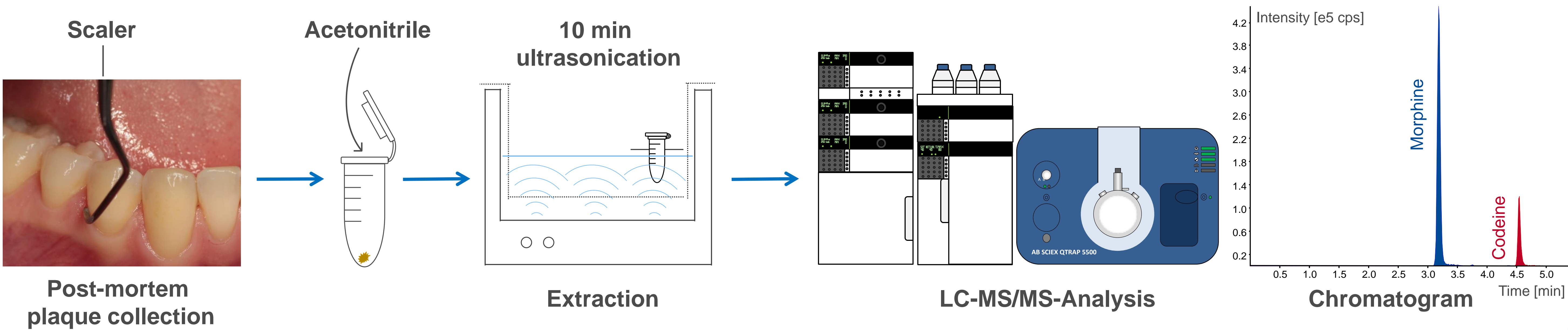


Goals

Non-mineralised dental biofilm (plaque) as material for drug analysis might extend the spectrum of common biological matrices (e.g. blood, urine, hair) used in forensic toxicology. Especially in post-mortem toxicology, analysis of plaque could provide crucial information for casework. So far, the retention of extraneous substances in plaque has been investigated only sparsely. Hence, post-mortem plaque samples from nine intoxication cases were analysed for illicit and medicinal drugs using liquid chromatography-tandem mass spectrometry (LC-MS/MS). Since opioids show a high prevalence in intoxications, findings for morphine and codeine in plaque are highlighted here. The results were compared to those of routinely analysed hair and body fluid samples.

Methods



Results

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Dried mass plaque sample [mg]	1.6	6.3	1.0	3.7	2.4	3.9	4.4	1.0	0.76
Morphine									
Femoral blood [ng/mL]	310	54	1,200	810	1,500	×	×	×	×
Urine	✓	✓	✓	✓	n.a.	✓	×	×	×
Hair (proximal-distal) [pg/mg]	n.a.	870 – 680	170 – 240	210	190 – 180	67 – 78	520 – 740	×	×
Plaque [pg/mg]	43	~ 490	1,400	~ 3,700	~ 8,100	~ 3.6	~ 5.8	14	90
Codeine									
Femoral blood [ng/mL]	21	~ 2.4	130	82	×	×	×	×	×
Urine	×	✓	✓	✓	n.a.	×	×	×	×
Hair (proximal-distal) [pg/mg]	n.a.	240 – 140	×	230	×	~ 41 – ~ 55	140 – 140	×	×
Plaque [pg/mg]	290	44	400	750	~ 2.8	~ 0.43	×	×	×

Table 1: Results Case 1 – 9, ✓ = detected (not quantified), × = not detected, n.a. = not analysed, ~ = approximately (extrapolated)

Findings

Morphine:

- Plaque samples positive: 9/9
- Concentration range: ~ 3.6 to ~ 8,100 pg/mg
- Median value: 90 pg/mg

In two cases (7 and 8) morphine has not been detected in the investigated body fluids (femoral blood and urine) but in hair and plaque. In case 9 morphine has been exclusively found in the plaque sample. In cases 1 – 6 morphine has been detected in plaque as well as in hair and body fluid samples.

Codeine:

- Plaque samples positive: 6/9
- Concentration range: ~ 0.43 to 750 pg/mg
- Median value: 167 pg/mg

Codeine has been exclusively found in plaque and in no other material in case 5. Besides plaque, only femoral blood or hair were positive for codeine in case 1 (no hair available in this case) and 6. In case 2 and 4 codeine was found in all investigated materials and in case 3 in all samples but the hair sample.

Case History and Discussion

Cases 1 – 4: A **heroin overdose** led to death. High concentrations of morphine and codeine in femoral blood, as proof for a recent uptake of heroin, were also reflected in the investigated plaque sample.

Case 5: A **morphine overdose** was fatal and led to high morphine concentrations in femoral blood as well as in plaque. Additionally, hair analysis proved a regular morphine uptake over a sustained period of time.

Case 6 – 8: **Heroin use** was not fatal but a **regular**, non-recent use has been reported. Consistently, morphine and codeine were not found in body fluids (except for case 6) but in hair, which represents a larger window of detection than body fluids. In all cases morphine was detected in plaque as well.

Case 9: A **history of heroin addiction** has been reported, but neither morphine nor codeine were found in any routinely investigated material. Hence, morphine findings in plaque served as the only analytical evidence for a possible heroin uptake.

Conclusions

The results show that **opiates are retained in plaque** and can be detected using the here-presented method. Compared to other matrices (especially body fluids), plaque may offer a **larger window of detection** as demonstrated in three of nine cases. In one case morphine was exclusively found in plaque confirming an uptake of opiates that would have been missed by the routinely analysed matrices. Therefore, plaque might be a suitable **additional alternative matrix** in forensic toxicology, especially if other material is not available (e.g. burned bodies).

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