

The Misuse of 'Less-Hazardous' Cigarettes and Its Detection: Hole-Blocking of Ventilated Filters

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Abstract: Smokers of low-yield, ventilated-filter cigarettes sometimes defeat the purpose of the smoke-dilution holes by occluding them with fingers, lips, or tape. Blocking the holes is shown to have large effects on the delivery by these cigarettes of toxic products (nicotine, tar, and carbon monoxide). Techniques for detecting this misuse of "less hazardous" cigarettes are discussed, with particular emphasis on the distinctive signs of hole-blocking which are left in the spent filters. (*Am J Public Health* 1980; 70:1202-1203.)

Most of the apparently least-hazardous of the 'less-hazardous' low-tar, low-nicotine, low carbon monoxide (CO) cigarettes,¹ achieve their low yields of toxic products by means of ventilation holes in the filters. In 1979, about 25 per cent of all cigarettes sold in the United States had perforated filter tips.² The rings of perforations cause inhaled tobacco smoke to be diluted with air and thereby decrease the amount of smoke per puff delivered to the smoker.

The effects (and frustrations) of ventilated filters can be illustrated by making a ring of small holes about 10 mm from the proximal end of a drinking straw. A desired beverage can still be drunk, but it is adulterated with air and much harder to suck through the straw. Although smoking machines which measure tar and nicotine deliveries do not occlude the perforations, we have found in systematic interviews that 32 per cent to 69 per cent (95 per cent confidence interval) of

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low-tar smokers have blocked the holes with their fingers, lips or with tape.* Lipstick marks on the holes have proven to be clear-cut indicators of hole-blocking; holding the cigarette between the teeth appears to facilitate the practice of covering the holes with one's lips. A few smokers confess to having held their cigarettes with two hands (the tips of four fingers over the holes) to block the perforations. A simple "pinch" of the perforations with opposing fingers is a more common method of blocking the holes. The present study reports the extent to which hole-blocking can increase the delivery of tobacco smoke to the smoker.

Methods

Labstat Inc., (the laboratory used by the Canadian government) was contracted to analyze a popular brand of low-yield cigarette for tar, nicotine, and CO delivery, using standard assay procedures.³ These cigarettes have a single ring of 24 perforations on the filters. Twenty cigarettes were smoked with one-half of the holes blocked by epoxy (as if two opposing fingers blocked them); 20 cigarettes were smoked with all the holes blocked with tape (as if lips or tape blocked them). The analysis of 20 cigarettes is performed in blocks of five cigarettes, producing four independent samples.³

Results and Discussion

Hole-blocking increases the yield of toxic products by 59 per cent to 293 per cent (Table 1). Larger yields occur despite a smaller number of puffs taken during the standard assay.**

*Kozlowski LT, et al, manuscript in preparation.

**The standard assay specifies puffing-rate (1-min), not the number of puffs to be taken. Problems with this aspect of the standard procedure are discussed elsewhere.⁵

TABLE 1—Effects of Blocking the Ventilation Holes on the Yields of a Popular, Low-yield Cigarette*

	Unblocked	Half-blocked	Fully-blocked
Nicotine (mg)	0.45	0.73 ± .06	0.98 ± .06*
Tar (mg)	4.40	7.03 ± .04	12.60 ± .20*
CO (mg)	4.50	7.80 ± .24	17.70 ± .40*
Puffs	11.10	10.50 ± .20	9.20 ± .40*

*Half-blocked vs Fully-blocked comparison (*t*-test, 2-tailed) $p < .01$. Values are means ± standard deviations. Government figures for the June–July 1979 assay were used as the unblocked control; variances were not reported, but those found in similar analyses⁴ give us reason to expect that all within-row comparisons would be statistically significant. All analyses in the Table were performed by the same laboratory employing the same techniques.

The misuse of ventilated cigarettes could account for the observation that smokers sometimes consume more CO from these cigarettes than would be predicted from standard smoking-machines.⁶

Blocking of holes leaves unmistakable tracks in the spent filters. If holes are not blocked, air takes the place of

smoke in the periphery of the proximal section of the filter, i.e., downstream from the holes (see Figure 1). As the number of holes blocked increases, observable smoke deposits increase on the proximal side of the perforations, and staining spreads toward the sides of the filter.

We have used a refinement of assays for residual nicotine in filters^{7, 8} to confirm that what can be seen in these filters reflects what the smoker gets. Our procedure begins with slicing the filters at the perforation line. The index of hole-blocking is the ratio of the mass of nicotine per unit weight of proximal filter to that of the distal filter: The larger the ratio, the more the holes have been blocked. (The distal nicotine provides a control for the amount of nicotine which initially was drawn into the filter.) A preliminary study has shown that these ratios for unblocked, half-blocked, and fully-blocked cigarettes are, in order, $.45 \pm .01$, $.54 \pm .01$, and $.72 \pm .004$ ($F(2, 10) = 935.19$, $p < .001$).

The misuse of ventilated filters can be detected by: 1) watching smokers smoke; 2) asking them if they have blocked or do block the holes (but not all of our smokers were aware they were doing it); and 3) looking at the stain-pattern on the spent filters. Finding a discrete center stain (as in Figure 1) means only that the smoker has not misused the cigarette by hole-blocking; more frequent and deeper inhalations can independently increase the risks of these cigarettes.

Health researchers and tobacco scientists have been interested in ventilated filters primarily as a way to make less toxic cigarettes;^{9, 10} however, smoking behavior can act to sabotage the benefits of these filters.

FILTER SECTIONS

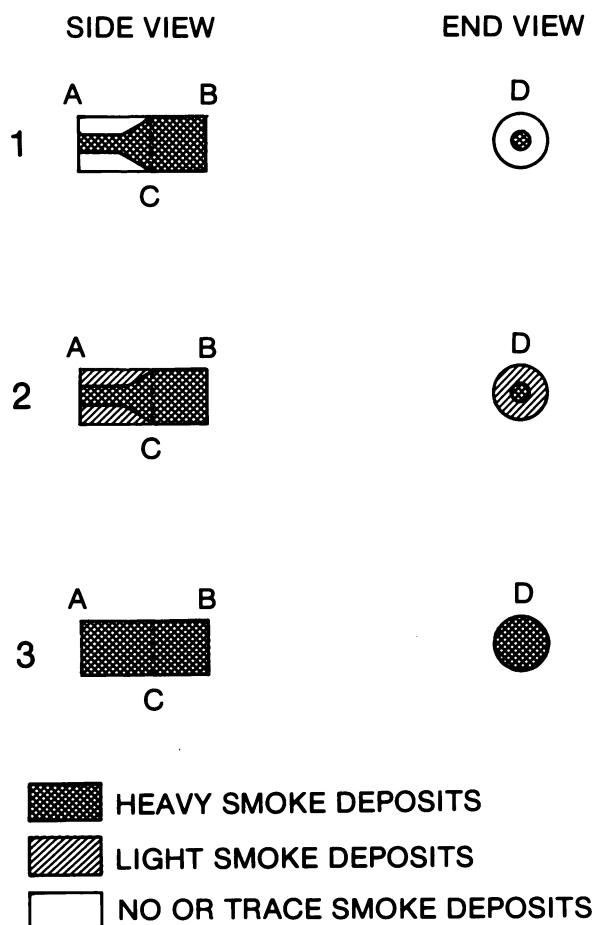


FIGURE 1—Shows the progressive staining of the proximal end (A & D) of the filter downstream from the perforation line (C) as the number of holes blocked increases from none in filter 1, to a partial block in filter 2, and a complete block in filter 3. B is the distal end of the filter.

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