Investigating The Presence Of Drugs Of Abuse In Oral Fluid Using Surface Enhanced Raman Spectroscopy (SERS) As A Possible Application For A Roadside Screening Device.

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Abstract
There is an increasing demand from politicians and the general public for a roadside screening device for the detection of drug drivers. A method of qualitatively determining a major illicit drug group and its associated metabolites present in oral fluid using Surface Enhanced Raman Spectroscopy (SERS) is presented. Experimental results for amphetamines and substituted amphetamines will be discussed. Details of sampling, sample preparation and experimental method used to validate this technique are given.

Introduction
In recent months the incidence of reports on drug use amongst young adults and especially those of driving age has increased considerably. Defining objective limits using a practical roadside screening device is proving difficult and is not aided by the increasing trend of poly-drug abuse. Within the United Kingdom a subset of field impairment testing techniques has been developed from the American Drug Recognition Expert Program. Training in these techniques is available to police officers who express an interest in recognising drug impairment. However, this to date has not been incorporated into their routine training. There is evidence to support the effectiveness of these tests at the roadside for identifying individuals who warrant further investigation for being under the influence of drugs. However, if these tests were to be used in conjunction with a quick and simple roadside screening test this would have an added deterrent effect as well as enabling drug detection, thereby increasing the number of professional tools available to a police officer.

Methods
A group of twenty-five volunteers from a rehabilitation clinic were recruited to participate in the study. The group was comprised of individuals (18-65 years) involved in the stimulant maintenance program at the clinic. Each volunteer was recruited whilst waiting for their appointment to receive their daily medication. The volunteers were asked to complete a self-assessment questionnaire and provide two oral fluid samples. The first sample was collected without the aid of instructions and the second with instructions to enable the effectiveness of issuing clear directions to be evaluated and allow a comparison of the drug profile. The two samples were then analysed using SERS followed by confirmatory Liquid Chromatography/Photodiode Array (LC) analysis in-house. Twenty-five control group volunteers (18-65 years) were also recruited and underwent the same experimental procedure. Each subject was required to read and sign a consent form before they participated in the study.
The oral fluid samples were collected by the subject using two cotton Salivette swabs. The first swab was presented to the subject with minimal instructions. The subject was told to place it in his/her mouth and leave it there for a designated period of time (up to 5 minutes). During this time period the subject was free to move it around his/her mouth, chew on it, suck on it, etc. The subject then removed the Salivette from his/her mouth and replaced it in the sterile container that it had originally been removed from. The subject was then given the second swab. Instructions were then given to the subject requiring him/her to place the swab on his/her preferred side of the mouth between the teeth and jaw line and leave it in position for a designated period of time. The Salivette again was removed by the subject and replaced in the sterile container that it had removed it from. Both samples were stored in an icebox until they were transported to the laboratory and frozen until required for analysis.

The sample was defrosted and then centrifuged to ensure that all of the oral fluid was removed from the cotton swab. A pellet of oral fluid remained in the bottom of the Salivette container. Half of the sample was removed for SERS analysis and the second half was stored for confirmatory LC analysis.

SERS is a spectroscopic form of analysis using a suitably conditioned metal surface to facilitate Raman signal enhancement. A small cotton swab was placed in the oral fluid sample that was being used for the SERS analysis and that sample transferred onto a suitably conditioned metal surface. This metal surface/oral fluid sample was placed under a Renishaw Raman Microscope for excitation with a 633nm Helium/Neon laser. The laser beam was focused onto the sample using a X20 microscope objective for a total time period of 10 seconds and a SERS spectrum captured. Component identification was performed by comparing the captured spectrum to a database.

The subjects were also asked to complete a self-assessment questionnaire which included questions about their current drug usage through their maintenance program and any drugs they had taken outside of it. This information was kept confidential and not released to the clinic. The samples and questionnaires could be cross-referenced using a barcode unique to each subject. The barcodes were also used to match the oral fluid samples and questionnaires with a subject’s consent form if they wished to withdraw from the study. The same process was used for the control group.

**Results**
The findings of this experimental work will be presented at the conference. Work at the time of writing is ongoing and the results are not available for preliminary comment.

**Discussions**

**References**

**Journal Articles**


**Book Chapter**


**Conference Paper**


**Acknowledgements**
Our thanks to Strathclyde University for the supply of the suitably conditioned metal surfaces.