On July 17, 1929, I saw the patient again. Vision was the same, as was the field of vision; the central scotoma was slightly smaller; the fundus showed atrophy of the retina. Arteries were filamentous. Veins were full. The disc was atrophic, and there was choroidal atrophy surrounding the macula lutea.

The patient died suddenly in August, 1929, in a severe attack of angina pectoris. Unfortunately he was buried the same day, and I was therefore unable to obtain the eye for pathological examination.

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**THE USE OF THE DIATHERMY CURRENT IN EYE DISEASES**

**BY**

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Heat, in some crude form or other, has long been used for the relief of pain in any part of the body, including the eye. Heat is also used in treating disease, even without pain.

Crude heat or external heat, *i.e.*, heat generated outside the body, must exert surprisingly little therapeutic effect when applied to the eye. The penetrative power is minute and the resultant hyperaemia is very superficial. The chief therapeutic objection, however, is that it is impossible to maintain the initial temperature, once the application is made.

A method of applying penetrating, persistent heat to the eye is possible by the use of the diathermy current. This current is a to-and-fro, alternating, current, which is made and broken; that is, enters and leaves the body, at a rate of from one million to three million times a second. The current that enters the body is sufficiently powerful to be dangerous, were it not for the amazingly high periodicity, which enables the current to leave the body again before it can kill person or tissues. (I may here interpolate that I am discussing medical diathermy, as distinguished from surgical...
diathermy, where coagulation necrosis is actually aimed at and achieved). The effect of the resistance of the tissues to the rapid passage of a strong current is to raise the local temperature of the tissues in the path of the current, the temperature area being limited fairly closely to the area of the electrode applicator. This means that the diathermy current applied to the eye heats uniformly, raises the temperature of the entire contents of the orbit, not merely the superficial epidermis. The physical effect is that of putting a poultice through the eye, or, rather, making a poultice of the eye without destroying it. Bier's methods of producing active and passive hyperaemia and their effect in the treatment of disease are sufficiently well known. The difficulty hitherto has been to produce this in the eye. Diathermy produces an active hyperaemia of the eyeball and adnexa.

One can divide the action of the eye diathermy into two parts.

1. *Heat*, for the relief of pain (and perhaps also a factor in the actual treatment of a disease process, though this is a difficult matter to prove or disprove).

2. *Hyperaemia*, as the primary therapeutic factor of the process.

Eye diathermy was first employed by Iredell and Meadows-Ryley primarily for the relief of pain in a case of glaucoma (*Proc. of the Roy. Soc. Med. 1918*). The man was already completely blind and was admitted to hospital for removal of the eye because he could no longer bear the pain. As he was already blind and no worse could befall him, diathermy was applied, with complete relief of the pain and the saving of the eye.

A series of varying cases were then done and good results were claimed. In spite of this the method was not taken up. I soon found out the reason.

In 1925, Mr. Meadows-Ryley asked me to give diathermy to a patient, a woman, suffering from retro-bulbar neuritis. The pain had resisted all treatment and prevented the patient following her occupation as a masseuse. Six treatments with diathermy cleared up the pain completely and there has been no relapse since. I then tried other cases, but found the electrode used by Iredell was too dangerous and unreliable, besides being difficult at times to apply. I had several bad frights with it. Finally I gave it up until I was successful in devising a new diathermy eye applicator (*Brit. Med. Jl.* 1, 1927), which makes the treatment safe in skilled hands and with a trained assistant.

This diathermy eye electrode consists, in principle, of an eye bath with a stem. The bath has a rubber protection where it fixes into the eye socket and has a projecting wine-glass stem by means of which an assistant holds the electrode firmly in position on the patient's eye. The electrode is sterilised by boiling
DIATHERMY CURRENT IN EYE DISEASES 407

after each application, another being used where two eyes of one patient are treated. I find it better to apply the electrode dry, rather than wet, which I did at first. It makes it easier to fix and to hold in position.

The patient lies on a table on one pillow with the head slightly extended. After the electrode is in position, warm, sterilised, normal saline is poured in through a connecting glass tube leading from the hollowed platform of the wine stem into the eye-bath. The eye-bath is pierced with a metal terminal, which is connected to one pole of the diathermy machine. There is also an air-hole.

The other pole is connected to a handle electrode which is grasped in the patient's right hand. This handle electrode for the second pole facilitates the giving of treatment to numbers of patients, particularly in hospital practice. It is not necessary to apply large metal electrodes with interposed layers of lint, over the back, chest or abdomen. The handle is grasped in the patient's right hand, whether the treatment is being applied to the right or the left eye. A sand-bag should be placed under the right forearm, so that the patient does not get cramp in the muscles of the forearm through strain. He is told to grasp the handle firmly, but not fiercely and is warned not to let go, as there may be a spark, or even an actual burn if, on letting go, contact is diminished to a small area.

Preferably, the assistant holding the electrode on the eye should be seated, as there is sufficient strain in holding the electrode in position and looking out for leaks of saline, without adding to it. All of my nurse assistants have appreciated the difference of giving the treatment sitting instead of standing.

It does not matter whether the eye is kept open or closed during treatment. The patient should be told so and also that he should not try to open or shut it after the electrode is on, as this may cause the electrode to shift a fraction and to leak. The warmed saline should be poured in till it just reaches the level of the air-hole in the eye-bath.

Patients are naturally afraid, as electricity applied to the eye sounds a terrifying and painful business. Before the first treatment, therefore, it is necessary to reassure the patient and to gain his co-operation, which is necessary for the best result. He is told that he will not get any shocks or feel any pain, but that it is absolutely essential for him to lie quite still. He will feel a gentle warmth in the eye, gradually getting hotter. As the current is increased he is asked if it is too hot. If it gets too hot, he is told to say so, but is warned only to move his lips and not to nod or move his head in speaking or in replying to questions. All patients are nervous and afraid of the first diathermy eye treatment, but the first treatment completely re-assures them. It is
advisable, on the first treatment, to keep one hand close to the switch, ready to break off the current in case the patient moves suddenly or jumps in fright. So far this has not actually happened to me, but one must be prepared for it.

The first treatment should last four minutes as a maximum, the treatment being stopped earlier if the patient so desires.

The duration of treatment can be increased on the second occasion, if the patient will stand it, but some patients can never stand more than four minutes, even after many months. Five minutes is the average length of the treatment, some few standing six or seven minutes. I consider six or seven minutes should be the maximum, as in my early days with this treatment, I tried ten minutes and found I was not getting such good results as with five minutes.

Two treatments a week are usual, but never more than three treatments should be given in any one week.

The amount of current the patient will stand without pain is the amount that should be given. The current should be increased as slowly as possible. The patient usually feels nothing until he is taking about 200 milliampères. The average dose is 350 to 600 milliampères. A few will stand 500 milliampères. Very rarely 600 milliampères will be borne, but never for more than one minute. In most cases the current had to be lessened considerably from the patient's maximum before the end of each treatment.

I used to advise the patients to wear large, dark goggles for a few hours after each treatment to protect them from light and wind but I never do so now. It does not seem to make any difference to the patient's comfort or to the effect of the treatment. Occasionally in very old or nervous subjects, there is a transient vertigo immediately following treatment, necessitating the patient's lying down or sitting for a few minutes. Otherwise, there are no ill-effects.

Constant care is certainly necessary and the patient must be closely watched and not left for a moment while the current is on. With these provisos, one can say the treatment is perfectly safe, though I can imagine dangerous happenings in the hands of an unskilled operator. It need hardly be added that eye diathermy is not a form of treatment that an unqualified person should be allowed to handle.

The length of time over which eye diathermy will extend must vary with the individual case but in the usual chronic type of eye disease for which it is suitable, it may be reckoned in months rather than weeks. I have had several cases which were treated continuously for over a year. My experience of acute cases has been limited to one: a man with double, severe, gonorrhoeal conjunctivitis. Three applications of diathermy to each eye
DIATHERMY CURRENT IN EYE DISEASES

sufficed to resolve the condition completely, without any subsequent relapse.

An important point that I insist on is that eye diathermy must be constantly controlled by the ophthalmologist in charge of the case. He should see the case after the first six treatments and every two or three weeks subsequently in a long case and the onus must rest on him as to whether diathermy is benefiting the condition and should be continued or whether it should be stopped temporarily or permanently.

This paper deals primarily with the technique of eye diathermy and general considerations, based on over four years' experience of it in the electrical departments of three general hospitals, during which I have treated some 60 cases with eye diathermy. I leave to the ophthalmic surgeons in charge of the cases the duty of giving their findings on the results of the treatment.

I may, however, perhaps be allowed to give my own general review of my impressions of the value of diathermy in eye diseases and of the type of case for which it is suitable.

Pain in the eye from whatever cause in any chronic eye disease, is relieved always by diathermy. That statement is made deliberately and without qualification. Some patients have volunteered the information that they have had a good night's sleep after two or three treatments, occasionally after the first.

Chronic senile conjunctivitis invariably does well. Iridocyclitis and cyclitis vary in their results. I can say, definitely, however, that the majority do well and a few have apparently completely recovered. I have had one case only of episcleritis, which is still under observation. She has had recurring attacks in both eyes, with severe pain for years. Treatment with diathermy has resulted in the intervals between attacks being lengthened, the attacks shortened and pain abolished.

In glaucoma the tension is appreciably lessened after each treatment, at least temporarily. In two cases it appeared to me that the condition was arrested. The most successful glaucoma case I have had was that of a man aged 60 who had already lost the sight of his right eye from glaucoma. When he was sent for treatment, he was "seeing colours round lights" with the left eye and the eyeball was very tense. The symptoms completely cleared up after a course of eye diathermy. If one can describe it so, the glaucoma seems to have aborted and the eye and its vision remain normal nearly a year after the completion of diathermy treatment.

Chronic infections of the eyelids, too, do very well, particularly chronic blepharitis.

In cataract there would appear to be scope for diathermy if this disease is in part due to a nutritional defect, from whatever cause
Most of my cataract cases did not respond to treatment, though some seemed to improve and become stationary. I can mention one cataract case, however, in which resolution seems to have become complete, with restoration of almost full vision.

An eye disease which I have not had the opportunity of treating, but I believe is particularly suitable for diathermy, is trachoma.

In conclusion I would deprecate any extravagant claims for diathermy. Eye diathermy is still in its infancy, but I feel convinced that it has a useful field and will become one of the stock forms of treatment in eye diseases. With time, with more experience and, perhaps with the collective experience of others who have followed me in this line of treatment it may be possible in the future to designate the particular eye diseases which will derive benefit and those in which it is contra-indicated.

Meanwhile, while we are still groping, I continue to say to the ophthalmic surgeons of my hospitals "Send to the Electrical Department any case you find does not respond to any treatment, however hopeless. I can at least promise you that diathermy properly applied to the eye will do no harm."

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TWO CASES OF INTRA-OCULAR SARCOMA

BY

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I think short notes of the following two cases of intra-ocular sarcoma are of sufficient interest to justify publication.

Miss J. R., aged 54 years, came to me in January, 1925, with a history that her left eye had recently failed. She had worn glasses for about 5 years for reading; her distant vision had always previously been good in both eyes. She had had her left breast removed for carcinoma 8 years previously; there had been no recurrence. Her right eye was practically emmetropic.

The left pupil reacted to light but vision was reduced to about 1/60. On dilating the pupil, I saw a large detachment of the retina, part of which was clearly filled by a solid mass not much pigmented; the mass was more or less hemispherical in shape and projected forward considerably.

In view of the history, I thought it probable that the mass was a recurrence of the original carcinoma; and a similar view was taken by a colleague to whom I showed the patient; but there