Smoking, Puff Topography and Stimulant Use

Sarah E. Evans, Ph.D.

February 28, 2007

David Geffen School of Medicine at UCLA
Department of Psychiatry and Biobehavioral Sciences
Semel Institute for Neuroscience and Human Behavior
Acknowledgments.

UCLA Stimulant Abuse and Addiction Research Group

• Thomas F. Newton, M.D. & Richard De La Garza, II, Ph.D.
Introduction.

• Non-traditional career path
• Why tobacco research?
• Innovative device
• Stimulant studies
Non-traditional career path

- Educate Congress regarding the importance of research
  - seminars, publications designed for non-scientists
- Educate scientists in productive dialogue to expedite activities related to research
  - Conferences on communication, how to testify before Congress
  - Interaction with government officials
  - Education regarding appropriations process
- Lobby
  - Increased funding for NIH
  - HR 1271, Family Privacy Protection Act (absolute parental consent)
- Learned rejection
Career path, graduate school: why nicotine?

- 1612: First commercial tobacco crop was grown in Jamestown, VA
- Virginia Commonwealth University

**Richmond Times-Dispatch**

TOBACCO TOWN, USA

PHILIP MORRIS USA WILL MOVE ITS NYC HEADQUARTERS HERE IN JUNE
Overview.

- Smoking kills >400,000 Americans/year.
- Quitting smoking reduces risk of tobacco-related death and disease.
- Quitting smoking reduces economic losses
- Medications (bupropion, varenicline) and nicotine replacement (transdermal nicotine, gum, lozenge, inhaler) help smokers quit.
- Nicotine is addictive
Neurochemical Effects of Nicotine

Nicotine

- Dopamine → Pleasure
- Norepinephrine → Appetite Suppression
- Acetylcholine → Arousal, Cognitive Enhancement
- Vasopressin → Memory
- Serotonin → Mood Modulation
- ß-endorphin → Anxiety Reduction

Benowitz NL. Primary Care. 1999; 26: 619.
Clinical evidence for reinforcement and withdrawal.

• Nicotine is a reinforcer in humans
  - Robust self-administration of pure nicotine and tobacco-delivered nicotine.

• After discontinuation of chronic tobacco-delivered nicotine:
  - Signs such as reduced heart rate, increased caloric intake and weight, change in EEG frequency
  - Behavioral performance decrements such as decreased concentration, impaired attention
  - Symptoms such as urge to smoke, impatient, irritability, difficulty concentrating

• Withdrawal syndrome can reduce the likelihood of a quit attempt and decrease chances of long-term cessation.
What is puff topography?

• Puff topography measures:
  - Puff volume.
  - Puff duration.
  - Puff number.
  - Peak flow rate.
  - Inter-puff interval.

• CReSSMicro:
  - Holds 800 cigarettes/four weeks worth of data.
  - Every data point is time and date stamped.
  - Device self-calibrates after every cigarette.
  - Weighs 4.1 ounces with battery.
Introduction to puff topography

• Puff topography measurement has been used to:
  - Predict efficacy of smoking cessation medications.
  - Study gender differences in tobacco use.
  - Examine brand-induced changes in smoking behavior.

• Generally, topography is measured in the clinical laboratory
  - Custom-made hardware and software.
  - State-of-the-art, off-the-shelf desktop: CReSS.

• Laboratory measurement limits research.

• Many attempts at ambulatory topography measurement:
  - Radiotelemetry (Kushinski et al. 1995): Restricted to lab area.
  - Microcomputer (Kolonen et al. 1992): Weighs 3.75 lbs.
To validate a novel handheld device (CReSSmicro) for measuring puff topography in smokers by:

- **Study 1**: Comparing it to the gold standard desktop system (CReSS) in the laboratory.

- **Study 2**: Using it to demonstrate brand-induced changes in puff topography in the smokers’ natural environment.
Study 1 Conclusion.

- Handheld device:
  - can be used to measure topography in the laboratory.
  - produces similar results as desktop gold standard (CReSS).
  - is sensitive to brand-induced changes in puff topography.
  - Measured smoking behavior consistently across smoking bouts.
  - Smokers are not opposed to using handheld topography device.

- Can handheld device be used in the field?
Study 2 method.

- Two, 4-day (M-Th) counterbalanced conditions.
  - Own brand (Mean; CO = 13.6, Tar = 13.0, Nic = 1.0)
  - Ultra light (Merit®; CO = 7, Tar = 5.0, Nic = 0.5)
- Conditions separated by a minimum 72-hr washout period.
- First cigarette of each condition was smoked in the laboratory.
- Subjects asked to use device outside of the lab for:
  - First cigarette of the day (days 2, 3, and 4; compensated $5.00).
  - Any other four cigarettes (Days 1-4; compensated $2.50 each).
- Puff topography outcome measures:
  - Total and average puff volume
  - Puff number and duration
  - Interpuff interval (IPI)
Inclusion/exclusion criteria.

• Inclusion:
  - Smokers of “king size” or “100s” aged 18-50.
  - Afternoon expired air carbon monoxide (CO) ≥ 15 ppm.
  - Reported smoking ≥ 15 cigs/day for the 2 years.

• Exclusion:
  - Smoker of any “slim” and/or “ultra light” cigarette brand.
  - Pregnant or breast feeding.
  - History of chronic psychiatric or health problems.
### Subject characteristics (3 men, 6 women).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean</th>
<th>[SD]</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Non-white</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>26.9</td>
<td>[10.9]</td>
</tr>
<tr>
<td>Cigarettes per/day</td>
<td>19.7</td>
<td>[4.4]</td>
</tr>
<tr>
<td>CO level at screening (ppm)</td>
<td>20.3</td>
<td>[9.2]</td>
</tr>
<tr>
<td>Own brand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>13.6</td>
<td>[2.9]</td>
</tr>
<tr>
<td>Tar</td>
<td>13.0</td>
<td>[3.4]</td>
</tr>
<tr>
<td>Nic</td>
<td>1.0</td>
<td>[0.2]</td>
</tr>
<tr>
<td>Fagerstrom TND score (max = 10)</td>
<td>5.6</td>
<td>[1.9]</td>
</tr>
</tbody>
</table>

Note: Subject characteristics include 3 men and 6 women.
1. How soon after you wake up do you smoke your first cigarette?
   • Within 5 minutes
   • 6-30 minutes
   • 31-60 minutes
   • After 60 minutes

2. Do you find it difficult to refrain from smoking in places where it is forbidden (e.g., in church, at the library, cinema, etc.)?

3. Which cigarette would you hate most to give up?

4. How many cigarettes a day do you smoke?

5. Do you smoke more frequently during the first hours after waking than during the rest of the day?

6. Do you smoke if you are so ill that you are in bed most of the day?
Total puff volume: by cigarette and day.
Mean values for cigarette comparison (n=9).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Own brand</th>
<th>Ultralight</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total vol (ml)</td>
<td>526.9</td>
<td>671.2</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Average puff vol (ml)</td>
<td>50.2</td>
<td>57.1</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Puffs/cig (num)</td>
<td>10.8</td>
<td>12.1</td>
<td>ns</td>
</tr>
<tr>
<td>Puff duration (sec)</td>
<td>1.4</td>
<td>1.4</td>
<td>ns</td>
</tr>
<tr>
<td>IPI (sec)</td>
<td>31.8</td>
<td>28.9</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>
Conclusion.

• Handheld device:
  - can be used to measure topography in the field.
  - is sensitive to brand-induced changes in puff topography.
  - reported as easy to use.
Future research: nicotine and stimulants

- 22% of “normal” population smokes vs. 75% of drug users in treatment programs
- Acute stimulant exposure:
  - increases the number of cigarettes smoked
  - increase reports of “positive effects”
- Cocaine users reports smoking for increased stimulant effects; decrease in cigarettes during outpatient treatment
  - Increase the reinforcing effects of nicotine by producing an additive effect on nucleus accumbens dopamine release?
  - Behavioral activation?
Future research: nicotine and stimulants

• Submitted grant to determine if MA pre-exposure enhances the effects of nicotine
  - Examine nicotine self-administration after treatment with MA or placebo
  - Smoke because of behavioral activation or because reinforcing effects of nicotine enhanced?
  - Administer varenicline, a4b2 partial agonist, no effect if behavioral activation

• Use CReSSMicro to further assess smoking characteristics of stimulant users
Secondary outcome measures.

- Subjective effects assessed pre/post cigarette:
  - Minnesota Withdrawal Symptom VAS. (Hughes & Hatsukami, 1986)
  - Questionnaire of Smoking Urges. (Tiffany & Drobes, 1991)
  - Direct effects visual analog scale (VAS).
Subjective measure: withdrawal VAS.

URGES to smoke

Not at all  |          | Extremely

Anxious

Not at all  |          | Extremely

CRAVING a cigarette/nicotine

Not at all  |          | Extremely
Subjective measure: QSU.

I need a cigarette now

Strongly disagree

Smoking a cigarette would not be pleasant

Strongly disagree

My desire to smoke seems overwhelming

Strongly disagree
Thank you!

"I just thought I'd drop by personally and congratulate you on your accomplishment. No one has ever quit smoking 17,000 times in one year before."

© QuitSmoking.com

www.quitsmoking.com