Public Health Briefs

Prevalence of the Misuse of Ultra-Low-Tar Cigarettes by Blocking Filter Vents

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Abstract: Evidence from tar-stain patterns in 135 cigarette filters discarded in ashtrays in public areas of shopping malls was used to estimate the prevalence of behaviorally blocked air dilution vents in ultra-low-yield cigarettes. Nineteen per cent (± 4, standard errors of the mean) of the filters had been blocked extremely, 39 per cent (± 5 SEM) had been blocked to some degree, and 42 per cent (± 5 SEM) had not been blocked at all. Smokers, health practitioners, and researchers need to be warned of the risks of vent blocking. (*Am J Public Health* 1988; 78:694–695.)

Introduction

It has been claimed that ultra-low-tar cigarettes (1 mg tar) are less risky for smokers than low-tar cigarettes (5 mg tar), because fairly complete over-smoking was found with low-tar cigarettes, but not with ultra-low-tar cigarettes.[1] However, the sample on which this assertion was based was too small (N = 11) to ensure that behavioral hole-blocking would occur.[2] Commercial ultra-low-tar cigarettes depend on vented filters for reduced yields. When 1 mg tar cigarettes are smoked on standard smoking machines, 80 per cent or more of each puff is added ambient air (for 4 mg tar cigarettes about 60 per cent is added air).[3,4] Behavioral blocking of filter vents with the lips, fingers, or even tape is a way smokers compensate for low standard yields.[5,6] Full blockage of 4 mg tar cigarettes increases standard yields from 4 mg to 13 mg tar[5]; blocking holes on 1 mg tar cigarettes contributes to increasing yields to 16 to 29 mg tar, depending on the brand.[6]

One earlier survey[6] looked at the prevalence of hole-blocking, but it is not surprising that researchers have hesitated to generalize from this sample of 46 office workers who responded to advertisements. A recent review of lower-tar cigarettes claims that hole-blocking is "sporadic."[7] We estimate prevalence of vent blocking by examining the evidence found in a sample of spent filters in public ashtrays.

Methods

Unblocked conventional vented filters produce characteristic tar stains (a bull's-eye of tar surrounded by unstained filter). The basic stain pattern is caused by the displacement of smoke from around filter holes by ambient air drawn into vented-filters. Fully blocked filters (as by lips or tape over the vents on every puff) produce a uniform tar stain on the filter end.[5] Raters using the stain pattern can identify hole-blocking (91 per cent to 96 per cent accuracy rate[8]; cf.[9]).

Two experimenters collected butts from sand-lined ashtrays in five indoor public shopping areas (middle-class to high-class) in downtown Toronto in the early afternoon on four weekdays in February and March of 1987. Butts were examined with forceps and placed in vials, numbered, and stored frozen until rated. Patterns were not changed by storage for up to three weeks. All butts of 4 mg tar or less were collected, and remaining butts in ashtrays were counted. About 1,000 butts were inspected to attain a sample of 135 "low-yield" butts: 56 per cent = 4 mg tar, 21 per cent = 3 mg tar, and 23 per cent = 1 mg tar; no 2 mg tar cigarettes were on the market. Tar yields were taken from figures on current cigarette packs.

The Scoring Procedure

Filters were scored by three independent raters on a 3-level scale:

- 1 = No stain at the outside edge of the filter or only a small area of stain at the outside edge (no larger than 3 mm) [the 3 mm exception was included to deal with the occasional slight manufacturing flaw that causes a few holes to be blocked under a seam on the filter];
- 2 = Light to moderate stain around the outside with a noticeably darker center stain [evidence of some or incomplete hole-blocking];
- 3 = Uniform stain from inside to outside [consistent with complete blockage] (see next page). If none of the above categories seemed appropriate, a "best guess" rating on the above scale was also given (this happened once). Raters wore surgical gloves, and an unsmoked filter was available for comparison.

To allow for some repeat sampling from the same smokers, we calculated standard errors of the mean (SEM) values assuming a sample of 100 independent observations. To eliminate this 25 per cent reduction and consider each of the 135 observations as independent, subtract 1 unit from each SEM value.

Results

Inter-rater correlations (.86, .86, and .91) and the reliability coefficient (an estimate of concordance) were excellent (.95).[10] A single butt score was obtained by taking the majority rating or the average rating as appropriate to resolve inconsistencies. (Use of either a mean or a majority criterion did not alter the results significantly.)

Fifty-eight per cent of filters (95% CI = ± 10) gave evidence of at least some hole-blocking; only 42 per cent of butts (95% CI = ± 10 showed no sign of behavioral hole-blocking; 19 per cent of butts (95% CI = ± 8) showed evidence of extreme hole-blocking. Chi-square analyses

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Editor's Note: See also related briefs, pp 696, 699 and letters, p 718, this issue.

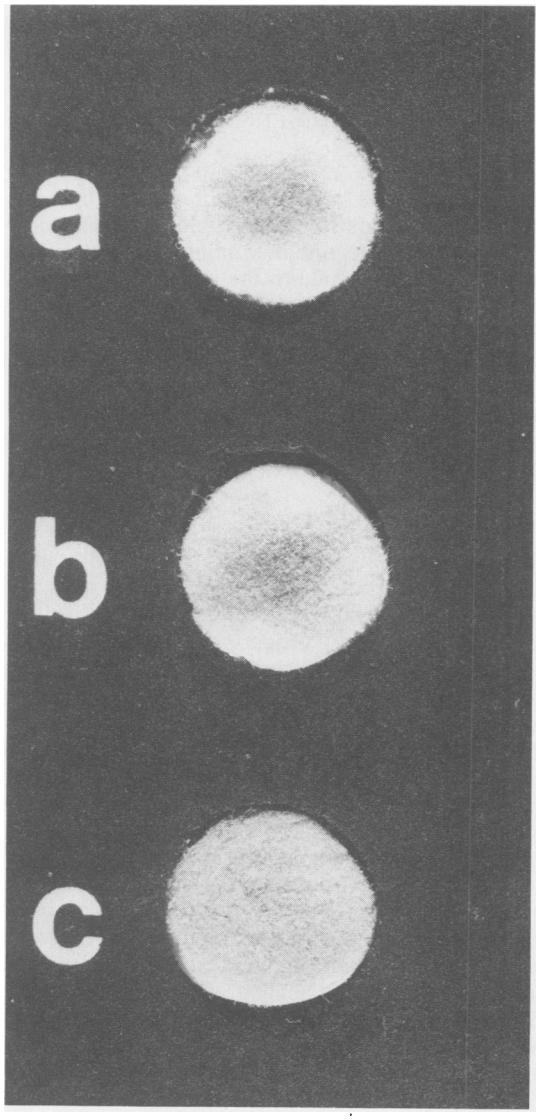

FIGURE 1—Examples of Filter Stains Showing no Signs of Vent-blocking (a), Some Signs of Vent-blocking (b), and Signs of Complete Vent-blocking (c)

showed no hint of differences in hole-blocking as a function of tar yield.

Discussion

A recent study[8] confirms in smokers the high exposure estimates derived from smoking machine studies of hole-blocking.[5,6] The substantial influence of hole-blocking on smoke exposure is shown by the fact that compensatory smoking took place in spite of a 32 per cent reduction in puffs taken and a 32 per cent reduction in average puff volumes when smokers used blocked rather than un-blocked cigarettes.[8]

Our naturalistic sample of non-volunteer, un-paid, and un-self-conscious smokers is likely to be more representative of ultra-low-yield smoking habits than are the small samples of paid volunteers who perform in laboratory studies.[1,11–13]

Smokers block vents to enhance smoking "satisfaction."[8,14] Some do not realize that better "taste" means increased tar, nicotine, and carbon monoxide—thinking that there are special "low-tar tobaccos" in the cigarette; other smokers are unaware of blocking the vents.[6,9,15] Lombardo, *et al,*[9] found that many smokers are "forced" to block vent holes with their fingers toward the end of a cigarette by the advance of the burning coal.

Removing the "Low-Yield Excuse" for Continued Smoking

Some smokers believe that they have responded to health concerns about smoking by selecting the lowest-tar cigarettes available. These are unrealistic beliefs. Hole-blocking is a major mode of compensatory smoking in smokers of these cigarettes. Smokers of low-tar cigarettes should be warned of the problem of hole-blocking and instructed in the detection of hole-blocking[16]; they need to be told that, if they do not miss their high-yield cigarette smoke, it may not really have gone away.[14] Complete cessation of cigarette use remains the most sensible response to the adverse health effects of smoking.

ACKNOWLEDGMENTS

Supported in part by grant (A-1036) from the Natural Sciences and Engineering Research Council of Canada. Thanks to Renate Krastins for assistance and D.A. Wilkinson for advice. The opinions expressed are those of the authors and not necessarily the Addiction Research Foundation.

REFERENCES

1. Benowitz NL, Jacob P, Yu L, *et al:* Reduced tar, nicotine, and carbon monoxide exposure while smoking ultra-low- but not low-yield cigarettes. JAMA 1986; 256: 241–246.
2. Kozlowski LT: Blocking the filter vents of cigarettes. JAMA 1986; 256:3214.
3. Norman V: The effect of perforated tipping paper on the yield of various smoke components. Betrage zur Tabakforschung 1974; 7:282–287.
4. Kozlowski LT: Smokers, non-smokers, and low-tar smoke. Lancet 1981; 1:508.
5. Kozlowski LT, Frecker RC, Khouw V, Pope MA: The misuse of less-hazardous cigarettes and its detection: Hole-blocking of ventilated filters. Am J Public Health 1980; 70:1202–1203.
6. Kozlowski LT, Rickert WS, Pope MA, *et al:* Estimating the yield to smokers of tar, nicotine, and carbon monoxide from the 'lowest yield' ventilated filter cigarettes. Br J Addict 1982; 77:159–165.
7. Participants of the Fourth Scarborough Conference on Preventive Medicine: Is there a future for lower-tar-yield cigarettes? Lancet 1985; 2:1111–1114.
8. Zacny JP, Stitzer ML, Yingling, JE: Cigarette filter vent blocking: effects on smoking topography and carbon monoxide exposure. Pharmacol Biochem Behav 1986; 25:1245–1252.
9. Lombardo T, Davis CJ, Prue DM: When low tar cigarettes yield high tar: cigarette filter ventilation hole blocking and its detection. Addict Behav 1983; 8:67–69.
10. Winer BJ: Statistical Principles in Experimental Design. 2nd Ed. New York: McGraw-Hill, 1971; 283.
11. West R, Russell MAH, Jarvis MJ, Feyerabend C: Does switching to an ultra-low-nicotine cigarette induce nicotine withdrawal? Psychopharmacology 1984; 84:120–123.
12. Nemeth-Coslett R, Griffiths RR: Effects of cigarette rod length on puff volume and carbon monoxide delivery in cigarette smokers. Drug Alcohol Depend 1985; 15:1–13.
13. Russell MAH, Sutton SR, Iyer R, *et al:* Long term switching to low-tar low-nicotine cigarettes. Br J Addict 1982; 77:145–148.
14. Kozlowski LT: Less hazardous smoking and the pursuit of satisfaction. Am J Public Health 1987; 77:539–541.
15. Kozlowski LT: Perceiving the risks of low-yield, ventilated-filter cigarettes: the problem of hole-blocking. *In:* Covello VT, Flamm WG, Rodricks JV, Tardiff RG (eds): The Analysis of Perceived versus Actual Risks. New York: Plenum, 1983; 175–182.
16. Kozlowski LT: Tar and nicotine ratings may be hazardous to your health: Information for smokers who are not ready to stop. [Pamphlet]. Toronto: Addiction Research Foundation, 1982.