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Analysis of paired blood and oral fluid specimens from randomly selected nighttime drivers

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AIMS: The aim of the study was to determine the feasibility of collecting paired blood and oral fluid specimens from a nighttime driving population, and analyzing them for drugs.

METHODS: Drivers were stopped at random, at six different locations within the USA. They were asked to consent to a survey, an oral fluid collection, a blood sample collection and a breath alcohol test. Participation in the study was entirely voluntary, however, subjects were given a small monetary incentive for providing biological samples. The specimens were shipped overnight to the laboratory for analysis. The laboratory was completely blinded to the pairing system, and the data were provided back to the study group as individual specimen results. Overall, six hundred and thirty-nine oral fluid specimens were collected using the Quantisal™ device, which collects 1 mL of neat oral fluid, and 394 blood samples were taken. All subjects providing a blood sample also provided an oral fluid. The specimens were tested for the drugs shown in Table 1. All specimens were screened using ELISA technology and confirmed (if positive) using gas chromatography mass spectrometry (GC/MS) or liquid chromatography – tandem mass spectrometry (LC/MS/MS) using fully validated procedures which determined the precision, accuracy, interference, linearity and limit of quantitation of the methods.

Drug Class	Cut-off concentrations (ng/mL) ORAL FLUID		BLOOD	
	ELISA Screening	*Confirmation*	*ELISA Screening*	*Confirmation*
Cocaine, BZE	20	8	25	5
Opiates	40	10	25	5
Oxycodone	25	10	25	5
Methamphetamine	50	50	25	5
Amphetamine	50	50	25	5
Cannabinoids	4	2	10	0.5
Phencyclidine	10	10	5	5
Benzodiazepines	20	10	20	1
Barbiturates	50	50	500	500
Methadone	50	25	50	5
Tramadol	50	25	50	5
Sertraline	50	25	50	5
Fluoxetine	50	25	50	5
Zolpidem	10	10	10	5
TCA's	25	25	25	5
Methylphenidate	10	10	10	5
Carisoprodol	100	50	500	500
Ethanol	20 mg/dL	20 mg/dL	20 mg/dL	20 mg/dL

TABLE 1. *Cut-off concentration and limit of quantitation (ng/mL) used for analysis of oral fluid and blood*

RESULTS: Overall, 96 samples were positive for drugs, and there were 144 total drug positives, since some were positive for multiple drugs (Tables 2 and 3). Even though blood alone accounted for 29 of the total positives, five of those were positive for benzodiazepines, and nine for low-level THC-COOH, with no parent THC present, suggesting marijuana use was not recent. Samples screening negatively were not confirmed by mass spectrometry.

Analytical result	Number of samples	% of total
Oral fluid and blood positive	33	34.3
Oral fluid positive	6	6.25
Blood positive	29	30.2
Oral fluid positive; blood refused	28	29.1
Total	96	100 %

TABLE 2. *Overall results from specimens collected at the roadside*

Drug Class	Number of positive samples	
	ORAL FLUID	BLOOD
Amitriptyline/nortriptyline	1	1
Amphetamine/methamphetamine/MDMA/MDA/MDEA	4	3
Barbiturates	2	0
Benzodiazepines	1	6
Carisoprodol/meprobamate	1	1
Cocaine/benzoylecgonine	14	1
Fluoxetine	4	8
Methadone	1	0
Opiates (hydrocodone, oxycodone, codeine, morphine, 6-AM)	4	4
Pseudoephedrine/phentermine/phenylpropanolamine	2	8
Sertraline	5	9
THC (THC-COOH, 11-OH-THC)	37	20
Tramadol	2	2
Total	78	66

TABLE 3. *Overall results from specimens collected at the roadside*

There were more cocaine and marijuana positive results from oral fluid than from blood. In this study, oral fluid was only tested for THC, while blood was tested for THC, 11-OH-THC and THC-COOH. In any future study, THC-COOH analysis can be included for the oral fluid samples to a concentration of 2 pg/mL.

CONCLUSIONS: The collection device is an important part of this data, since it provides a known amount of oral fluid, and sufficient sample volume for multiple drug analysis as described. Oral fluid is an extremely viable biological matrix for the detection of drugs in drivers if sufficient sample volume is collected, and a transportation buffer able to release drugs from the collection pad is used. The individual collection compliance was considerably better than blood, with oral fluid accounting for more total positives. The impairing drugs, THC and cocaine were present at higher rates and in higher concentration in oral fluid than blood, and some of the legal drugs such as carisoprodol, hydrocodone, methadone and tramadol were also detected in oral fluid. However, the low saliva: plasma ratio of benzodiazepines caused some difficulty with their detection in oral fluid.

KEYWORDS: *Oral fluid, Blood, Driving*

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