The Canadian Slave Smoking Machine

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In the debate over “light” cigarettes, recently released documents demonstrate that the Canadian tobacco companies were aware that smokers were compensating for nicotine years before it was recognized in the literature and well before the introduction of most “light” brands.¹ Compensation is the process by which the smoker adjusts his or her smoking inhalation pattern to maintain a certain level of nicotine.²

Information on the deliveries of cigarettes is collected by the use of a smoking machine, a device that uses air pressure to “smoke” a cigarette. In many countries, including Canada, the International Organization for Standardization (ISO) provides a standard setting for the parameters of the machine.³ Although the ISO standard was never meant necessarily to provide correct individual dosage information, at the time of the development, the test method was supposed to reflect actual human smoking of cigarettes.⁴ However, by the 1960s, tobacco company researchers were questioning the validity of the ISO standard.⁵ Smokers were clearly not smoking like the ISO machine, but no one could accurately measure the yield a human smoker received.⁶

In 1966, work started on a machine that would reflect the real human delivery of cigarettes.⁵ The machine was to duplicate human smoking behaviour as accurately as possible from the motion of the cigarette to the variables of the puff.⁷ The human smoking duplicator or “slave smoking machine” was needed to test for the effects of compensation and the actual deliveries in low tar/nicotine cigarettes. Imperial Tobacco scientists stated that, “It

was of vital importance, for product development, to confirm these compensating actions of smokers, and more particularly to measure the degree of success in compensation possibly to help in judging the extent of nicotine decrease which would be tolerated by smokers.”⁷

In 1972, after six years of work, the first working smoking duplicator, called the Freiri machine after the names of the inventors Frei-esleben and Ri-el, was finished.⁸⁻¹² The Freiri machine was able to “simultaneously reproduce a subject’s smoking actions, so that the subject and the machine smoke matched cigarettes concurrently by the same puffing patterns with minimal interference in the subject’s smoking pleasure.”⁷

Tests on the Freiri smoking machine demonstrated that standard machine assays did not reflect the actual levels of tar, nicotine, or total particulate matter received by the smoker.^{13,14} For instance, a test of the cigarette brand Players demonstrated the differences between standard machine smoking and human smoking behaviour (see Table I). Every parameter tested by Imperial Tobacco on the Freiri was different from the standard machine smoking. A real smoker took more and harder puffs for a longer period of time.

Many types of studies were conducted.¹²⁻¹⁷ Different brands were tried: high and low nicotine, high and low tar (see Table II). Different types of filters, papers, and ventilation were all examined. Each study added gave ITL more information on real human smoking habits, and it was clear that smokers compensated to maintain a steady nicotine level: “In each case, the smoker adjusted his smoking habits in order to duplicate his normal cigarette nicotine delivery.”¹³

It was now possible for Imperial Tobacco to design cigarettes that would seem to be low in tar and nicotine according to ISO testing, but that deliver much higher quantities of each with actual smoker behaviour. For example, Kozlowski and O’Connor (2001) demonstrated how BAT and ITL used filter ventilation, a feature not present in early 1960s cigarettes, to “cheat” the ISO standard.² Pressure drop, or the ease of draw, was also manipulated in experiments to aid compensation.^{2,13,18-20}

The development of the Freiri Slave Smoking machine enabled ITL to produce cigarettes that took advantage of the dis-

TABLE I

Players Filter Regular Smoking Parameters [9 volunteers from within ITL]¹³

Smoking Parameter	Standard Machine (mean value)	Freiri Slave Smoker (Human) (mean value)
Nicotine Delivery (Mainstream Smoke) (mg/cigarette)	1.4	2.3
TPM [Total Particulate Matter] delivery (Mainstream Smoke) (mg/cigarette)	25.3	41.0

TABLE II

Comparison of Nicotine Yields from Canadian Cigarettes (Matinee and Two Experimental Cigarettes) Measured on a Standard Smoking Machine and Human Smoking Parameters from the Freiri Slave Smoker¹⁴

Cigarette Type	Matinee	Experimental Cigarette 1	Experimental Cigarette 2
Standard Smoking nicotine (mg/cigarette)	0.45	0.58	0.88
Freiri (Human) mean nicotine (mg/cigarette)	0.86	0.88	0.88

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parity that existed between real smoking behaviour and the figures that appeared on the side of cigarette packages. The documents clarify that tobacco companies have known since at least 1972 – a decade before it was recognized in the scientific literature – that the league tables of nicotine and tar content printed on cigarette packages do not reflect the actual or relative delivery of a cigarette.

Thanks to the made-in-Canada Freiri machine, ITL knew that smokers had control over and the ability to titrate the nicotine dose they received. For governments and regulatory bodies, this knowledge would have allowed them to know much earlier that “light” cigarettes would not necessarily be safer, potentially preventing decades of deception. ITL, on the other hand, used this knowledge to maximize the deception, creating products that widened the division between the ISO standard and reality. Furthermore, this knowledge of compensation came before the introduction of most “light” cigarette brands from the late 1970s to the present. Since ITL was aware that there was nothing light about the new cigarettes in terms of delivery, the concept of “light” brands was from the beginning a strategy of marketing and deception.

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