

## BRIEF REPORT

## Increase in common cold symptoms and mouth ulcers following smoking cessation

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**Objective:** To examine changes in reports of common cold symptoms and mouth ulcers following smoking cessation. It was hypothesised that reports of these symptoms would increase on stopping smoking.

**Design:** Smokers were assessed one week before stopping smoking (baseline), then after one, two, and six weeks of smoking abstinence.

**Participants:** 174 smokers attending a seven week smoking cessation programme combining behavioural support with nicotine patches.

**Main outcome measures:** Self reports of cold symptoms, mouth ulcers, and smoking abstinence (validated using expired carbon monoxide) were recorded on each measurement occasion.

**Results:** Following one, two, and six weeks of smoking abstinence 73.0% (127/174), 57.5% (100/174), and 44.8% (78/174) of the participants, respectively, maintained continuous abstinence and provided reports of cold symptoms and mouth ulcers. For those abstinent from smoking for six weeks, relative to baseline, a significant increase in reports of the number of cold symptoms was observed following one and two weeks of smoking abstinence ( $p = 0.009$  and  $p = 0.038$ , respectively) and an increase in reports of mouth ulcers after one and two weeks of abstinence ( $p = 0.004$  and  $p = 0.008$ , respectively). Following one week of abstinence significant increases in reports of sore throat, coughing, deafness, and sneezing were observed ( $p = 0.049$ ,  $p < 0.001$ ,  $p < 0.039$ , and  $p < 0.003$ , respectively).

**Conclusions:** This is the first study to systematically document significant increases in cold symptoms and mouth ulcers following smoking cessation. Smokers should be informed that they have an increased chance of experiencing these symptoms on stopping smoking. Being psychologically prepared for these effects may reduce their impact on the attempt to stop smoking.

The incidence of aphthous (mouth) ulcers has been found to be lower in smokers than in non-smokers<sup>1</sup> and clinical observation suggests that some smokers experience an increase in mouth ulcers on stopping smoking.<sup>2,3</sup> Conversely, smokers tend to be more susceptible than non-smokers to developing common cold symptoms,<sup>4,5</sup> while clinical observations suggest that some smokers experience an increase in cold symptoms on stopping smoking. In addition, clinical observation suggests that the discomfort associated with both mouth ulcers and cold symptoms may sometimes act as a deterrent to successful smoking cessation.

A literature search did not reveal any studies that systematically documented changes in mouth ulcers on stopping smoking. One study found no changes in reports of coughing, headaches or sore throat following smoking cessation.<sup>6</sup> However, this study was limited by a small sample

size ( $n = 48$ ) and symptoms were only reported following 24 hours of smoking abstinence. The present study aimed to examine changes in common cold symptoms and mouth ulcers through administering self report measures both during smoking and then following up to six weeks of smoking cessation.

## METHODS

## Participants

One hundred and seventy four men and women wanting to stop smoking and smoking at least 10 cigarettes a day for at least three years were recruited through newspaper advertisements across a 12 month period. Those with a psychiatric illness, substance misuse problem or pregnancy were excluded. The smokers provided written consent and ethics approval was obtained.

## Design and measures

All participants were assessed one week before stopping smoking (baseline), and then after one, two, and six weeks of smoking cessation. They attended six weekly smoking cessation treatment sessions involving individual cognitive-behavioural support<sup>7</sup> and a follow up session two weeks after the final treatment. Participants were required to cease smoking at the second session and were advised to use 15 mg 16 hour nicotine patches on a daily basis.<sup>8,9</sup>

At the first session demographic data were collected. Self reports of continuous smoking abstinence<sup>10</sup> following one, two, and six weeks of abstinence were verified with expired carbon monoxide (CO, cut-off 10 ppm) using a Bedfont Smokerlyzer, and participants reported on their use of nicotine patches. At the first session, then following one, two, and six weeks of smoking abstinence, those participants maintaining continuous abstinence were asked "Have you had any of the following cold symptoms in the last week": sore/scratchy throat, cough, blocked-up nose, runny nose, sneezing, off-colour, fever, chill, headache, muscle-ache, catarrh, feeling of deafness/muzziness in ears, ear ache, and temperature.<sup>11</sup> Each symptom was coded 1 or 0. It is standard practice to produce a composite cold symptoms score.<sup>12,13</sup> Therefore, for each smoker, scores for the individual cold symptom items were summed at each measurement point to produce a composite score (range 0–14). Additionally, participants were asked "Have you had any mouth ulcers in the last week?" (yes or no).

All statistical tests were two tailed.

## RESULTS

At baseline the mean (SD) age was 43.2 (11.4), mean (SD) years of full time education was 13.0 (2.0), mean (SD) Fagerström test for nicotine dependence<sup>14</sup> score was 5.5 (2.0), mean (SD) cigarettes smoked per day was 21.3 (8.0), and the mean (SD) for expired CO concentration was 21.3 (9.0) ppm. The sample ( $n = 174$ ) included 108 (62.1%) women, 56.3% (98

**Table 1** Changes in reports (% (number)) of individual cold symptoms between baseline and the first week of smoking abstinence (n = 127)

Symptom	Gained a symptom	Lost a symptom	*p Value
Sore throat	19.7 (25/127)	9.4 (12/127)	0.049
Cough	78.7 (100/127)	0 (0/127)	<0.0001
Blocked nose	8.7 (11/127)	9.4 (12/127)	1.000
Runny nose	12.6 (16/127)	7.1 (9/127)	0.230
Sneeze	19.7 (25/127)	5.58 (7/127)	0.003
Off-colour	7.9 (10/127)	4.7 (6/127)	0.454
Fever	5.5 (7/127)	1.6 (2/127)	0.180
Chill	3.9 (5/127)	1.6 (2/127)	0.453
Headache	13.4 (17/127)	10.2 (13/127)	0.584
Muscle ache	9.4 (12/127)	6.3 (8/127)	0.503
Catarrh	13.4 (17/127)	7.1 (9/127)	0.170
Deafness	7.9 (10/127)	1.6 (2/127)	0.039
Ear ache	3.9 (5/127)	0.8 (1/127)	0.219
Temperature	6.3 (8/127)	2.4 (3/127)	0.227

\*For difference between symptoms lost and gained using binomial tests.

were married or cohabiting, 46.0% (80) were in a professional or managerial occupation, and 87.9% (153) were white.

Following one week, two weeks, and six weeks of smoking abstinence 73.0% (127/174), 57.5% (100/174), and 44.8% (78/174) of the participants, respectively, maintained continuous abstinence and provided self reports for cold symptoms and mouth ulcers during the previous week. Of those abstinent for one, two, and six weeks, 91.3% (116/127), 87.0% (87/100), and 65.4% (51/78), respectively, reported using nicotine patches on a daily basis.

When examining the composite cold symptom scores (range 0–14) Wilcoxon tests showed that significantly more cold symptoms were reported relative to baseline following one week of smoking abstinence ( $Z = -2.7$ ,  $p = 0.007$ ; mean (SD) scores (n = 127): baseline = 1.5 (2.2), one week = 2.2 (2.7)), although not after two weeks of abstinence ( $p = 0.185$ ; mean (SD) scores (n = 100): baseline = 1.4 (2.1), two weeks = 1.9 (2.7)), or six weeks of abstinence ( $p = 0.220$ ; mean (SD) scores (n = 78): baseline = 1.4 (2.1), six weeks = 1.8 (2.9)). When only including those who were abstinent from smoking for six weeks, Wilcoxon tests showed that more cold symptoms were reported relative to baseline after both one and two weeks of smoking abstinence ( $Z = -2.6$ ,  $p = 0.009$ ;  $Z = -2.1$ ,  $p = 0.038$ , respectively; mean (SD) scores (n = 78): baseline = 1.4 (2.1), one week = 2.1 (2.5), two weeks = 2.2 (3.0)).

Changes in reports of individual cold symptoms were examined between baseline and one, two, and six weeks of smoking abstinence. Significant increases were observed following one week of abstinence for three of the five cardinal cold symptoms<sup>15</sup>—namely, sore throat, cough, and sneeze (table 1). In addition, there was a significant increase in reports of deafness. After two weeks of abstinence significant increases were found for sneeze ( $p = 0.001$ ), off-colour ( $p = 0.012$ ), and sore throat ( $p = 0.031$ ). After six weeks of abstinence significant increases were detected for ear ache ( $p = 0.031$ ), off-colour ( $p = 0.021$ ), catarrh ( $p = 0.035$ ), and headache ( $p = 0.039$ ). Following the first week of smoking abstinence 90.5% (115/127) of the participants gained at least one cold symptom, 47.2% (60/127) gained at least two symptoms, and 30.7% (39/127) gained three or more symptoms.

Pair-wise binomial tests showed a significant increase in reports of mouth ulcers relative to baseline following both one week of smoking abstinence ( $p = 0.001$ ; gained an ulcer = 13.4%, 17/127; lost an ulcer = 0.8%, 1/127) and two weeks of abstinence ( $p = 0.021$ ; gained an ulcer = 9.0%, 9/100; lost an ulcer = 1.0%, 1/100), although not after six weeks of abstinence ( $p = 0.070$ ; gained an ulcer = 9.0%, 7/78; lost an ulcer = 1.3%, 1/78). When only including those who were abstinent for six weeks, again the binomial tests showed

a significant increase in reports of mouth ulcers relative to baseline following both one week and two weeks of smoking abstinence (one week:  $p = 0.004$ , gained an ulcer = 11.5%, 9/78, lost an ulcer = 0; two weeks:  $p = 0.008$ , gained an ulcer = 10.2%, 8/78, lost an ulcer = 0).

There was no significant association between increase in mouth ulcers and increase in the number of cold symptoms between baseline and one week of smoking abstinence (point-biserial correlation coefficient = 0.094,  $p = 0.293$ ). Nor were there any significant associations between changes in reports of individual cold symptoms and changes in reports of ulcers at this time. Neither increases in cold symptoms nor increases in mouth ulcers following one week of smoking abstinence predicted smoking lapses at two weeks ( $p = 0.299$  and  $p = 0.072$ , respectively) or six weeks ( $p = 0.781$  and  $p = 0.290$ , respectively), although the association between mouth ulcers and smoking relapse at two weeks approached significance.

## DISCUSSION

This study is the first to provide clear evidence for an increase in reports of cold symptoms and mouth ulcers following smoking cessation. The lack of an association between reports of cold symptoms and reports of mouth ulcers suggests that different mechanisms may underlie the effect of smoking cessation on these symptoms. Increases in mouth ulcers following smoking cessation may be related to the absence of the antibacterial effect of smoking.<sup>16</sup> Increases in cold symptoms could be explained by a reduction in salivary immunoglobulin A upon stopping smoking.<sup>2</sup>

Increases in coughing following smoking cessation are unlikely to be related to improved mucociliary clearance as previous evidence suggests that there are no improvements in mucociliary clearance following one week of smoking cessation.<sup>17</sup> Furthermore, coughing has been shown to reduce across the first month of smoking cessation,<sup>18,19</sup> whereas mucociliary clearance has been shown to improve across the first months of smoking cessation.<sup>17</sup> Studies are needed to investigate possible psychological and physiological mechanisms underlying the reported changes in symptoms after smoking cessation.

This study is limited in that it relies on self reports of symptoms. Future studies would benefit through confirming the presence and severity of symptoms using clinical examination or microbiological analysis. Data were gathered over a 12 month period and significant increases in ulcers and the number of cold symptoms were only detected up to three weeks following the baseline measures. Therefore the chances of any effects being the result of seasonal variations were very small. Further studies with larger sample sizes are needed in order to examine whether cold symptoms and ulcers are elevated beyond two weeks of abstinence.

**What this paper adds**

Clinical observation indicates that some smokers experience an increase in common cold symptoms and aphthous (mouth) ulcers on stopping smoking and that the discomfort associated with these symptoms may sometimes act as a deterrent to successful smoking cessation. Until now no study has systematically monitored changes in reports of mouth ulcers and cold symptoms on stopping smoking.

The results of this study indicate that smokers have an increased chance of experiencing cold symptoms and mouth ulcers for up to two weeks following abstinence from smoking. These results confirm clinical observations and suggest that smokers who are preparing to stop should be informed of their increased susceptibility to these symptoms.

Interestingly, when examining whether increases in ulcers predicted two weeks of smoking abstinence the finding approached significance. In order to adequately assess the impact of increases in ulcers and cold symptoms on rates of smoking abstinence further studies are required which examine the incidence of these symptoms among those who have lapsed to smoking, including the first few days of abstinence, as well as among those who have maintained continuous abstinence. Furthermore, it would be useful to assess the extent to which smokers relate the occurrence of these symptoms to a smoking relapse.

The results of this study have implications for the smoker who is trying to stop. Smokers need to be informed that they have an increased chance of experiencing an elevation in cold symptoms and mouth ulcers on stopping smoking. Being psychologically prepared for these effects is likely to mitigate their impact on the cessation attempt. Previously it has been shown that having realistic expectations of the consequences of medical interventions increases the chances of positive outcomes.<sup>20 21</sup>

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