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Evaluation of 4 Swab Transport Systems against a Published Standard

R.P. HUMAN, G.A. JONES

Microbiology Laboratory, Derriford Hospital, Plymouth, Decon PL6 8DH, UK

robert.human@phnt.swest.nhs.uk gillian.jones@phnt.swest.nhs.uk

BACKGROUND

Prior to the publication of the M40-A standard by the United States National Committee for Clinical Laboratory Standards (NCCLS)[1] no quality control data for swab transport systems (STS) had been available.

AIMS

To compare 4 commercially available STS against the published standard in order to ascertain bacterial survival after a set holding time.

INTRODUCTION

A potential for delayed transportation to the laboratory is now more likely with the centralisation of laboratory services, use of evening surgeries and community-based clinics. It is imperative that STS provide optimised preservation of bacteria in order to produce an accurate diagnosis for the timely treatment of bacterial infection.

Prior to production of the M40-A standard there had been no recognised standard for the performance of swab transport systems. The standard now provides a method of quality control testing together with acceptance criteria not only for viability but also for overgrowth of bacteria.

In the absence of a standard procedure for determining the effectiveness of swab transport systems, previous papers on this subject have only been able to provide comparative data. The new standard resolves this by defining whether a product is acceptable in terms of bacterial survival.

METHODS

The STS tested were both non and charcoal containing and were manufactured by Copan Italia, Brescia, Italy (M40 Product); Medical Wire and Equipment, Corsham, UK (MW170/1 product); Starplex Scientific Inc, Ontario, Canada (SP130X/131X product) and Technical Service Consultants, Heywood, Lancs, UK (TS5-17/18 product).

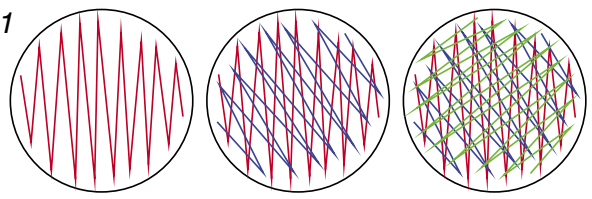
Bacterial strains used for viability studies were *Haemophilus influenzae* (ATCC 10211), *Neisseria gonorrhoeae* (ATCC 43069), *Streptococcus pnuemoniae* (ATCC 6305), *Prevotella melaninogenica* (ATCC 25845) and *Peptostreptococcus anaerobius* (ATCC 27337). For overgrowth studies *Pseudomonas aeruginosa* (ATCC BAA-427) was used.

For viability studies, inocula were prepared in 0.85% saline (pH 6.8-7.2) to a concentration of approximately 1.5 x 10^8 CFU (equivalent to 0.5 McFarland standard) from an 18-24 hr growth of organism. From this dilution final working dilutions were made ranging from 1.5 x 10^6 to 1.5 x 10^4 CFU/ml, 100 µl of each of these 3 dilutions were used to inoculate the swabs. For overgrowth studies one dilution of 1.5 x 10^3 was used.

Swabs were subsequently cultured on plates containing 5% horse blood Columbia agar for *S pneumoniae* and *Ps aeruginosa*, 5% horse blood Fastidious Anaerobic agar for *P melaninogenica* and *P anaerobius* and 5% horse blood Columbia chocolate agar for *N gonorrhoeae* and *H influenzae*. All plates were incubated at 37°C in either CO_2 or anaerobic atmospheres as appropriate.

Inoculated swabs were rolled over the entire surface of the medium as stipulated by the standard (figure 1) and were plated at zero time, 6, 24, 48 hours after storage at 4-8°C and ambient temperature (20-25°C), although the standard only required a holding time of 24 hours for *N gonorrhoeae* and 48 hours for the other species. Colonies were counted after incubation of the plates for 24/48hrs at 37°C. To ensure consistency all swabs were tested in triplicate at all dilutions and storage temperatures.

Figure 1



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RESULTS

Colonies were counted at time zero, 6, 24, and 48 hours and compared against the time zero count.

The standard clearly states the criteria for acceptance of recovery of bacteria, and is shown in the table as acceptable or unacceptable depending on whether the standard was met.

Supplier	Transport Medium Type	Holding Temperature (°C)	Performance @ Target Time (48 hours except NG)					
			HI	NG (24 hr)	SP	PA	PM	Pseud.
COPAN	CHARCOAL	4-8	✓	✓	✓	✓	✓	✓
		20-25	✓	✓	✓	✓	✗	
	PLAIN	4-8	✓	✓	✓	✓	✓	✓
		20-25	✓	✓	✓	✓	✓	
MWE	CHARCOAL	4-8	✗	✗	✓	✓	✗	✓
		20-25	✗	✗	✓	✗	✗	
	PLAIN	4-8	✗	✓	✓	✓	✓	✓
		20-25	✗	✗	✗	✗	✗	
STARPLEX	CHARCOAL	4-8	✓	✓	✓	✓	✗	✓
		20-25	✓	✓	✓	✗	✗	
	PLAIN	4-8	✗	✓	✓	✗	✗	✓
		20-25	✗	✗	✓	✗	✗	
TSC	CHARCOAL	4-8	✗	✗	✓	✓	✗	✓
		20-25	✗	✗	✗	✗	✗	
	PLAIN	4-8	✗	✗	✓	✗	✗	✓
		20-25	✗	✗	✗	✗	✗	

Acceptable ✓ Unacceptable ✗

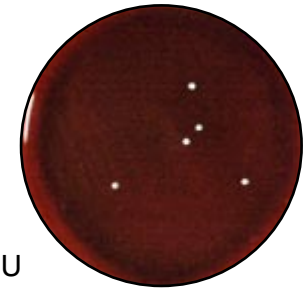
HI H influenzae
NG N gonorrhoeae
MWE Medical Wire and Equipment
SP S pneumoniae
PS P anaerobius
TSC Technical Service Consultants
PM P melaninogenica
Pseud. Ps aeruginosa

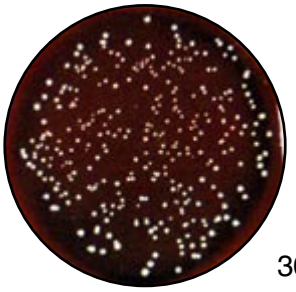
All swabs were able to meet the required standard for overgrowth studies by demonstrating non proliferation of *Ps aeruginosa*.

The standard states for overgrowth studies that there shall be no more than 1 log increase in CFU between zero time count and the counts of the swabs that were held at 4 - 8°C for 48 hours.

The standard states for viability studies that there shall be ≥ 5 CFU following the specified holding time from the specific dilution that yielded zero time plate counts closest to 300 CFU. (Photograph)

5 CFU





300 CFU

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RESULTS (continued)

To meet the standard, inoculated swabs were required to be held for either 24 or 48 hours. However, bacterial viability started to decline at 6 hours for some of the strains (Table 2 a/b, Table 3 a/b).

Table 2a

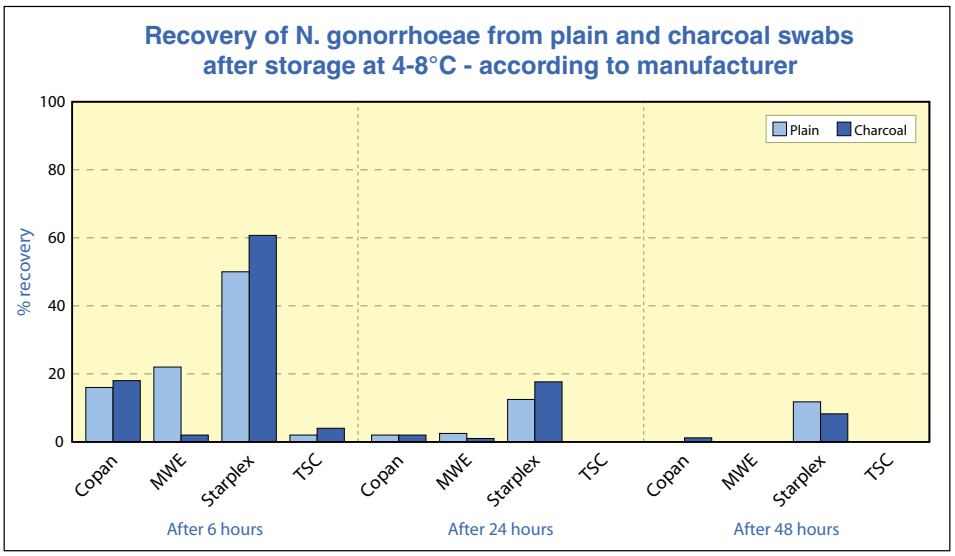
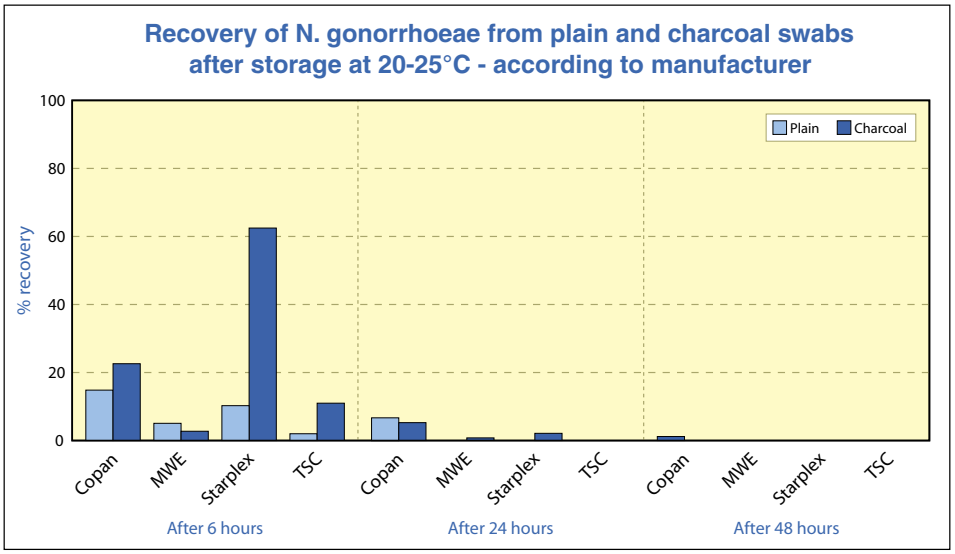


Table 2b



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RESULTS (continued)

Table 3a

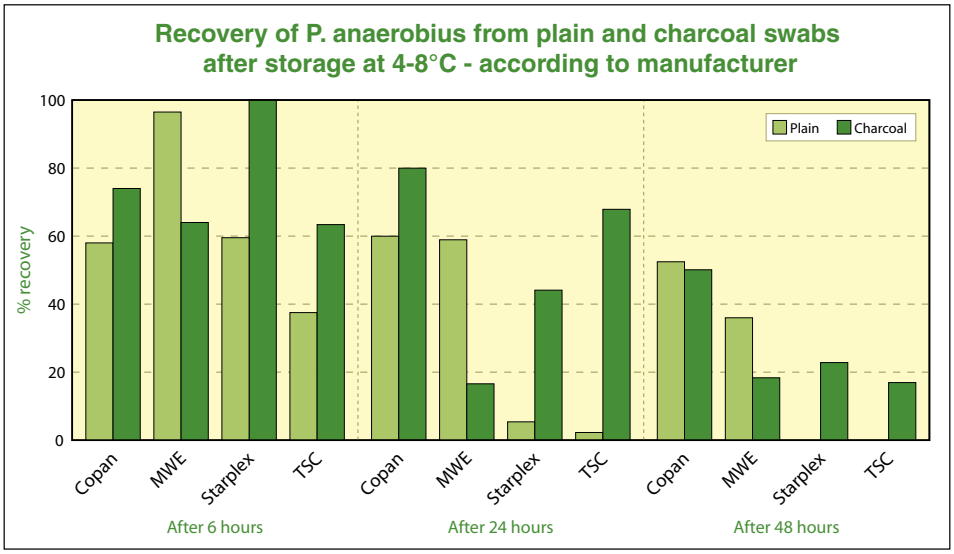
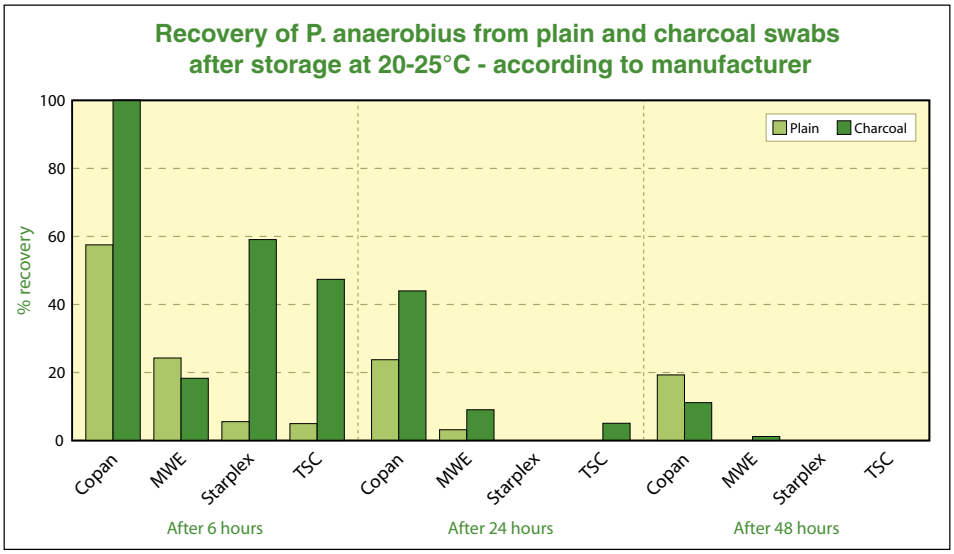


Table 3b



CONCLUSION

The study clearly demonstrated a wide divergence in the performance of the STS tested, with the Copan manufactured product being the only one capable of meeting the standard.

The performance of the STS is dependent on the manufacturer and could have a bearing on clinical relevance, for example, with the non isolation of fastidious organisms such as N. gonorrhoeae. A worrying feature was that some swabs showed a marked reduction in colony numbers after storage for only 6 hours.

The rigorous M40-A standard gives manufacturers a goal to provide a product that will best serve the needs of the patient by assuring bacterial survival during transportation. From this study, laboratories now have guidance to select the best swab transport system for viability which should not be compromised against cost.

It would now seem prudent with the publication of the NCCLS standard that European countries should adopt this standard to ensure conformity with manufacturers' performance.

Results demonstrate that swabs held at 4-8°C generally provide better viability than those held at ambient temperature, users should be encourage to place swabs in the refrigerator if delay in sending to the laboratory is likely.

REFERENCE

1. NCCLS. Quality Control of Microbiological Transport Systems; Approved Standard. NCCLS document M40-A [ISBN 1-56238520-8]. NCCLS, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania 19087-1898 USA.