

Inhibitory Properties of a Swab Transport Device

A recent switch to a less expensive swab transport product initiated by our purchasing department provided a reference point for this report. Copan swabs (Copan Diagnostics, Inc., Corona, Calif.) were replaced by Starswab swabs (Starplex Scientific, Etobicoke, Ontario, Canada). Both products employ a sponge saturated with liquid Stuart's medium. The Starplex product appeared visually to vary in medium content of the sponge. This was verified by disassembling a number of devices and observing the volume of expressed holding medium. A two-phase study was designed to determine if this variable affected the survival rate of common fastidious aerobes and to compare recovery rates with those obtained with Copan swabs.

Phase I consisted of swab inoculation with American Type Culture Collection strains followed by direct plating with swabs after incubation at room temperature for 0, 2, 4, 6, 24, and 48 h. Phase II utilized a previously described method of swab inoculation, extraction by vortexing, and quantitation by using a calibrated loop (5). Standardized inocula for both protocols were prepared by using a BBL Prompt device (Becton Dickinson). Samples (100 µl) of *Haemophilus influenzae*, *Streptococcus pneumoniae*, and *Neisseria gonorrhoeae* were pipetted onto three Copan and Starplex swabs for each time point in phase I. The inoculum was allowed to be absorbed into the swab for 10 s, and then swabs were placed in their respective devices and incubated at room temperature until harvested. Three swabs for each organism and device were removed at zero time (baseline count) and 2, 4, 6, 24, and 48 h after inoculation. Swabs were carefully applied to and rotated across the surface of appropriate agar plates by using gentle pressure to express the maximum volume of inoculum and to cover the entire plate surface. Triplicate plates for each time, swab, and organism were counted, and values were averaged. Survival was calculated as percentage of zero-time counts. Results of direct plating are presented in Table 1. Considerable disparity in organism survival was noted. Previous studies in our laboratory and elsewhere prompted us to be cautious in overinterpreting these preliminary data (1, 4, 5). Swab porosity, organism entrapment, variation in absorbency, and lack of reproducibility of organism release during direct plating were factors suspected to contribute to the increasing counts of *S. pneumoniae* after 24 and 48 h with Copan swabs compared to an abrupt decrease in counts with Starplex swabs during the same period.

TABLE 2. Comparison of rates of organism recovery from Copan and Starplex swabs following extraction by vortexing

Organism	Swab	Colony count (% survival) ^a after incubation at room temp for:			
		0 h	2 h	4 h	6 h
<i>H. influenzae</i>	Copan	423 (100)	403 (95)	397 (94)	399 (94)
	Starplex	490 (100)	121 (25)	46 (9)	20 (4)
<i>S. pneumoniae</i>	Copan	256 (100)	246 (96)	140 (55)	115 (45)
	Starplex	370 (100)	213 (58)	170 (46)	67 (18)
<i>N. gonorrhoeae</i>	Copan	396 (100)	379 (96)	277 (70)	154 (39)
	Starplex	985 (100)	102 (10)	0 (0)	0 (0)

^a Survival is calculated relative to the zero-time count (100%).

A more controlled phase II study was performed by following a previously reported protocol limiting sample points to 0, 2, 4, and 6 h postinoculation to more closely approximate actual specimen transport time (5). Five lots of Starplex swabs and three lots of Copan swabs were evaluated separately to assess product variation. No significant lot-to-lot variation was noted. Six clinical isolates of each fastidious organism were tested in this phase, and all results were averaged (Table 2). Survival trends were similar to those observed in the phase I study.

A comparative study of this nature cannot be performed with actual clinical specimens without introducing uncontrollable variables. Clinical specimens vary in viscosity and contain cellular and chemical constituents that may act as nutrients or toxins and are often polymicrobial. These factors all have the potential to affect organism viability. Vortexing of swabs and subsequent performance of quantitative cultures in phase II were done in an attempt to circumvent variables in swab porosity, organism entanglement in swab fibers, and mechanical transfer of microorganisms to agar surfaces. Survival of test organisms reported here may not faithfully reflect results from actual clinical material, but our method did allow recovery rate comparisons to be made and most certainly permitted insight into a system's ability to sustain fastidious-organism viability.

The primary difference between these two commercial products was the type of sponge used to hold the Stuart's liquid

TABLE 1. Comparison of rates of organism recovery from Copan and Starplex swabs directly applied to agar plates

Organism	Swab	Colony count (% survival) ^a after incubation at room temp for:					
		0 h	2 h	4 h	6 h	24 h	48 h
<i>H. influenzae</i>	Copan	2,167 (100)	1,661 (77)	1,568 (72)	1,128 (52)	1,477 (68)	1,520 (70)
	Starplex	2,131 (100)	979 (46)	491 (23)	92 (4)	0 (0)	0 (0)
<i>S. pneumoniae</i>	Copan	361 (100)	336 (93)	332 (92)	166 (46)	552 (153)	TNTC ^b
	Starplex	335 (100)	145 (43)	120 (36)	88 (26)	5 (2)	0 (0)
<i>N. gonorrhoeae</i>	Copan	1,248 (100)	339 (27)	201 (16)	198 (15)	1 (<1)	0 (0)
	Starplex	1,416 (100)	301 (21)	140 (10)	36 (3)	0 (0)	0 (0)

^a Survival is calculated relative to the zero-time count (100%).

^b TNTC, too numerous to count.

medium. Copan uses polyurethane, whereas the Starplex device contains a cellulose sponge. A literature search revealed that inhibitory properties of cellulose sponges have been noted and reported in the past several years (2, 3, 6). The sponge sampling technique for environmental microbial surveillance has been used in food manufacturing plants for a number of years. Inhibitory properties of cellulose sponges were first noted in this application. Compressed cellulose sponges may retain small amounts of several sulfur compounds which are used in the manufacturing process to break down the wood fibers from which these sponges are made, while noncompressed cellulose sponges may contain sulfur compounds plus quaternary ammonium compounds, which act as a further preservative (6). There is some compound or property inherent in the Starplex sponge that inhibits survival of some fastidious organisms. Because of this inhibition, caution should be used if this transport device is used in your health-care facility.

REFERENCES

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