Pleasant Odors to Reduce Cigarette Craving: Sayette Laboratory

Craving has been identified as a key feature of smoking, inducing intense states that challenge smoking cessation attempts. It is clear that craving promotes relapse, but specific and effective ways to mitigate these experiences are not as clear. As smoking is the leading cause of preventable death in the U.S., it is necessary to find ways to change this identifiable behavior in order to greatly reduce cancer risks. It is important to continue to examine the properties of cravings to better understand why smoking is more appealing in these states than when in neutral states, helping to explain why individuals are often unable to perform learned coping skills when craving. Although there exist many methods to control cravings, all come with limitations; behavioral approaches are often ineffective when the intensity of cravings becomes too strong, pharmacologic approaches are often too slow acting and are accompanied by side effects, and airway sensory replacement approaches might remind smokers of the pleasures of smoking, instead motivating them to smoke. The lack of a current highly effective method indicates the need for new investigation into intervention techniques that can target cravings at the time of onset without aversive side effects.

This study examines a new biobehavioral approach that explores the relationship between olfaction, emotion, and cognition and the power of this relationship to control cravings. Neurobiological and behavioral research on olfactory triggers of emotional memories and states reveal an interaction of emotion and cognition during craving, and it has been found that similar neural structures are involved in craving and emotion. It is proposed that the ability of odors to trigger intense emotional memories can serve as a disruption from the experience of craving. The induction of specific positive memories associated with odor exposure has the potential to significantly alter mood and distract from craving. Because olfaction has both affective and

cognitive components, odors might be able to compete with cravings for the same pool of attentional resources, allowing individuals to divert their attention from the uncomfortable experience of craving and to find immediate relief. In this study, during peak craving states participants will be exposed to odors that fall into one of three categories; pleasant, smoking related (tobacco), and neutral, as previously rated on pleasantness by the participants. Sayette & Parrott (1999) found that sniffing hedonically evaluated odors, both pleasant and unpleasant, with strong emotional associations effectively reduced the urge to smoke. The current study expands on this finding through use of heavier smokers and more potent odors in order to assess the relationship between self-reported urge to smoke and hedonic evaluation of odors with more confidence.

There are four specific aims that the current study attempts to address. First, to test if pleasant cues can immediately and substantially reduce craving, especially when they trigger episodic memories. Specific positive memories can alter mood and distract from craving, thus making pleasant distracting odors potentially more effective than odors that mimic smoking and aim to address craving through artificial satiation. Second, to examine the impact of olfactory cues on both cognitive and behavioral processes, specifically that effective cues might reduce the appeal of smoking by neutralizing craving-related effects that are thought to make smoking more appealing when in these craving states than when in neutral states. Third, to determine potential relationships between pleasant cues and certain groups of individuals who are more sensitive to olfactory cues. If person-level moderators such as gender or capacity of working memory exist to make certain groups more likely to respond positively to olfactory stimuli or more likely to be distracted by such stimuli, these factors might indicate more promise for these groups in a clinical application of these theories. Fourth, to evaluate how olfactory cues maintain both over

5-minute intervals during peak craving states as well as across episodes on multiple days. As studies on olfaction and elicitation of episodic memories have revealed low susceptibility of olfactory cues to retroactive interference, there remains promise of maintained effectiveness across days.

This research aims to yield results to better understand the implications of this novel biobehavioral approach in addressing cravings in clinical, conceptual, and methodological disciplines. Through studying the cognitive processes that occur during peak craving episodes, such as increased value attributed to smoking and the reduction of anticipated consequences of smoking, the underlying reasons of why craving makes smoking cessation more difficult can begin to be examined. Understanding of key mechanisms that link emotional and cognitive processes that challenge smoking cessation attempts can provide great insight to intervention theories. The study of the interplay olfaction, emotion, and cognition through a biobehavioral framework will help point toward novel methods to control intense cigarette cravings.

Method

Participants

This study aims to recruit 250 participants between the ages of 18 and 55 via advertisements, screened via telephone for preliminary inclusion criteria. Informed consent is obtained during the first session from all participants, and eligibility for the second and third sessions is determined at this point. Participants have the option to grant permission to retain videotapes during the debrief at their last session. Individuals are paid $20 for their completion of Session 1, $30 for their completion of Session 2, and $100 for their completion of Session 3. Participants are asked not to smoke for at least 8 hours prior to their experimental sessions, as well as to refrain from all other nicotine and tobacco products, marijuana, alcohol, and other

recreational drugs. Abstinence is assessed through self-report and a carbon monoxide (CO) breath sample. Sense of smell is also tested at the first session via the Sniffin' Sticks test kit to ensure adequacy for the aims of the study.

Procedure

The purpose of this study is to test the ability of olfaction to reduce peak cravings in an environment realistic to one that would be experienced outside the laboratory, involving a combination of abstinence and exposure to smoking cues. Across all three sessions participants complete a multitude of assessments and tasks to measure craving responses and individual differences. These include reports of demographics, smoking practices, affect, working memory, reporting biases, and personality. Participants are asked to abstain from smoking cigarettes, along with all other nicotine and tobacco products, for at least eight hours prior to the experimental sessions in order to achieve a level of abstinence that facilitates high craving. Participants are also asked to bring their preferred brand of cigarettes and a lighter. At the first session, participants rate odors on pleasantness to determine which ones might be most effective during the experimental sessions for themselves specifically, as odor preferences can vary between people. Participants are then randomly assigned into one of three conditions based on olfactory cues: pleasant unrelated to smoking, smoking related, and neutral. During odor exposure participants are asked to smell 12 odors and rate them on a 9-point scale on pleasantness, intensity, and familiarity, as well as to acknowledge any associated emotions/feelings and memories. Because the study looks at the relationship between olfaction, emotion, and cognition, participants are also asked to rate any identified associated memories on pleasantness, intensity, and specificity using a similar 9-point scale. One notable development from Sayette & Parrott's 1999 study includes replacing the unpleasant condition with a tobacco

condition to provide more clinical application. In experimental sessions participants engage in a process of craving induction that they are guided through via intercom, during which they remove the cover on a tray to find their cigarette, their lighter, and an ashtray. Participants were then asked to light their cigarette without using their mouth and to stare at this lit cigarette for 10 seconds, after which they immediately report their urge to smoke verbally using a scale of 1-100, with 100 being the most intense urge to smoke that they have ever felt. Following this peak craving induction participants are asked to sniff the odor for the condition to which they were assigned, and again asked to rate their urge to smoke on the same 1-100 scale. Participants then fill out a Smoking Consequences Questionnaire while being interrupted every minute for the next 5 minutes over the intercom, being asked to sniff the assigned odor and again report their urge to smoke.

During the study, my primary involvement was in the recruitment process and data entry. The study was advertised through a variety of outlets including bus signs, the City Paper, and Craigslist, and I helped to hang flyers around the surrounding Oakland area. More significantly, I made a great number of phone calls, contacting those who had called the lab interested in the study and those who were referred through the University of Pittsburgh's Research Participant Registry, in order to go through some of the specifics of the study and to screen them to determine if they were eligible to enroll in a first session with the lab. This responsibility was fundamental to the study because it helped to bring participants in to begin the sessions. When the participants I screened over the phone were eligible I went through the scheduling process with them, and when participants were determined ineligible for a first session I would often call back with news of ineligibility. Occasionally I made reminder calls as well, which helped to ensure that the participants we took the time to screen over the telephone would begin the study

and that those who had already enrolled would complete the study, helping to decrease attrition rates and not waste the lab resources of both time and money. After eligible participants completed all three sessions, I was also responsible for entering the raw data into the appropriate files. This task required diligence as the data that I entered was that which will be analyzed in order to examine the results and draw conclusions from the study.

I also had the opportunity to observe the Lab Manager run parts of the sessions with participants, namely the odor exposure and the cue induction portions. I found it beneficial to observe the process of participants completing the study, not only because the Lab Manager highlighted how to interact with participants in a professional manner, but also because it allowed me to see how the theories I had been reading about and the data that I had been entering all factored into the study as a whole. This context helped me to understand the importance of my responsibilities and to see how different tasks were applied in actuality.

While not a direct contribution to the ongoing study, I frequently read journal articles and wrote responses on related topics such as craving, cognitive behavioral theory, and social drinking, which allowed me to strengthen my critical reading skills and more effectively synthesize the information that I was reading. These readings helped me to realize the ways in which different studies can be conducted and how different theories can be tied together and applied to questions and problems in the real world.

Preliminary Results

At this point, 174 participants have completed all three sessions. The initial findings indicate successful induction of a peak craving state, with the mean urge to smoke being rated at 82 on a scale of 1-100, with 100 being the most intense urge to smoke. The odor cue portion has also found success in accurate assignment of pleasant odors. Participants assigned to sniff a

pleasant odor have rated that odor at a mean of 8.5 on a scale of 1-9, on which "1" is extremely unpleasant and "9" is extremely pleasant. Compared to participants assigned to the neutral odor condition (mean rating of 5.1 for that neutral odor) and participants assigned to the tobacco odor condition (mean rating of 4.7 for that tobacco odor), the pleasant odors used in this study have been successful in being rated as substantially more pleasant than those in both the neutral and the tobacco conditions. It is important to note that both peak-provoked craving states and pleasantness ratings of odor cues have been successful, for the theories of this study are based on these two fundamental ideas, and it is essential that the mechanisms upon which the hypotheses of the study operate are in fact working in the expected manner.

Although the target of 250 participants has not been reached at this point, it is still possible to examine the data without adjusting for outliers or other factors that might skew the data. An initial analysis reveals that sniffing a pleasant odor immediately following peak cue exposure, and again at 1, 2, and 3 minutes after, significantly reduced the reported urge to smoke a cigarette when compared to the tobacco and neutral odor conditions. The tobacco and neutral odor conditions did not differ from each other in reported cigarette urge ratings. These findings are consistent with the hypothesis that pleasant cues can immediately and substantially reduce craving, and they highlight the part in which it was hypothesized that pleasant distracting odors are potentially more effective in reducing craving than odors that mimic smoking. The current analysis looks only at the effectiveness of odors across the first 5-minute experimental session, and not at the maintenance across days as the fourth aim of the study states. This is because it is important to first determine if there is any effectiveness within one session, for if there is not then it would not be useful to begin to examine odor conditions and reported urges across days.

Discussion

Implications

It is crucial to address craving because the related cognition has been identified as a key feature of smoking that promotes relapse. This study yields a variety of implications, both theoretical and practical, and can open the door for further research into biobehavioral approaches that might aid in craving reduction during smoking cessation treatments. These novel approaches linking olfaction, cognition, and emotion allow researchers to begin to understand essential brain and behavioral mechanisms involved in craving, paving the way for related neurobiological research that might include fMRI studies based on similar fundamental theories. The process of following peak craving state induction with odor exposure allows testing for immediate craving reduction and controls for the act of sniffing alone by incorporating a neutral odor condition. It also allows the study of key mechanisms involved by incorporating both a tobacco and a pleasant condition, helping to understand if odors that distract are more effective than odors that mimic smoking, which would indicate that odors that compete with cravings for the same pool of attentional resources might be more effective than those that simply try to fulfill these cravings through artificial means.

The practical implications of this study can be broken down into three distinctive paths, depending on the effectiveness determined by the study as well as person-level differences that might indicate the use of odors to control cravings as more effective for groups with certain characteristics. First, ideally, odors found to immediately and sustainably reduce urges through associations with strong positive episodic memories could be used to eliminate craving. Second, odors might serve as a tool to momentarily allow time for individuals to regain focus and eliminate threatening smoking cues, removing them from the intense craving state in which

smoking cigarettes becomes more appealing and letting them utilize previously learned coping strategies such as exercise or meditation. Third, olfactory cues might be able to be used in a complementary approach to remove individuals from peak craving states, buying time before slower acting nicotine replacement products can begin to work. Regardless of the way in which olfaction is used in relapse prevention, if it serves to eliminate high-risk moments of cravings it could prove highly valuable.

Future Directions

The data provided from this study should be used to evaluate the potential of specific odors in cessation interventions, either as an independent treatment or as part of a greater comprehensive approach with cognitive coping strategies or with some form of nicotine replacement product. The results could also be used to identify subgroups for which this method might be particularly effective, indicating greater clinical promise for specific individuals, such as those who score higher on Neuroticism and are more susceptible to emotional triggers or those with lower working memory who can be more easily distracted from craving by odor cues. Additionally, tracking data would allow the evaluation of participants over time to investigate questions of comparable effectiveness across craving episodes or other longitudinal concerns. Tracking data would also enable the use of other methods such as fMRI studies to continue to uncover neurological mechanisms involved, using participants from whom the study already has data.

Overall Conclusions

Previous research has indicated that sniffing hedonically evaluated odors, both pleasant and unpleasant, reduced the reported urge to smoke over sniffing a neutral odor. Drawing on attentional resources and demanding limited-capacity processing, such odor exposure disrupts

the responses to smoking cues during peak craving states that mimic in the laboratory the combination of abstinence and exposure to smoking cues when attempting cessation in the real world. Preliminary data analysis reveals that sniffing a pleasant odor immediately following peak induced craving states significantly reduced the reported urge to smoke when compared to neutral and tobacco odor conditions, indicating promise of the methods at hand. This new biobehavioral approach that examines the relationship between olfaction, cognition, and emotion might lead to key insights that could be used to help individuals quit smoking and prevent relapse.

References

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