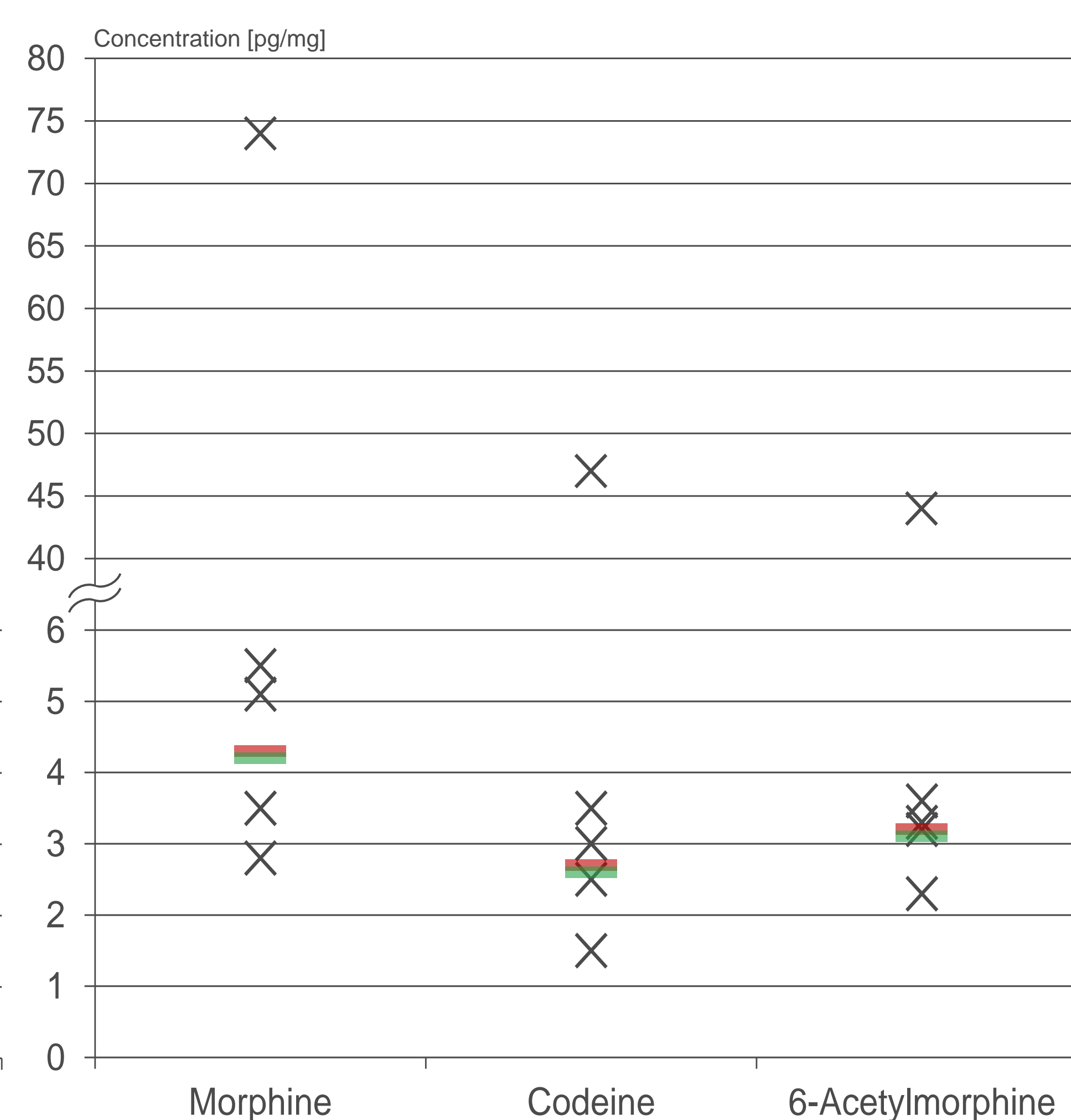


Fig. 2: Results after **three times** incubation over 7 d, sample removal after **16 h**

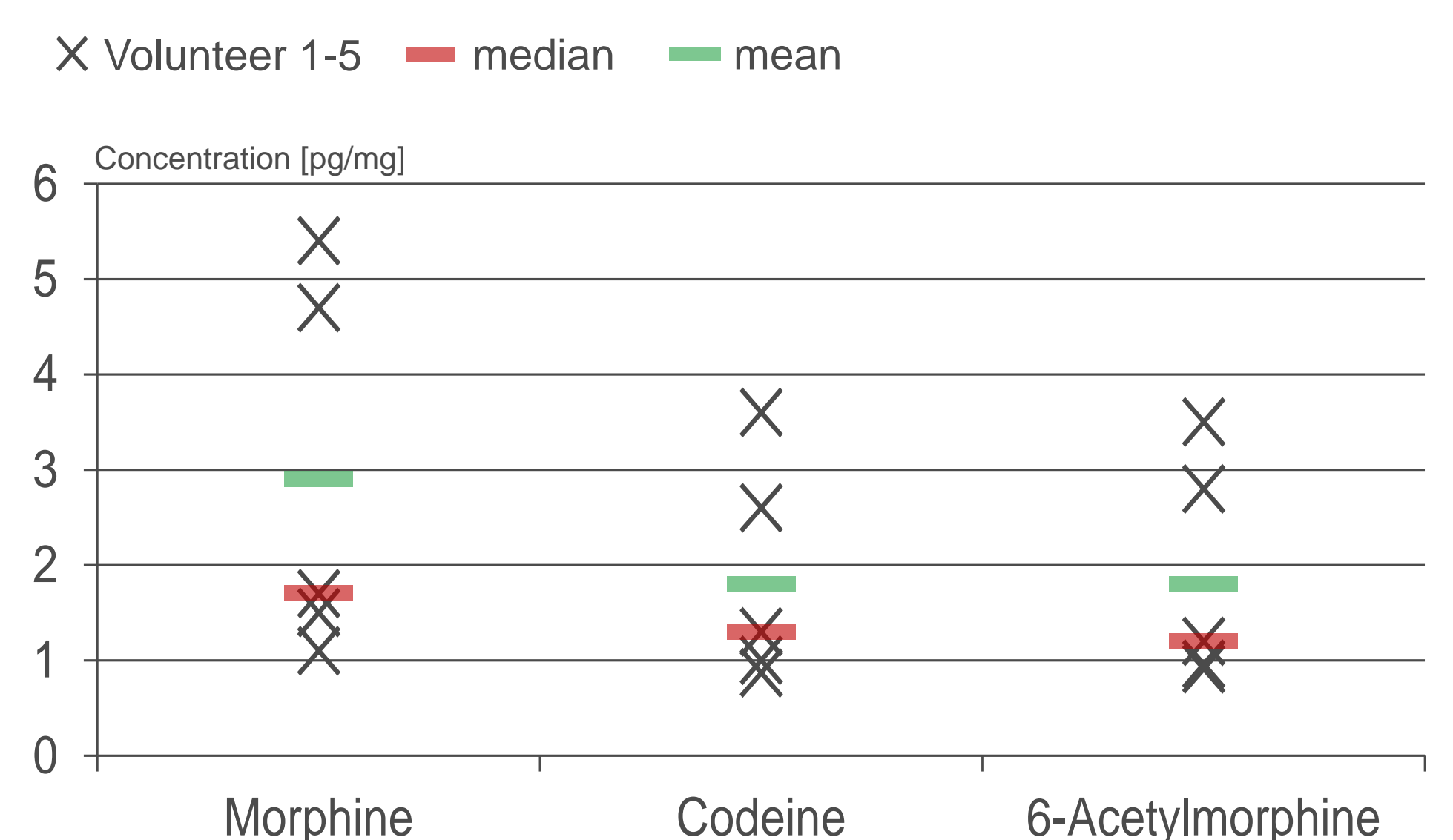


Fig. 3: Results after **three times** incubation over 7 d, sample removal after **40 h**

Conclusions

The study shows that a simulated, repeated drug uptake over seven days is detectable for at least 40 hours. Even a single simulated drug uptake is detectable after 16 hours. The relatively low differences between the concentrations reached after single and repeated drug exposure (16 hours) suggest a finite binding capacity of dentin for the drugs. This is also supported by the rather small decrease of concentrations in case of sample removal after 40 hours compared to 16 hours.

References

- [1] Spinner, J., Klima, M., Kempf, J., Huppertz L. M., Auwärter, V., Altenburger M. J., Neukamm M. A., Determination of drugs of abuse in bovine dentin using liquid chromatography-electrospray ionization tandem mass spectrometry, *J. Mass. Spectrom.* **2014**, 49, 1306-13
- [2] Klima, M., Altenburger, M. J., Kempf, J., Auwärter, V., Neukamm, M. A., Determination of medicinal and illicit drugs in post mortem dental hard tissues and comparison with analytical results for body fluids and hair samples, *Forensic Sci. Int.* **2016**, 265, 166-171

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