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Short Communication

Evaluation of recalcitrance of mascara in a cartridge container system to microbial challenge

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SUMMARY

A cartridge mascara system designed to minimize the exposure of mascara to the environment during use was evaluated for recalcitrance to bacteria. The design of the system contributed to low numbers of bacteria found in the mascara, but the need for preservatives was not alleviated.

INTRODUCTION

Most cosmetics contain preservatives not only to protect the esthetic quality of the cosmetic but also to protect the consumer from exposure to potentially pathogenic organisms that might develop in the cosmetic. Automatic mascaras, in particular, require preservatives because the applicator brush can be an instrument of accidental trauma that can introduce potentially infectious agents, notably *Pseudomonas aeruginosa,* to the cornea [6,7]. The types of preservatives available for ocular cosmetics are limited by product incompatibility, economics and their toxicity and potential mutagenicity to the user. Kabara [4] stated, 'In fact, the solution to the problem of preservation is not necessarily to find more powerful germicides but, rather, to build into the product an environment hostile to microbial growth'. Wilson and Ahearn [7] suggested that consideration should be given to marketing mascaras with disposable containers and brushes, and in quantities large enough for only a limited number of applications. Recently, a new mascara (Oftalysine Eye Cosmetics, Rome, Italy) has had the above concepts incorporated into its manufacture [3]. The mascara is supplied in sealed polypropylene cartridges each with an applicator wand enclosed inside. The cartridge provides a microaerophilic environment for the mascaras. The cartridges are inserted onto a handle which, when twisted, breaks the cartridge seal and permits withdrawal of the disposable applicator wand with mascara (Fig. 1). Each cartridge contains mascara (about 0.2 g) for 5–10 applications. We examined the recalcitrance of this cartridge system to microorganisms introduced during its use.

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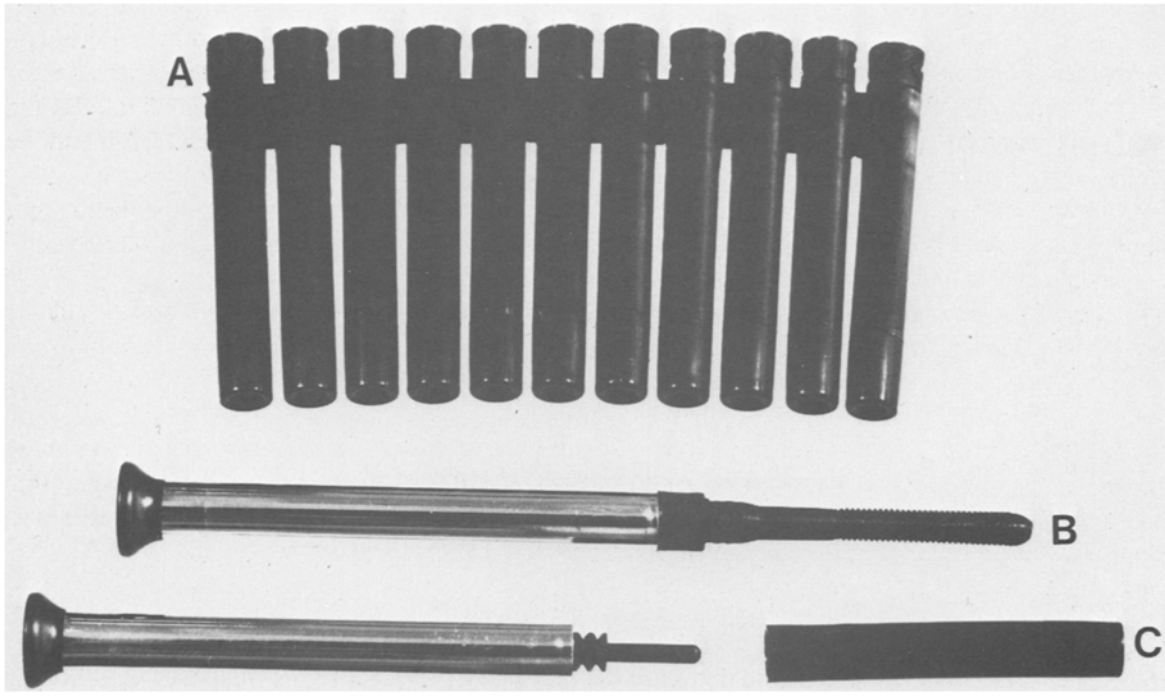

Fig. 1. Cartridge mascara system. Cartridge pack (A), handle with attached applicator wand that is contained in each cartridge (B), detached handle and cartridge (C).

MATERIALS AND METHODS

An experimental emulsion-type, black mascara with a formula based on slightly varying concentrations of stearic acid, glyceryl monostearate, polyvinyl alcohol, propylene glycol, beeswax and approximately 66% demineralized water was formulated with and without propyl paraben (0.15%), methyl paraben (0.25%) and diazolidnyl urea (0.15%) (Germall II, Sutton Laboratories, Chatham, N.J.) and packaged within the cartridge system. The formulations contained the antioxidants butylhydroxanisole and tocopherol (0.02%). Antimicrobiol properties of diazolidinyl urea have been reported [2,5]. The mascaras were examined with in-use study groups [7]. The study groups were composed of 15–25 individuals, mostly college students. Each participant within a group was provided with a mascara formulation and was instructed to use the mascara and to provide the laboratory with a history of its usage. The mascara was to be returned to the laboratory twice weekly for microbiological analysis. The group using the non-preserved formulation was instructed to apply the mascara to the back of the wrist rather than to the eye area. For the purposes of this study, a single cartridge was counted as one mascara. The applicator wands from used mascaras were swabbed with a dacron swab moistened with Dey-Engley (DE, Difco) neutralizing broth and the swab was streaked onto DE agar. The cartridge from which the applicator was removed was sealed tightly with parafilm and kept in storage until results were obtained from the swabbed plates. Cartridges whose applicator wands yielded microorganisms were sampled with sterile glass or wood rods at 48-h intervals for 10 days. The mascara on the sampling rods (about 10–20 mg) was suspended in DE broth, serially diluted and plated onto DE agar. Persistent survival is defined as the recovery of a microorganism from mascara for up to 10 days after the last use of the mascara. Prior to our distributing the mascara, we tested random samples to ensure that they were free from microorganisms.

RESULTS AND DISCUSSION

The incidence of persistent survival among the nonpreserved cartridges was 46%. Surviving microorganisms were mostly micrococci at densities of < 1 cell/mg. Only two cartridges yielded confluent growth on initial sampling. These two gave 10^3–10^6 cells on every subsequent sampling. The preserved mascara yielded only an occassional colony during the in-use study (Table 1). In an earlier study, the incidence of microbial recovery among samples of a conventional-size mascara with an ineffective preservation system was 49% after 25 uses, but almost all positive samples yielded dense growth of microorganisms [1]. The design of the cartridge system is based on the concept that a limited amount of product is exposed to environmental challenge for a short time, thereby decreasing the potential for contamination. Also, the applicator wand, the fomite involved in accidental trauma to the cornea, is replaced every eight or ten uses. Contamination of the cartridge system seemed reduced as contrasted to conventional mascaras of similar formulation, but differences in procedures (e.g., application on hands rather than outer eye area) did not allow definitive comparisons. Regardless of the reduced potential for contamination, the nonpreserved mascara was shown to harbor bacteria soon after the cartridge seal was broken. Considering this and the uncontrollable factor of individual consumer practices, we recommend that mascara for the limited-use mascara cartridge system be adequately preserved.

Table 1

Recovery of bacteria from mascaras during use

Formulations	No. mascaras	Av. No. Uses	No. mascaras with persistent survival[a]
Non-preserved	56	6	26
Preserved	60	5	0

[a] Microorganisms recoverable 10 days after last use.

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