thought that "the knowledge yielded by these researches was hardly commensurate with the time and cost at which it was obtained . . . that his scientific achievements seldom, if ever, realised the expectation which had been formed with regard to them." But *The Times* also added "it is by no means improbable that some of his investigations may yet bear important fruit."

Certainly Thudichum's fame is entirely posthumous. He was 50 years before his time. Page⁶¹⁻² considers that "he was the father of brain chemistry." Dr. Otto Rosenheim,⁵⁴ the London biochemist, uncle of the late Lord Rosenheim, thought that "Thudichum might justly be called the first English biochemist." In 1930 Dr. Rosenheim discovered samples of Thudichum's preparations, many of the highest purity, in the stable of his house. In 1931, largely through Rosenheim's efforts, a Civil List Pension was awarded to each of Thudichum's five daughters who still resided there—at 11 Pembroke Gardens, Kensington.

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Clinical Problems

Sterilization of Soft Contact Lenses Using Boiling Water in a Vacuum Flask

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Summary

The vacuum flask method of using boiling water to decontaminate soft contact lenses is better and less expensive

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than other ways of using moist heat and can be safely and effectively applied under most domestic circumstances.

Introduction

The soft contact lens hydrogel material has properties which render disinfection of its surfaces by chemical methods difficult to achieve without side effects.^{1,2} Damage to contact lens due to inefficient sterilization has been noted many times in this laboratory. Lenses from two patients were contaminated with a fungal growth (fig. 1).³

The purpose of this study was to show the reliability of "sterilizing" soft contact lenses by placing them in a soaking

case filled with normal saline and submerging it in boiling water poured into a vacuum flask left for a minimum period.

FIG. 1—Colony of unidentified fungus growing near site of "L" engraving of a left soft plastic contact lens. (x 88.)

Methods

A Nova hydrophilic contact lens soaking case with screw-on caps was used. It has two discrete water-tight wells, each holding about 2 ml of fluid. The vacuum flask was an inexpensive model available in any department store and holding 500 ml of fluid.

Two types of micro-organisms—bacterial and viral—were used as sterility indicators: *Staphylococcus aureus*, a pathogenic micro-organism which is one of the most resistant of the non-sporing bacteria found in cases of eye infections,⁴ and adenovirus type 5, a common causative agent in viral eye infections which is also relatively heat resistant as compared with other viruses causing ocular infections.

Bacteriological Studies.—Each well of the case containing one lens and 2 ml of physiological saline was inoculated with 24×10^6 colony-forming units of *Staph. aureus*. The vacuum flask was filled with boiling water, the contact lens case added, and the flask stoppered as normally. After one hour the lens case was removed. Dilutions were made of the fluid from each well of the case, plated on to nutrient agar, and incubated at 37°C with the unheated control culture dilutions.

Virological Studies.—Adenovirus type 5 was grown to a concentration that caused a cytopathogenic effect three days after inoculation. Then 2 ml of suspension was added to each well of the lens case, which was placed in the vacuum flask of boiling water as above. After one hour 1 ml of fluid from each well was inoculated into two tissue culture tubes and incubated with controls at 37°C for seven days.

Results

Bacteriological Studies.—The staphylococci were killed, and control cultures confirmed that the calculated test dose of staphylococci had been present.

Virological Studies.—Live virus was not detected after 14 days' incubation, including one passage to fresh tissue cultures. The positive control tubes showed complete cytopathogenic effect after three days at each passage.

Physical Studies.—To obtain an indication of the actual temperatures inside a lens case during the treatment a Phillips

3500 recording potentiometer was used. The temperature of the water in the flask outside the lens case dropped within one minute from 100°C to 93°C. The temperature of the saline in the wells rose from 24°C to 90°C in 10 minutes, after which time the water temperature in the flask had dropped also to 90°C. From this point on it needed almost eight hours for the temperature inside the case to drop to 60°C (fig. 2).

FIG. 2—Temperatures inside flask and lens case after addition of boiling water.

Discussion

Several patients did not adhere to the recommended boiling technique (immerse lens case in boiling water for 15 minutes) and left their lenses immersed for only five to seven minutes. Subsequently these patients developed eye infections. The temperature of the saline inside the case only reaches 90°C after ten minutes' immersion, and a longer period of time is needed to pasteurize vegetative bacteria. Eight patients who immersed the lens cases into actively boiling water either forgot about them or miscalculated the time of removal and as a result boiled the container dry, damaging the lenses.

The drawbacks of direct boiling of contact-lens cases and chemical methods of sterilization are surmounted by the vacuum flask technique which has the following advantages: (a) adding boiling water to a vacuum flask containing the lenses in their case is a one-step operation and a "fail-safe" procedure; (b) the process does not require further attention once the boiling water is added to the thermos; (c) it does not involve any chemical or substance that can harm either the lenses or the user; (d) the lenses can be retrieved and worn at any stage after sterilization—that is, there is no delay by having to rinse them free of any chemicals; (e) the lenses, as well as the case and fluid they are stored in, are decontaminated at the same time.

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