REMARKS ON ELECTROLYSIS IN THE TREATMENT OF LACHRYMAL OBSTRUCTION.

BY J. W. E. STEAVENSON, M.D. CANTAB., M.R.C.P.,
In charge of the Electrical Department at St. Bartholomew's Hospital;
AND

WALTER H. JESSOP, M.B., F.R.C.S.,
Surgeon to the Central London Ophthalmic Hospital, and Ophthalmic
Surgeon to the Paddington Green Children's Hospital.

THE great difficulty of effecting anything like a cure for obstinate cases of epiphora due to obstruction in the lachrymal passages is known to all. The usual treatment by astringents, probes, styles, and splitting up the canaliculi are all open to grave objections, and often little benefit to the patient. Mr. Power, in his lectures at the Royal College of Surgeons of London, drew special attention to the anatomical conformation of the lachrymal passages, and the great harm that might be generally done to them by the passage of the large probes so often used.

The treatment of obstruction of the puncta and the lachrymal canals by electrolysis is only another example of the great advantages that the employment of electrolysis possesses in the treatment of stenosis, and other affections occurring in parts difficult of access. The smaller the passage the greater the difficulty of performing an operation. The application of caustic alkalies in the treatment of stricture of the urethra has been used, and abandoned on account of the difficulty experienced in limiting the action of the caustic to the part it is wished to destroy. This objection does not exist in the application of electrolysis, because its action is entirely under the control and direction of the operator. The site of its influence can be limited to the smallest point. The duration and extent of its cauterising action is also absolutely at the command of the operator, and depends on the strength of the current employed and the time it is allowed to flow.

The cases Mr. Jessop records prove that there is a mode of treating these obstructions at the same time more expeditious than the use of probes, free from danger, and very fairly successful, the complications arising being less in number and gravity than those which accompany the other methods employed.

Electrolysis is the name given by Faraday to the power which electricity possesses of splitting up all compound substances that are conductors into their constituent elements. It is a chemical decomposition, the several elements reappearing in the proportion in which they combined—not in proportion to their atomic weights, but in proportion to their chemical quantivalence. Thus, for every grain of hydrogen evolved in the electrolysis of water there are not sixteen grains of oxygen at the opposite pole, but eight grains, as two volumes of hydrogen combine with one of oxygen to form water; the volume of the gases given off will be as two to one.

The same process in a much more complicated form takes place when electrolysis is performed on living animal tissue. The number and complexity of the elements and compounds composing animal tissue, and their different nature in different parts of the body, makes any analysis of the decompositions and recombinations which take place when an electric current is passed through them extremely difficult and almost impossible.

The chief outlines of the electrolytic action has been studied and investigated principally by Dr. Althaus. It is known that at the negative pole the alkalies, such as the soda and potash salts which exist in the body, are split up, and sodium and potassium are liberated in a nascent state; these elements seize upon the water in their immediate vicinity, splitting it up again into oxygen and hydrogen. The oxygen combines with the alkaline metals to form caustic potash or soda, and the hydrogen escapes as bubbles of gas. At the positive pole the oxygen and chlorine in the tissues are liberated, and oxidise and chlorinate other elements with which they come in contact. The debris at the negative pole is moist and deliquescent, and gives an alkaline reaction to test paper, at the positive pole it is comparatively dry and charred, and gives an acid reaction. No great amount of heat is evolved, no more than is inseparable from all chemical combinations and decompositions. Electrolysis is an entirely different

thing to that process which is known as galvano-cautery, and with which it is so frequently confounded.

For the removal by electrolysis of organic material of any description which has caused an obstruction or stricture in any of the passages of the human body, the negative pole is used, because the obstructing material is by its means as it were melted down and dissolved, and the passage thus made larger. The electrode which is used, if in the first place it is not very much too large, is enabled to pass the obstruction and be removed again with ease. If an electrode connected with the positive pole is used it becomes glued to the surface of the passage and cannot be removed without much difficulty. The negative pole has no effect upon the metal of which the electrode is made, and when the electrode is withdrawn it is as bright as when introduced, but at the positive pole the metal is dissolved as well as the tissues, and enters into the new combinations which take place; this, in the case of stenosis or stricture, is undesirable.

For electrolysis, a battery composed of a large number of cells is required, and these cells are arranged "in series;" that is, the negative pole of one cell is connected to the positive pole of the next, and so on. This arrangement is made for obtaining a current with a high electro-motive force for the purpose of overcoming the resistance which all chemical compounds offer to their decomposition by electricity. The power of affinity which keeps chemical compounds in combination requires a strong force to overcome it. The material to be decomposed by electrolysis in stenosis of the lachrymal canals is not very dense and does not offer such a very great resistance, and, therefore, a battery composed of a comparatively smaller number of cells is sufficient. A galvanometer should be introduced into the circuit for the purpose of measuring the current, for different batteries are possessed of different electro-motive force; a difference also exists in cells which have been recently charged, or which have been in use for a long time. Two to four milliamperes will be found a sufficiently strong current to enlarge any narrowed lachrymal canal. Some patients

Fig. 1.

Fig. 2.

offer very much more resistance than others; whereas in one patient three or four cells will give the required current strength, in another it will require six or eight cells. This difference in resistance is what is so little understood, but it is the factor which plays, perhaps, the most important part in electro-therapeutics. No reliable information can really be derived from reports of cases in which the number of cells only is given, so much depends upon the resistance of the patient and the strength of the cells. We have in our cases in several instances mentioned the number of cells employed, because we had not always a galvanometer in the circuit; and from always working with the same battery, and the experience we had acquired by constantly performing the operation, we were enabled to estimate pretty accurately what number of cells would give the current strength we required. For stenosis of the lachrymal canals, a probe small enough to be inserted into the punctum is introduced and passed along the canal to the nasal duct. We have usually used one made of platinum. The probe is fitted into a handle (Fig. 1), which is attached to the negative pole of a

battery. A flat plate electrode (Fig. 2), covered with some substance which will retain moisture, is connected with the positive pole, and generally placed on the back of the neck beneath the collar, having been first moistened with salt and water. The handle to the negative electrode possesses a mechanical arrangement for completing the circuit. The battery we have generally used has been one manufactured by Dr. Stöhrer, of Dresden, and composed of zinc and carbon elements immersed in a solution of sulphuric acid and water. A Leclanché battery would do equally as well for such a small operation; perhaps one or two additional cells would have to be used. We have found four cells of the Stöhrer's battery usually sufficient, and with the resistance they have to overcome have generally given a current strength of four milliampères. A lower current strength would accomplish the object desired, but then the electrode would have to be held in the canal for a longer space of time. With four milliampères the enlargement of the canaliculus takes thirty seconds. No anæsthetic is used. A sharp burning sensation is produced in the canal during the time the current is passing, but this is usually easily borne by the patient, especially when he is assured beforehand that it will only last for half a minute. During the operation a little froth collects by the side of the electrode, and oozes out of the punctum. In a very few seconds after the circuit is closed, the probe, which was at first gripped tightly in the canal, can be made to move backwards and forwards along the passage with great ease. On one or two occasions, through various accidents, we have inadvertently used the positive instead of the negative pole, the probe has then become fixed in the canal, instead of easily sliding backwards and forwards; and by this occurrence my attention has been called to the error. Certainly in two of the cases where we have had slight after difficulty, and the operation has had to be repeated, this mistake in the poles was made. The neighbourhood of the punctum, the inner canthus, and the surrounding integument to about an inch in circumference, remain slightly congested and suffused for about two hours after the operation.

CASE I.—C. S., aged 47, came on August 24th, 1886, complaining of epiphora for two years in right eye, much worse during the last three months. Right eye: punctum very small, and difficult to get probe (0.5 mm.) in. Stöhrer's battery, six cells, for thirty seconds; platinum probe (0.5 mm.) used. At commencement of operation, probe could scarcely be moved about; at end, very freely movable, and probe (1 mm.) inserted easily as far as sac. August 27th. Probe 1.5 mm. passed easily. No epiphora now. September 17th. Has had no epiphora since operation.

CASE II.—H. W., aged 34, came on January 24th, 1887, with history of right epiphora and mucocoele for two months. Right eye: lids inflamed; punctum small; mucocoele. Great difficulty in passing probe; borer used, and then probe (0.5 mm. passed). Stöhrer's battery—4 cells = 2 m. A.—for about fifteen seconds. February 1st. No discharge since operation. Slight pain in eye till last evening, none since then. Probe (1.5 mm.) passed. Stöhrer, 4 cells for fifteen seconds, and probe afterwards moved easily. March 22. No epiphora; no mucocoele. She says that before operation the right side of the nose was dry, but is now moist. June 17th. Has had no return of epiphora or mucocoele.

CASE III.—S. B., aged 45, came under treatment on March 1st, 1887, and complained of epiphora in left eye for two years, slight mucocoele, and dryness of left nostril. Probe (1 mm.) passed along left lower canaliculus, and obstruction found at entrance into sac. Stöhrer's battery—6 cells = 5 m. A.—for thirty-five seconds; probe (1 mm.) After operation, probe (1.5 mm.) easily passed. March 4th. Had pain for twenty-four hours after operation. No epiphora. Probe (1.5 mm.) passed. Seen last in June, and had no return.

CASE IV.—A. H., aged 33, complained of epiphora in right eye for seventeen years, ciliary blepharitis during the same time, and dryness of right nostril. Right eye: marked ciliary blepharitis. Punctum very small, canaliculus small, and obstruction apparently at entrance into sac. March 15th, 1887. Stöhrer's battery, 4 cells, for thirty seconds; probe (0.5 mm.). May 17th. Has had probes (1.5 mm.) passed every fortnight, and is much relieved. Has very little epiphora, and right nostril is now always moist. Electrolysis as before, but probe now larger (1.5 mm.). July 6th. Has had no epiphora since last operation, and ciliary blepharitis very much improved.

CASE V.—H. W., aged 28, complained of epiphora and mucocoele for eighteen months. March 15th, 1887. Right eye: lower punctum patent; obstruction at entrance of canaliculus into sac. Operation: Stöhrer's battery, 4 cells, for thirty seconds; probe (1 mm.), but attached by mistake to positive pole of battery. March 22nd. Has now lachrymal abscess, and probe will not pass along the canaliculus. Free incision externally into most prominent part of abscess, and a

little pus evacuated. June 3rd, 1887. The abscess healed up quickly, and she has been away in the country for the last month. Right eye: obstruction at entrance of lower canaliculus into sac. Operation: Stöhrer's battery, 4 cells for thirty seconds, and probe (1 mm.) used, and by moving probe about it was passed through into sac. July 19th. The right lower canaliculus was probed four times after last operation. The patient has not had epiphora since June 5th, and right nostril is moist.

CASE VI.—S. A. R., aged 50, has complained of epiphora in right eye for three years. Right eye: very small puncta; no mucocoele. March 2nd, 1887. Electrolysis: Stöhrer, 4 cells, thirty-five seconds; probe (0.5 mm.) and probe (1 mm.) passed easily afterwards. April 15th. Electrolysis as before, but with 1 mm. probe, and afterwards 1.5 mm. probe used. May 24th. As there is still slight epiphora, electrolysis again performed with probe (1.5 mm.) July 17th. Has no epiphora, and right side of nose moist.

CASE VII.—E. K., aged 38, complained of epiphora for three years. Right eye: punctum small; also obstruction at entrance into sac; no mucocoele. April 1st, 1887. Electrolysis: 4 cells for one minute; probe (1 mm.) April 4th. No epiphora for two days. I have heard from the patient since, and she expresses herself as quite cured.

CASE VIII.—E. K., aged 41; epiphora for ten weeks. April 15th, 1887. Right eye: lower punctum normal; obstruction at entrance of canaliculus into sac. Electrolysis: 4 cells, thirty seconds; probe, 1 mm. In this case the canaliculus was probed once a week for a month, and then electrolysis again done twice. The result has been complete recovery.

CASE IX.—T. P., aged 36; epiphora for six months following a severe fist blow. May 12th. Right eye: canaliculus very small; probe, 0.5 mm., passed with difficulty. Electrolysis: 6 cells for thirty seconds; 0.5 mm. probe, and made positive by mistake. May 26th. The right lower canaliculus has been probed every other day since operation to counteract and prevent cicatrization owing to use of the positive probe. Electrolysis: 1 mm. probe made negative for forty-five seconds. This patient made a complete recovery, and was last seen about fourteen days ago.

CASE X.—W. P., aged 35. Epiphora for one year in left eye. June 6th, 1887. Left eye, lower punctum very small; borer used, and then 0.5 mm. probe passed along lower canaliculus. Electrolysis; 4 cells = 4 m. A.; for one minute, 0.5 mm. probe used, and 1.5 mm. probe passed easily afterwards. June 13th. 1.5 mm. probe passed easily; has no epiphora now. July 20th. Has had no epiphora since operation.

The cases we have just related are confined to those in which the obstruction is at the punctum or in the canaliculus, and not in the sac itself. For some of the cases I am indebted to the great kindness of Mr. Hulke, the others attended my practice at the Central London Ophthalmic Hospital.

The cases are consecutive ones, and with the exception that in two a mistake was made in the probe being positive instead of negative, no trouble has followed, and even in these two cases the after treatment effected a cure. Care must be taken in all cases in which electricity is applied to the head, owing to its often producing faintness in the patient. The probes used have never been greater than 1.5 mm. During the operation great care must be taken to keep the patient's head fixed, as sudden pain is felt at making and breaking the current; the probe must also be kept away from the eyeball.

Advantages.—The advantages attending this procedure are chiefly due to the fact that so little displacement or alteration of the normal channels is effected. We have by it the means of increasing the lumen of the puncta and canaliculi without any excessive stretching, which must necessarily alter the conditions of the surrounding muscular and other structures.

Time must, of course, alone decide whether the operation procures complete recovery, and our cases are too recent to decide this point, but as far as they go they hold out great hopes of success.

A LARGE and influential deputation from the Commons Preservation Society, the Kyrle Society, and the Public Gardens' Association waited upon the Charity Commissioners on Wednesday last week to advocate the appropriation of a large part of the general charity property of the City parishes to the preservation of open spaces.

THE South Hornsey Local Board have decided to contribute £6,000 towards the balance required to make up the purchase money of Clissold Park as an open space, and it has been decided to apply to the Metropolitan Board of Works for the loan of the money. Stoke Newington has already decided to contribute £10,000 out of the £22,500.