reason why real progress has not been made is because we have been too often satisfied to apply to the lungs the principle of rest half-heartedly, whereas it should have been applied up to that point of completeness just short of lung function incompatible with life, and in time.

THE THERMOPHORE—ITS USE IN EYE THERAPY*

REPORT OF CASES

By M. F. WEYMANN, M. D.
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DISCUSSION *by Frank H. Rodin, M.D., San Francisco; A. Ray Irvine, M.D., Los Angeles; Otto Barkan, M.D., San Francisco.*

THE thermophore was devised by Shahan of St. Louis in his search for a means of combating pneumococcus ulcer of the cornea. After many painstaking experiments he found that the pneumococcus in the cornea could be destroyed by a temperature of 152 degrees F. applied directly to the infected area by means of a nickel-plated brass conductor, and that this method of destruction did less damage to the cornea than any other means of destroying the pneumococcus now in use. It was also found that the normal cornea will stand temperatures of up to 150 degrees F. applied with this instrument without permanent scarring, but that 160 degrees F. will cause permanent opacity of more or less degree.

The thermophore itself consists of an electrical heating coil, in the center of which is placed a thermometer and a receptacle for various sized nickel-plated brass conductors for application to the tissue. The temperature is controlled and kept constant by an adjustable thermostat. Thus when the instrument is set at 140 degrees F. it remains within one degree of this temperature indefinitely by automatic control. The conductors have different sized and shaped tips for application to the various lesions to be treated.

TREATMENT OF PNEUMOCCUS ULCER

First we shall discuss pneumococcus ulcer for the treatment of which the instrument was primarily designed. Where I have used the thermophore in these cases the results have been excellent. It is necessary to apply it as soon as the ulcer is discovered and in the manner described below.

The eye is cocainized by instillation of 4-5 drops of 5 per cent cocain at 3-5 minute intervals. I always use either a subconjunctival injection of 1-3 min. of 5 per cent cocain or one of B. and W. 1/20 gr. cocain ophthalmic discs following this, five minutes before the application of the thermophore. Then an applicator is selected which will not only cover the ulcer, but will overlap the gray infiltration surrounding the ulcer into healthy tissue. It can be demonstrated histologically that pneumococci have penetrated in advance of the zone of gray infiltration. If the ulcer is of such size or shape that one conductor will not cover the entire area, successive applications of different sized conductors are made at the same sitting to cover the entire area. The conductor is brought into actual contact with the cornea and only enough pressure exerted to slightly dimple it. I have proved by experimentation on my own skin that the pressure exerted on the applicator has a marked effect on the amount of heat absorbed and the depth to which it penetrates. If there is any advancing edge on the ulcer on the next day it is a sign that an area was missed by the applicator and another application to this active area must be made. One uses the temperature of 160 degrees F. for one minute at each application to be sure to be above the thermal death point of pneumococci. The application must also be made continuously for one minute to get the full effect.

In his article on "Thermal Death Points" in "Contributions to Ophthalmic Science"—Doctor Jackson's birthday volume—Shahan goes into detail as to the temperatures which normal and tumor tissues will stand as applied by the thermophore.

The corneal epithelium is the most easily destroyed at 130 degrees F., but as this readily regenerates we need not worry about its destruction. Permanent damage to the corneal stroma and Bowman's membrane is not done until the temperature goes over 150 degrees F., so that with temperatures under this point we get no permanent scar. The sclera is very resistant, but I have observed complete atrophy of retina and choroid with no permanent damage to overlying sclera with 160 degrees F. for 3-5 minutes applied to the sclera in rabbits. As Shahan points out that the thermal death point of most tumor cells is under 145 degrees F., we may easily destroy small tumors without permanent damage to normal tissues.

Now as to actual case reports and clinical experiences. In all these cases the thermophore was applied with local cocain instillation anesthesia followed by subconjunctival injection or a 1/20 gr. B. and W. cocain tabloid.

CASE REPORTS

I have had four patients with dendritic ulcer treated with the thermophore.

The first was seen in February, 1924. After using everything from silver nitrate to absolute alcohol with refusal to heal for a month the thermophore was applied at 140 degrees F. for one minute to the entire area. Three days later there was no staining with fluorescin. A month later two small areas broke down, but healed in less than a week and have remained healed to date, as the patient was recently seen.

The second was first seen in October, 1925. The ulcer progressed for eight days under conservative treatment. The thermophore was then applied at 135 degrees F. for one minute.

The ulcer had healed on the following day. This ulcer was over the center of the pupil and that was the reason for the temperature of only 135 degrees F. In November there was a marked central opacity of the cornea. Dionin was prescribed and in January, 1926, the vision was

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20/20 with correction and only a faint nebula visible. The ulcer never recurred.

The third patient was seen in consultation with Doctor Jesberg in December, 1926. She had had dendritic ulcer on and off for ten months. The whole lower half of the cornea was involved. The entire area was covered, using 140 degrees F. for one minute. The pupillary area which was uninvolved was not touched. This patient experienced severe pain for five days following the treatment, which had to be kept under control by morphin and hyoscin. In all the others the pain was controlled by aspirin or allonal. There was only a slight stain on the day following treatment and no staining on the fifth day. On January 14, 1927, there was much clearing of the cornea and no further trouble.

The fourth was treated in January, 1927, the application made at 136 degrees F. for one minute. Complete healing followed in three days and the cornea is now clearing with dionin. From these experiences it would seem that application from 136 degrees to 140 degrees F., depending upon the severity of the ulcer, will cause healing in from one to five days and that the after treatment with dionin leaves very little scar. The scar persists from the ulcer and not the area touched with the thermophore.

Another patient with a progressive non-infected ulcer near the limbus was treated by the usual methods for ten days without healing. The thermophore was used for one minute at 140 degrees F. followed by healing in three days. The ulcer has not recurred. Thus one use of the thermophore is for the stimulation of healing of non-infected ulcers of the cornea.

My personal experience with corneal new growths has been limited to three cases. These have been epithelial growths, apparently non-malignant, entering from the limbus. One growth was covered with a waxy film and had been curetted with recurrence. I saw a similar growth in consultation with Doctor Irvine upon which we used the thermophore. In all of these corneal growths I used 150 degrees F. for one minute. In the first few days following the thermophore application there was hemorrhage into the growth and swelling. Then it gradually began to absorb and disappeared entirely, leaving practically no scar.

One large dermoid of the cornea was treated using repeated applications at 160 degrees F. for one minute, but there was so much fibrous tissue present that the treatment was ineffective.

A conjunctival nevus was removed using 150 degrees F. for one minute. The absorption took a period of almost two months. I saw one in the office of Doctor Ewing where a second application was necessary to cause complete disappearance of the growth.

At the General Hospital I have shown a patient where a granuloma extending from the plica up around under the upper fornix and around into the lower fornix was absorbed completely with 150 degrees F. applied over its entire extent for one minute. This was done in three sittings.

Non-pigmented nevi of the lids, especially those near the margin which one does not wish to excise may be destroyed through repeated applications at 150 degrees F. If the patient is very sensitive one may infiltrate with novocain. In experimental work I have removed small pigmented nevi and hemangiomata with 150 degrees F. for one minute.

Large, horny warts must have the horny layer removed with nitric acid and the pointed conductor plunged into their center at 160 degrees F. for one minute. My results with xanthomata have not been successful, as the process seems much more difficult than the simple excision and suturing of the skin. I have not used the instrument in trachomatous pannus, although Luedde of St. Louis reports a favorable result. Twice I have used the instrument on very small basal cell epitheliomata, less than five mm. in size, in the orbital region with complete disappearance and healing of the ulcer using 150 degrees F. for one minute.

In experimenting on myself on the skin of the forearm and allowing the instrument to rest with its full weight using a 4 mm. contact I found the following results: 135 degrees F. for one minute caused a temporary erythema; 140 degrees F. for one minute an erythema lasting several days, but with no permanent destructive effect; 145 degrees F. for one minute caused destruction of the skin with scar tissue replacement, but with an almost unnoticeable scar after a few months; 150 degrees F. for one minute left a quite noticeable scar. As the pressure used here was much greater than that ordinarily used and the skin is much thinner on the forearm, it is safe to conclude that under usual circumstances temperatures up to 150 degrees F. may be used on skin tumors without fear of a noticeable permanent scar.

CONCLUSIONS

To sum up my experiences I think we may say that the indications for thermophore therapy are:

1. Infected progressive ulcers of the cornea which require 160 degrees F. for one minute.

2. Non-infected progressive or indolent ulcers of the cornea requiring 135 degrees to 140 degrees F. for one minute, the lower temperature to be used if the ulcer is in the pupillary area. If this does not cause healing a second application with a higher temperature may be made.

3. Any tumors, malignant or non-malignant, of cornea or conjunctiva which require 150 degrees F. for one minute, to be repeated if entire mass does not absorb after the reaction is complete.

4. Non-malignant tumors of lids and skin surrounding eye where the mass is not so great that conducted heat will not penetrate. These require 150 degrees F. for one minute.

The precautions to be observed if one wishes success are complete anesthesia, an applicator large enough to extend well out into normal

tissue, and pressure firm enough to dimple the cornea or dent the skin.

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DISCUSSION

FRANK H. RODIN, M. D. (490 Post Street, San Francisco)—During the last twenty-five years many useful instruments have been added to the oculist's equipment. The most useful for therapeutic purposes is Shahan's thermophore. Doctor Weymann has fully covered the indications and the method of applying the thermophore.

There are a few points in applying the instrument which may be helpful in obtaining the best results. It is not necessary to emphasize the importance of proper anesthesia. The thermophore is best applied while the patient is in a supine position on an examining table or couch. It can also be applied while the patient is in bed. Having brought the instrument to the desired temperature, and having selected a conductor most suitable for the purpose, the thermophore is applied the same as one would a tonometer. If the patient cooperates and the lesion under treatment is small the eyelids may be separated with the fingers when applying the instrument, otherwise an eye speculum is indicated. The patient fixes with his normal eye at a point on the ceiling in such a way that the surface to be treated on the affected eye is directly upward. The surgeon must keep his eye constantly on the area under treatment and see that the thermophore is properly applied. It is well to have a nurse or an assistant to watch the time and notify the surgeon when the required time has elapsed—usually one minute.

My experiences in treatment of corneal ulcers with the thermophore are similar to those of Doctor Weymann. There is nothing so distressing to the patient and such a source of anxiety to the surgeon as a corneal ulcer that refuses to clear up in spite of all topical applications of drugs. Here the thermophore is most useful. It will not only shorten the period of treatment but will permit the patient to return to his work sooner. The tendency is to delay the application of the thermophore. Any pneumococcus ulcer or any large ulcer should have the thermophore applied at once, also any corneal ulcer that does not show an improvement after a few days of routine treatment. I believe that some of the cases of corneal ulcers reported which necessitated conjunctivoplasty might have been cured by the application of the thermophore without resorting to an operation. It is true that such intractable ulcers are not very common; but even if one such case occurs during a year's practice which can be helped with the thermophore the inclusion of this instrument in the equipment of every oculist is recommended.

My experience with the application of the thermophore to corneal and other growths has been limited. The tendency is to remove such growths surgically. However, there are many cases in which this instrument can and should be given a trial before resorting to surgical or other means.

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A. RAY IRVINE, M. D. (709 Westlake Professional Building, Los Angeles)—After five or six years' experience with the use of the Shahan thermophore, I agree with Doctor Weymann that it is one of the most valuable adjunct therapeutic agents in our armamentarium. For indolent corneal ulcers and also acute cases that tend to progress rapidly, the thermaphore, applied with a point sufficiently large to cover the ulcer and immediately adjacent infiltrated area, has given me better results than any other means which I have tried.

The pressure used in applying the point is of as great importance as the time used for the application. A pressure sufficient to flatten the corneal area involved will insure the most efficient penetration of heat, and the time of one minute at 140 degrees F. for corneal lesions will not destroy the normal tissue.

For papillomata of the lids it is necessary to first remove the horny layer before applying the instrument. We may here use a few more degrees of heat.

In a case of recurrent wax-like epithelial growth extending from the limbus and covering one-third of the cornea and into which were a number of angry vessels, I was able to completely remove, leaving transparent cornea. After eight months there has been no recurrence. Three applications at 140 degrees for one minute at week intervals were necessary, parts of the growth not having been covered at the first application.

In a case of very large papilloma of the upper lid, extending from the upper border of the tarsal plate to the margin of the lid, one in which surgical removal would have produced a considerable deformity of the lid, I was able entirely to remove in three or four applications, without deformity.

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OTTO BARKAN, M. D. (490 Post Street, San Francisco)—I take pleasure in complimenting Doctor Weymann upon calling the attention of the western specialists to the Shahan thermaphore. His excellent exposition of the subject seemed to me to fill a definite gap. No one that reads his interesting paper can fail to be impressed by the excellence and the manifest uses of the instrument.

Our experience in its application on several hundred cases has been most satisfactory. We agree that it constitutes a great step in advance in ophthalmological therapy. Not only can such conditions as herpes corneae, recurrent erosions, various types of chronic, recurring ulcers be cured within a few days—which formerly required several weeks or even months to relieve—and the patient thereby be saved a tedious convalescence but, in many of these conditions, the very rapidity of the cure, as well as the minimum destruction of tissue entailed, saves the patient permanent loss of vision.

DOCTOR WEYMANN (closing)—Lest we seem too optimistic I may say that ulcers healed by means of the thermophore may break down if attention is not paid to clearing up foci of infection and other etiological factors. Also one must select his cases with a knowledge of the underlying physiological principles of thermophore therapy and not use it where stimulation will do harm instead of good. But we may say that of all the means of therapy at our command for these conditions the thermophore, when properly used, gives the highest percentage of successful results.

NON-SPECIFIC PROTEIN THERAPY IN DERMATOLOGY*

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AND
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DISCUSSION *by Ernest Dwight Chipman, M. D., San Francisco; George D. Culver, M. D., San Francisco; George F. Koetter, M. D., Los Angeles; Kendal Frost, M. D., Los Angeles.*

THE remarkable disappearance or improvement in certain chronic diseases following an attack of an intercurrent and unrelated infection has been a rather common and puzzling clinical observation. Instances of this nature are within the experience of most practitioners. The apparent cure or arrest of a syphilitic infection following an exfoliative dermatitis due to arsphenamin therapy is a frequent finding. The favorable influence of malaria or some other fever producing infection upon general paresis of the insane is well established. One of us has seen a striking improvement in a patient almost moribund

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