Is sweat a suitable specimen for DUI testing?

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INTRODUCTION

It is generally accepted that chemical testing of biological fluids is the most objective means of diagnosis of drug use. The presence of a drug analyte in a biological specimen can be used as evidence of recent exposure. The standard in drug testing is the immunoassay screen, followed by the gas chromatographic-mass spectrometric (GC/MS) confirmation conducted on a urine sample. More recently, a variety of body fluids other than urine, such as saliva (1,2) and sweat (3,4) have been proposed to document recent drug exposure.

The advantages of saliva or sweat over traditional media are obvious: collection is almost noninvasive, relatively easy to perform, and in forensic situations it may be achieved under close supervision of law enforcement officiers to prevent adulteration or substitution of the samples. In addition, it has been claimed by some authors that the concentrations of many drugs in saliva correlate well with blood concentrations, which suggests that quantitative measurements in saliva may represent a technique of value to determine the current degree of exposure to a definite drug at the timepoint of sampling.

Among various possible applications in the field of clinical or forensic toxicology, particular attention has been recently paid to the use of saliva (5,6) or sweat (7) for roadside testing of subjects suspected of impaired driving, as a consequence of the increasing interest expressed by the authorities of several countries towards the problematics of driving under the influence (DUI) of psychoactive drugs.

In relation with the French Ministry of Transportation, our Laboratory has developed a research program on the applicability of sweat testing for DUI control. Considering that a *conditio sine qua non* for such drug testings is that they can be organized in the same way as alcohol testings are (i.e. systematic controls directly carried out on the roadside by police
officers with minimal scientific background, and obtention of immediate results allowing, if positive, the immobilization of the vehicle and the suspension of the driver's license until eventual confirmation tests), it has been especially emphasized that they should fulfill the following requirements: 1) acceptability by the population, which compels the sampling procedure to be simple, fast and noninvasive, and 2) simplicity and rapidity of sample handling and analysis, which practically restricts the choice of techniques to non-instrumental immunoassay.

Recently (8), the Drugwipe™ (Securetec, Vagen, Germany), a non-instrumental immunoassay designated for use on site to obtain indications of the presence of illegal drugs (opiates, cocaine or cannabis) on surface was used to document drug fatal overdoses when used as a skin swab. By wiping the skin on the arm-pit, it was demonstrated that the opiate Drugwipe tests matched the results of blood and urine examinations in more than 80% of the cases.

This report describes the use of the Drugwipe opiates for sweat testing after single oral administration of 60 mg of codeine to 6 subjects.

EXPERIMENTAL

Presentation of the Drugwipe
The Drugwipe test kit is designed for use on site in order to obtain indications of the presence of illegal drugs on surface. Basically, all smooth surfaces are suitable for testing. Moderately rough surfaces (suede, textiles, surface of the body...) should be wiped carefully. The Drugwipe elements are presented unitary in a closed protective foil, stored at ambient temperature. Different tests are available for opiates, cocaine and cannabis. According to the manufacturer, a positive test result for the Drugwipe "opiate" is obtained with 5 ng heroin, morphine or codeine.

The test function is based on an immunological detection method. The drug particles captured by the wiping section are transferred to the chromatographic strip. During immersion in tap water the test absorbs an adequate volume for chromatography. The water passes through the zone with binding specifically to various opiates. Excess conjugate is held back by a retention
zone with immobilized morphine deviate, so that only the conjugate laden with the wiped off
drug particles reaches the detection field. Depending on the quantity wiped off, a coloration
ranging from cream white to red will result (9).
The Drugwipe opiates tests were offered by Securetec.

**Subjects**
Six subjects, aged 25 to 36 years were recruited from laboratory personnel. All denied use of
codeine during the 3 previous months. The week before enrollment, two urine tests were
performed; the results were negative. Four males and 2 females participated in the protocol.
They signed an informed consent agreement and were not paid for participation.

Sixty mg of codeine phosphate were orally administered along with 100 ml water.

**Sweat collection and analysis**
The wiping section of the Drugwipe was used to swab the forehead of the subjects for 10 sec,
after 1, 4, 9 and 24 hours codeine administration. The results were obtained as described
previously for surfaces. At the same time, for each period, a Pharm-Chek™ sweat patch
(PharmChem™ Laboratories, Menlo Park, CA) was applied to the outer portion of the
upper arm. Codeine was then quantified in the patch by GC/MS according our procedure (10)
and the measured concentrations used as reference.

**RESULTS**

According to the manufacturer, it is not necessary for the read-out field of the Drugwipe to
show an even coloration. The coloration of part sections of the read-out field (on the edge, for
example) according to reference coloration also qualifies as a positive result. Coloration
remains at least stable for 1 hour.

Results of the Drugwipe tests are obtained in less than 5 min. The analyses for sweat are
presented Table I. As demonstrated by the results, codeine can be easily detected in forehead
sweat using the Drugwipe. By comparison with the sweat patch, it seems that the positive cut-
off for the Drugwipe is close to 10-12 ng/patch of codeine. Concentrations in the patch are in
the range of previously reported values (10). It was not possible to evidence codeine exposure with the Drugwipe in the case of subject 2.

DISCUSSION

The Drugwipe method may provide a rapid way to gather data about drug use without the embarrassment often felt when obtaining urine samples. Clearly, sweat drug tests can reveal the presence of a pharmacologically active drug in an individual at the time of testing. Reference methods, like the sweat patch technology, can provide valuable information in diagnostics, treatment and forensic investigations of individuals suspected of drug abuse. With the exception of one female, all the subjects tested positive with the Drugwipe in sweat with a positive cut-off of 10-12 ng/patch. No explanation was found to document the absence of positivity observed with subject 2. She was not under medical treatment and no drugs were detected after urinalysis. However, before using the Drugwipe in routine for sweat, standardization of the collection of the specimen must be established. At this time, the Drugwipe will constitute an excellent non-instrumental immunoassay, that will be rapid, sensitive and applicable on noninvasive biological samples.

Table 1: Sweat analysis using the Drugwipe and the sweat patch for the 6 subjects

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Time after codeine administration (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Wipe Patch</td>
</tr>
<tr>
<td>1</td>
<td>- 12</td>
</tr>
<tr>
<td>2</td>
<td>- 8</td>
</tr>
<tr>
<td>3</td>
<td>+ 27</td>
</tr>
<tr>
<td>4</td>
<td>+ 20</td>
</tr>
<tr>
<td>5</td>
<td>- 3</td>
</tr>
<tr>
<td>6</td>
<td>+ 24</td>
</tr>
</tbody>
</table>

For the Drugwipe : (+) : positive result, (-) : negative result
For the patch : all concentrations in ng/patch
REFERENCES


