

Deposition Characteristics of Methamphetamine and Amphetamine in Fingernail Clippings and Hair Sections

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Abstract

Fingernail clippings collected from 97 consenting females, who admitted amphetamines and/or opiates use and are currently under treatment, were quantitatively analyzed for the presence of methamphetamine and amphetamine. Sixty-two subjects were found positive for methamphetamine/amphetamine. Paired nail-hair specimens were collected from 6 of these subjects for a 12-week period and analyzed to determine the duration of detectability and deposition characteristics of amphetamines in fingernails; whether data derived from the analysis of nail clippings and hair sections are reflective of drug use patterns; and whether there is a relationship between the analytical data derived from the paired nail-hair specimens. Typical sample pre-treatment procedures and GC-MS protocols were evaluated to establish the validity of various analytical parameters and to ensure that the resulting data can be properly interpreted. Major findings include 1. Methamphetamine was found in the nails of 62 subjects collected in Week 0. The distribution of methamphetamine concentrations (ng/mg) in these nail samples are range, 0.46–61.50; mean, 9.96; and standard deviation: 13.33. The corresponding data for amphetamine are < 0.20–5.42, 0.93, and 1.01, respectively. 2. Sectional analyses of hair samples collected from 6 subjects in Week 0 show methamphetamine concentrations peak at different distances from the root. 3. The concentrations of methamphetamine and amphetamine in nail clippings are generally lower than the first 1.5-cm section of hair samples collected at the same time from the same individual. 4. Amphetamine/methamphetamine concentration ratios in nail clippings and hair samples are comparable. 5. Methamphetamine concentration in the nail clippings collected at Weeks 0, 4, 8, and 12 decreases in a pattern similar to that exhibited by the first 1.5-cm sections of the hair samples collected at the same time.

Introduction

There have been a very substantial number of studies addressing the analysis of hair for the detection of abused drugs

(1), and fewer reports have been devoted to the study of nail as the specimen for the same purpose. With respect to the use of nail as an analytical specimen, studies directed to the study of amphetamines (2–4) have not been as thorough as those addressing other commonly abused drugs, such as cocaine (5–8), opiates (6–9), cannabis (10), and methadone (11). (See Table I for summary of these studies.) Although limited in number, these studies have, however, undoubtedly demonstrated that nails can be used for detecting drug exposure.

In this study, fingernail clippings were collected from 97 consenting females who admitted the use of amphetamines and/or opiates and are currently under treatment. Female subjects were chosen for this study because the length of their hair tends more suited for monitoring drug contents in an extended time period. Specimens collected were analyzed quantitatively for methamphetamine and amphetamine. Paired nail-hair specimens were collected from 6 subjects with positive methamphetamine/amphetamine test results for a 12-week period and analyzed to study the duration of detectability and deposition characteristics of amphetamines in fingernails; whether data derived from the analysis of fingernail clippings and hair sections can be reflective of drug use patterns; and whether there is a relationship between the analytical data derived from the paired nail-hair specimens.

Experimental

Control/blank, specimen, reagents, and standard

Fingernail clippings collected from four laboratory personnel (on a monthly basis) are used for growth rate determination and as analytical controls/blanks.

The following specimen sets were collected from 97 consenting female drug users who are currently under treatment: Set A, fingernail clippings from 97 subjects; Set B, series of fingernail clippings from 8 subjects—fingernail clippings were continuously collected (in 4-week intervals) for a 12-week period from 8 subjects with higher concentrations of amphetamines; and Set C, series of paired hair-fingernail

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