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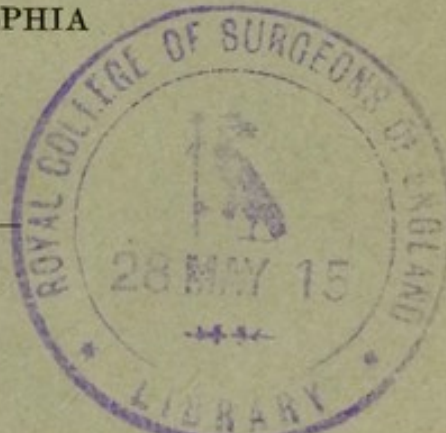
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S. LEWIS ZIEGLER, A.M., M.D.

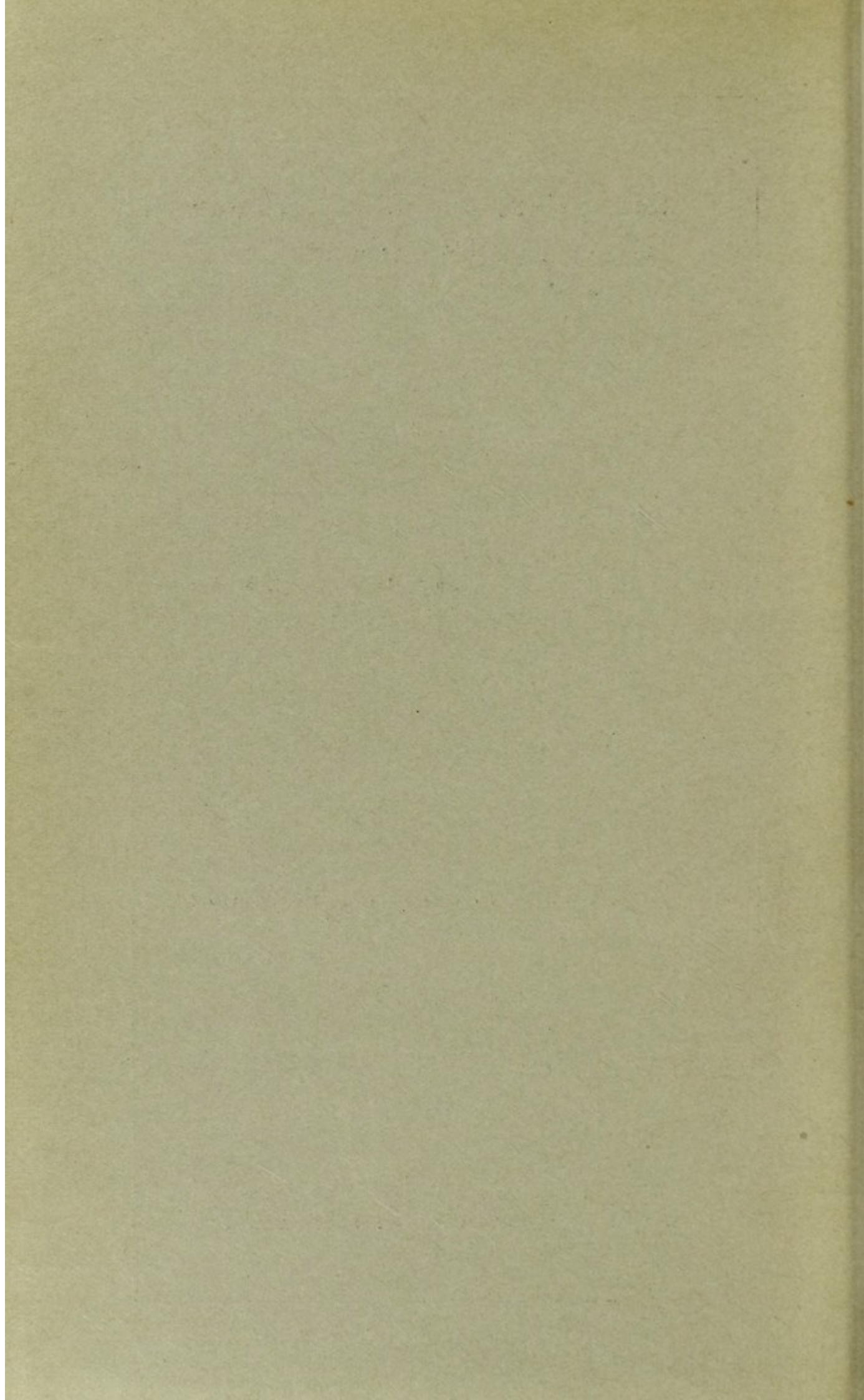
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PHILADELPHIA



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THE RADICAL TREATMENT OF LACRIMO-
NASAL DISEASE BY RAPID DILATATION
AND ALLIED MEASURES *

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PHILADELPHIA

Free drainage of the mucous-membrane-lined cavities and canals of the body is a fundamental essential in preserving their physiologic functions and preventing their infection. The radical relief of tear-duct disease presupposes, therefore, the successful accomplishment and maintenance of a patulous lumen in the lacrimonasal canal. The most important measures utilized for this purpose consist of dilatation, incision, introduction of styles, irrigation, electrolysis and cauterization. Extirpation of the lacrimal sac occupies a special field of its own and will not be discussed at this time.

ANATOMIC CONSIDERATIONS

For convenience we may roughly divide the tear-drainage apparatus into three parts, the first portion comprising the lacrimal puncta and canaliculi, the second the lacrimal sac, and the third the *ductus ad nasum*. The bony canal is lined with periosteum covered with cavernous tissue, over which is superimposed a layer of mucous membrane paved with columnar ciliated epithelium. This lining is often thrown up into transverse folds or rugæ which may be annular in arrangement and sometimes possess a valve-like action. The muscle of Horner at the upper end and the valve of Hasner at the lower end complete all the tissue elements essential to our problem.

* Read in the Section on Ophthalmology of the American Medical Association, at the Sixty-first Annual Session, held at St. Louis, June, 1910.

The length of the bony canal varies from 20 to 29 mm. and its diameter has been variously estimated at from 2 to 7 mm., the average being 4 mm. Power¹ in 1885 carefully measured 551 bony canals and found that the average diameter was 3.77 in whites, 4.70 in negroes and 4.63 in Mongolians, the general average of all races being 4.22 mm. Theobald² in 1877 stated that an examination of 70 bony canals revealed an average diameter of 4.11 mm., while tests of muco-periosteal lined canals in the cadaver showed a caliber of from 4.47 to 5.25 mm. It is evident, therefore, that moist cadavers permitted larger probes to be passed than could be passed through the distorted bony canals of dried skulls. To go a step farther, we may naturally deduce what I have found to be a fact, that the lacrimonasal canal *in vivo* is more distensible than it is in skulls because the bones and tissues are more flexible.

PHYSIOLOGIC DESIDERATA

The normal function of the tear-duct is to draw off from the lacus lacrimalis the excess of tears collected there and to pass them freely downward into the nose. By winking and slight muscular contraction we encourage a suction or siphonic action which carries off this lacrimal fluid through capillary attraction. It should be our aim, therefore, to secure a patulous tear-duct and at the same time to preserve, so far as possible, this physiologic function of capillarity. The ideal method should accomplish this by a sudden wide dilatation of the duct without incision of the punctum or of the canaliculus.

PATHOLOGIC FACTORS

The pathogenic influence of intranasal lesions in the etiology of lacrimal disease is generally accepted. It is estimated that at least 90 per cent. of these cases have a nasal origin. Secretions that are chemically irritating and laden with infectious bacteria are poured out from the accessory sinuses onto the floor of the nose and carried by reversed capillarity up into the lacrimonasal duct. The inflammation resulting from this irritation may be superficial, causing ulceration, stricture or catarrhal thickening of the mucosa. On the other hand,

1. Power, Henry: Lectures on Diseases of the Lacrimal Apparatus, Lancet, London, 1886, ii, p. 908.

2. Tr. Med. and Chir. Faculty of Maryland, 1877, p. 154.

the infection may penetrate the deeper structures, resulting in periostitis, caries or even in the formation of abscess. We must always bear in mind, therefore, the possibility of two active factors in the etiology of ocular disease, first, the pus-laden nasal fluids which the tear-duct may suck up and transmit directly to the eye, and second, the perverted secretions which the obstructed tear-duct may develop within itself. I have elsewhere³ referred to this as follows:

If now we concede an infectious cystitis of the antrum, we can comprehend how it is possible for an unlimited stream of pathogenic micro-organisms to be poured out onto the cup-like floor of the nasal chamber, and by capillary attraction drawn up into the lacrimonasal duct, and thence to the ocular cul-de-sac. The lacrimonasal duct itself is, moreover, a most fertile nidus for this bacterial development. The presence of strictures, viscid secretions, ulceration of the lining membrane, or interstitial thickening of the same, all tend to interfere with its siphonic action in the downward drainage of the tears. The bacterial growth is greatly facilitated by the consequent stagnation. Not only are the tears prevented from passing into the nose, but microbial infection is carried upward to the eye by the regurgitation of these septic secretions.

The ocular tissues that are most vulnerable to these septic and irritating fluids are the cornea, the conjunctiva and the palpebrum. Ulcerative keratitis, especially when recurrent, phlyctenular keratitis, vascular keratitis, sloughing of the cornea and wound infection may originate in this manner. Chronic conjunctivitis, eczema of the lid, and blepharitis marginalis may rise from the same cause, while the influence of persistent lacrimal irritation in causing ectropion and entropion is well known.

The absence of epiphora or blennorrhoea does not contraindicate lacrimonasal disease. On the contrary, we should always remember these two important facts, first, that we may have obstructive lacrimal disease without epiphora, and second, that we may have ocular infection without visible blennorrhoea.

DILATATION OF THE DUCT

While many authorities have advocated probing of the tear-duct, Bowman probably did most to popularize this procedure. His probes, however, were very small, the

3. Corneal Ulceration due to Nasal Infection, *Am. Med.*, April 9, 1904, p. 599.

largest measuring only 1.5 mm. Credit for the use of very large probes is undoubtedly due to Theobald, who in 1877 began to advocate publicly such extreme measures, and to demonstrate the excellent results which he had obtained. His probes were cylindrical in shape with a conical point, the series ranging from 0.25 mm. (No. 1) to 4 mm. (No. 16), the interval of increase being 0.25 mm. Probes of similar caliber were also adopted by Couper of London at about the same time, but were not so well accepted owing to the olivary shape of the point and the larger interval of increase (0.50 mm.).

While intern in the Wills Eye Hospital, from 1887 to 1889, I saw many patients treated with large probes in the services of Dr. Goodman and Dr. Harlan, and was greatly impressed with the superiority of this method over others in use at that time. My observations, however, convinced me that there were several disadvantages that ought to be overcome: (1) the process of dilatation was too slow; (2) oft-repeated probing created irritability of the tissues; (3) treatment was neglected by the patient because of the frequent visits required; (4) irritating nasal secretions were frequently expelled into the eye by blowing the nose; (5) the capillarity of the duct was completely destroyed by the combined Bowman's incision and the extreme dilatation secured by the use of No. 16 probes (4 mm.). The conviction was forced on me, therefore, that if a large caliber was necessary this should be accomplished at one sitting by a forcible dilatation, *ad maximum*, but without incision of the tissues, thus preserving the capillarity of the duct and avoiding the many disadvantages of the older method.

DESCRIPTION OF AUTHOR'S LACRIMAL DILATOR

I accordingly devised, in 1890, a lacrimal dilator⁴ with a cylindrical body and an oval point (Fig. 1), based on the old conical dilator of Levis, but essentially different in its size, shape and action. The conical dilator of Levis had three serious defects: first, it was so thin at the point that a false passage might easily be made; second, the cone in entering the bony canal became a sort of wedge that passed through the sac easily but soon became blocked; and, third, the thin point of the instrument did not properly stretch the

4. Wills Hosp. Rep., January, 1895, i, p. 31.



Fig. 1.—Ziegler's lacrimal dilator.



Fig. 2.—Ziegler's needle-probe.

inferior portion of the canal as it emerged into the nose. I therefore changed the body of the dilator to a cylinder, and made the point more ovoid or bellied, with a sudden widening of the caliber just above the apex. This allows it to dilate so rapidly that the point does not catch in the mucous lining of the canal, and the body of the dilator never becomes wedged as with the simple cone.

The instrument is made in the shape of a double bayonet, two sizes of the dilator being joined together on a single handle. The smaller end is somewhat sharp-pointed and has a diameter of 2 mm., corresponding to a No. 8 probe, the shaft being 28 mm. long. The larger end is more dull and has a diameter of 3 mm., which corresponds to a No. 12 probe, the shaft measuring 30 mm. in length. The maximum diameter (3 mm.) which I adopted, therefore, was sufficient to accomplish the end desired, although it was considerably less than the 4 mm. caliber exemplified by the No. 16 probe of Theobald. This dilator depends for its success on the rapidity of its dilatation, the avoidance of repetition in probing and the fact that it retains and improves the capillarity of the duct. The instrument is made of forged steel to avoid any danger of bending. A needle-probe (Fig. 2) was also devised for use in cases of atresia. The needle-probe has the same quick expansion just back of the point, which is much sharper than that of the dilator. The oval point in like manner avoids the danger of catching in the tissues. Either the needle-probe or the small end of the dilator may be used to dilate the punctum and canaliculus, but the large dilator should always be used to stretch the *ductus ad nasum*.

AUTHOR'S METHOD OF RAPID DILATATION

Anesthesia.—As the operation is somewhat painful anesthesia is required. The instillation of cocain and epinephrin into the cul-de-sac may prove to be sufficient. These solutions may also be injected into the duct through the small cannula of the lacrimal syringe, or, if preferred, with the hypodermic syringe. As a rule local anesthesia will suffice, but nervous patients will require general anesthesia. In private practice I frequently employ nitrous oxid, but chloroform and ether may also be used for this purpose.

First Stage.—If local anesthesia has been used the patient may be seated and his head covered with a towel. For the right eye the operator stands behind the patient, whose head should rest against the surgeon's chest. With a small piece of cotton under his left thumb the lower lid is drawn down and out until the margin is tense. Holding the dilator (or needle-probe) vertically in his right hand, the small end is inserted into the punctum with slight force in order to be sure that it is engaged. A feeble click may sometimes be heard, or a sensation of sudden yielding be felt, as the punctum stretches open.

Second Stage.—Still holding the lid tense, the dilator is rotated from the vertical to the horizontal position, and slowly but firmly passed through the canaliculus, the shaft being directed obliquely upward and inward, until the point rests solidly against the bony wall of the sac. If elastic resistance is felt at this point the bony landmark has not yet been reached, and further pressure should be made. As the dilator enters the lacrimal sac a rather pronounced click may be heard, or a yielding sensation may again be felt, as in entering the punctum.

Third Stage.—The small dilator (or needle-probe) is then withdrawn from the canaliculus and the large dilator (No. 12) is inserted, as in the first and second stages, until firm bony resistance is again felt.

Fourth Stage.—The lower lid is now released from the traction of the left thumb. The point of the dilator is held snugly against the bony wall while the shaft is again raised 90 degrees to the vertical position and half rotated on its long axis until the shoulder of the bayonet is turned backward. Still hugging the bone the point of the dilator describes a half-curve backward and downward as it slips over the bony ridge of the lacrimal crest and engages in the sac. It is then pushed with firmness and considerable force, downward and slightly forward, through the nasal duct into the nose. The bayonet shape of the shank allows this to pass without pressing against the eyebrow. The dilator is allowed to remain *in situ* for a moment (or longer if desired) and then withdrawn directly upward.

MINOR ACCIDENTS

A small rupture of the punctum may occur, but this is insignificant and usually heals promptly.

There may be some ecchymosis or even swelling of the lower lid, but this soon disappears.

The nose frequently bleeds for a few minutes owing to a slight scratch of the nasal mucosa by the point of the dilator as it emerges beneath the inferior turbinate.

Patients should be warned not to blow the nose for twenty-four hours, as a very slight rupture in the lining of the canal will permit a palpebral emphysema that might prove alarming and unsightly, although it will disappear spontaneously in a few days.

Irrigation should not be attempted for at least one week, as part of the fluid might escape through some minute laceration of the lining membrane and thus cause infiltration of the tissues.

In a few cases I have noted a crackling sound that indicated slight fracture of the bony walls of the duct, but I can only agree with Theobald in saying that nothing more serious than ecchymosis has followed.

I have often been asked as to the danger of making a false passage. I have never seen such an accident, but an ignorant, careless or unskilful operator may spoil any operation. I have encountered a few cases of caries in which the usual pressure might have caused the dilator to perforate the lacrimal bone and to enter the nose over the middle turbinate. One must always "have an eye in the point of the dilator."

POST-OPERATIVE TREATMENT

The after-treatment is usually very simple, consisting of a soothing eyewash, to which epinephrin may be added in the proportion of 1 to 16. If the eyelids are glued together for a few days following the operation an astringent application will promptly check the conjunctival discharge. If there should be any puffing of the lids ice-pads may be applied. If there is ecchymosis hot stupes are indicated. If emphysema occurs no treatment is necessary, as it will promptly and spontaneously disappear.

INDICATIONS FOR RAPID DILATATION

Rapid dilatation of the lacrimonasal duct is indicated whenever a permeable canal is desired. It is particularly effective in those cases of epiphora and obstruction arising from atresia, localized stricture and general stenosis with interstitial thickening of the mucosa.

Absorption of this submucous hyperplasia will often be stimulated by the mere mechanical pressure of the instrument in the canal. The most striking success of rapid dilatation is probably shown in ulcerative lesions of the cornea, and especially those of the recurrent type. The phlyctenular variety also yields promptly to this treatment. In sloughing keratitis, however, we must supplement the dilatation of the duct by disinfecting the corneal slough with formalin (1 per cent.) and by using an antiseptic wash or spray in the nostril, either hydrogen peroxid or potassium permanganate (1 to 2,000). I do not hesitate to practice rapid dilatation in cases of wound infection (lacrimonal) following operation or injury, and even after cataract extraction, thus eliminating the focal origin of the infection. In many of these cases, however, I inject formalin (0.25 per cent.) into the anterior chamber, in addition to disinfecting the margins of the wound and cleansing the nostril. This technic has undoubtedly saved many eyes that appeared to be hopelessly lost.

Rapid dilatation is also of value in cases of chronic conjunctivitis, blepharitis marginalis and eczema of the lid, in which the chemical irritation of the lacrimal fluids is the chief etiologic factor. It is likewise indicated in ectropion and entropion of mild degree arising from persistent lacrimal irritation. Contraction of the socket, with an irritating discharge and more or less palpebral disturbance, is a positive indication for this procedure. I have, for many years, performed rapid dilatation in every case of enucleation, as a routine measure, for the sole purpose of preventing any secondary disturbance that might arise from the accumulation of irritating secretions in the socket. This plan has been markedly successful in preserving a healthy socket.

I have previously discussed the treatment of trachoma⁵ before this section (1897) by advocating rapid dilatation of the tear-duct to relieve corneal maceration and pannus through the free drainage of acrid lacrimal secretions. At the same time I recommended that this operation should be combined with canthoplasty or external canthotomy (cantholysis) for the purpose of re-

5. The Surgery of Trachoma, THE JOURNAL A. M. A., Jan. 15, 1898, p. 131.

lieving the friction and corneal erosion caused by the tarsal pressure of blepharophimosis. Each one of these procedures thus supplements the other.

ALLIED MEASURES

While rapid dilatation is invaluable in cases of acute dacryocystitis, mucocele, persistent blennorrhoea, supuration, abscess and fistula, certain auxiliary measures may also be necessary. Irrigation, incision, stricturotomy and the insertion of styles or medicated bougies are often indicated to meet the requirements of the symptom-complex which these cases present.

Irrigation may be practiced either before or after rapid dilatation. The injection of an astringent or antiseptic solution is always a valuable cleansing adjuvant and often a curative agent. I have devised an all-glass lacrimal syringe (Fig. 3) for this purpose, which is provided with four cannulas; a small gold cannula for introduction into the punctum; a platino-iridium hypodermic needle for local anesthesia; a Tansley cannula with lateral perforations and closed end; and the ordinary Anel or De Wecker cannula.

Schwenk secures good results by injecting liquid petrolatum into the tear-duct once or twice a week and allowing it to remain until absorbed. Following the method of treating fistulous tracts by the use of bismuth-petrolatum paste, introduced by Beck,⁶ of Chicago, I have been injecting his formula modified as follows:

R	
Formalin	1/2 part
Alypin	1 part
Antipyrin	2 parts
Paraffin	5 parts
White wax	5 parts
Bismuth subnitrate	25 parts
Petrolatum, enough to make.....	100 parts
Mix and make antiseptic paste.	

This paste can be heated and injected into the tear-duct with the glass lacrimal syringe, in a fluid state, taking care that it shall not be forced through into the nose, and applying a small ice-bag in order to quickly harden it, *in situ*. If preferred, the compound may be

6. Beck, E. G.: Fistulous Tracts, Tuberculous Sinuses and Abscess Cavities; A New Method of Treatment by Bismuth Paste, THE JOURNAL A. M. A., March 14, 1908, p. 868.

used in a cold or congealed state, and forced directly into the duct by means of the cold paraffin syringe. I usually employ the latter method.

By the substitution of gelatin for petrolatum in the above compound it may be poured into moulds and hardened to form "lacrimal bougies." I have been using these gelatin bougies of formalin-bismuth and also those made with argyrol, but I have not tested them for a

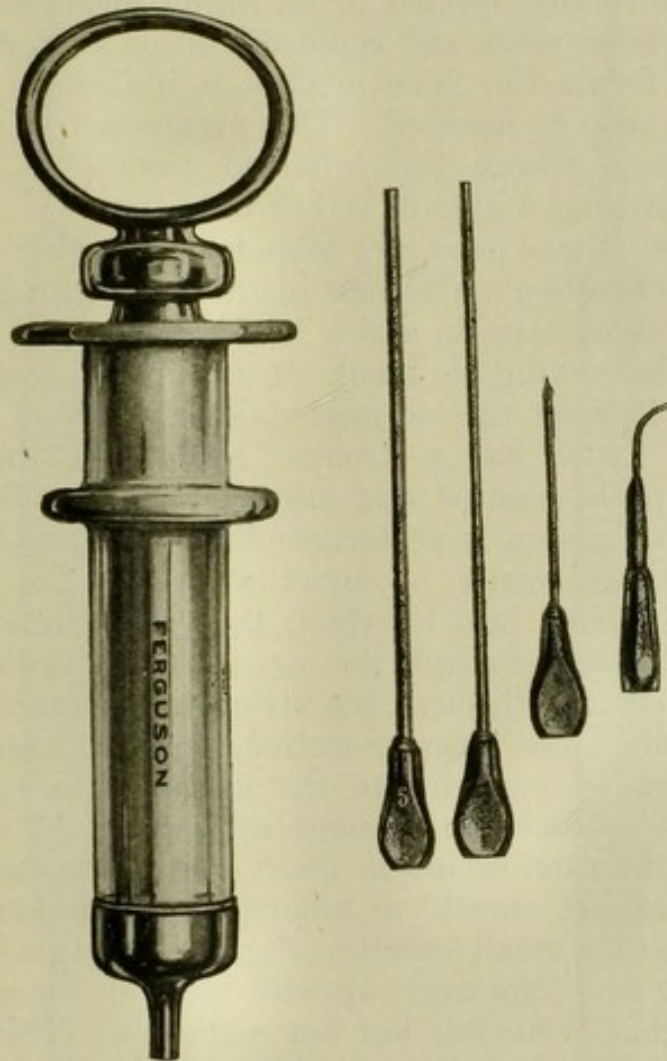


Fig. 3.—Ziegler's glass lacrimal syringe with special cannulas.

sufficient length of time to make a definite report on the results. I am convinced, however, that they will prove valuable. I have observed that the slower they dissolve the greater is their efficiency.

The incision of Bowman is indicated when suppuration is already established. This should be supplemented, however, by rapid dilatation. In performing Bowman's operation I prefer to use an instrument com-

binning my needle-probe on one end and a modification of Weber's knife on the other (Fig. 4). I have shortened this knife, widened the blade, made the edge more oval and used a straighter tip. With such a combination we can stretch the punctum and slit up the canaliculus without changing instruments, which is a great advantage when we have ignorant and unruly patients to deal with.

In cases of lacrimal abscess the abscess should be opened, formalin applied to its lining membrane, Bowman's incision made and rapid dilatation performed. In lacrimal fistula the same method is indicated. A lead style may also be inserted. This promotes free drainage of pus and allows the inflamed tissues to undergo normal healing, without further irritation.

It is sometimes necessary to go a step further and perform stricturotomy, after the method of Stilling, particularly in those cases in which localized bands of contraction are obstructing the canal. Instead of Stilling's knife, however, I prefer the lacrimal stricturotome⁷ of Thomas (Fig. 5) which has a stronger blade than the Weber knife, is probe-pointed and has a long malleable shank. Bowman's incision is performed first, followed by rapid dilatation and lastly by stricturotomy. The Thomas knife is inserted into the duct, the probe-pointed blade is pushed down through the stricture and again drawn up, thus cutting through the stricture fore and aft; or, if necessary, four quarter-sections may be made. An application of formalin to the diseased lining of the canal is sometimes an efficient supplementary measure.

If proliferation occurs in the lumen of the duct I employ a lacrimal curette to remove the granulomata. I have devised a small curette (Fig. 6), for this purpose, consisting of a long oval cup with teeth on the edge and a shank that is flexible but not malleable. This can be easily introduced and used with considerable pressure. The procedure is simple and the result will often prove most gratifying.

Lead styles have been popular ever since they were first recommended by Green⁸ in 1868. They are indicated chiefly in cases of dacryocystitis, stricture of the duct and caries of the lacrimal bones. They may be allowed to remain in the duct until the lining has

7. Tr. Ophth. Sect. A. M. A., 1892, p. 235.

8. Tr. Am. Ophth. Soc., 1868, p. 31.



Fig. 4.—Modified Weber's knife with Ziegler's needle-probe.

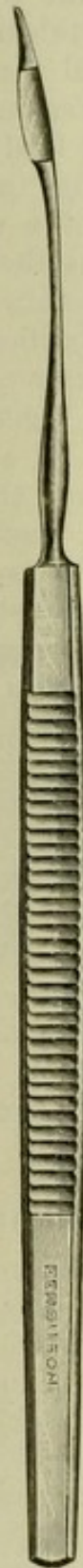


Fig. 5.—Thomas' lacrimal stricturotome.

reformed, although they should be removed at stated intervals and the canal irrigated. Occasionally they will create irritability of the tissues accompanied by granulations and must then be abandoned for some other form of treatment.

As pure lead wire is very soft, and may bend on itself while being introduced, I have modified this by the addition of a small amount of tin alloy, which so strengthens the wire that it can be passed more readily and still retain the necessary flexibility. I have made a further modification of this wire by having it drawn with a small groove, which I think facilitates the drainage problem. I generally use the 2 mm. wire, which is the equivalent of a No. 8 probe. Lead styles have the advantage that they are cut from the solid wire and are preferable, therefore, to any form of gold or silver canulas, which soon become filled with septic and foul-smelling secretions. They should be made perfectly smooth in order to avoid the deposit of accretions on any roughened area.

To facilitate the insertion of the lead style I have devised a pair of forceps with grooved jaws (Fig. 7) which grasp the style and hold it absolutely rigid. After the style has been introduced into the duct it can be released with the greatest ease by simply pushing the slide catch. If the style should subsequently slip down into the duct, or the tissues should grow over it, there may be considerable difficulty in locating and removing it. By using one of the small cures, preferably with teeth, it can be gently probed for and easily removed by slipping the curette under the bent arm of the style and drawing it upward.

AUXILIARY TREATMENT OF THE NOSE

We should never lose sight of the nasal etiology of tear-duct disease, and should apply our treatment accordingly. The rhinologist should remove all obstructive lesions, by reducing the hypertrophied tissues and instituting measures to restore ventilation of the upper air chambers and free drainage of the sinuses. As the anterior portion of the inferior turbinate sometimes presses on the valve of Hasner, and thus obstructs the lacrimal drainage, the fleshy fold of the turbinate should be excised, if necessary. Temporary disinfection of the nostril is especially indicated in all cases in which direct ocular infection is suspected.



Fig. 6.—Ziegler's lacrimal and chalazion curette.

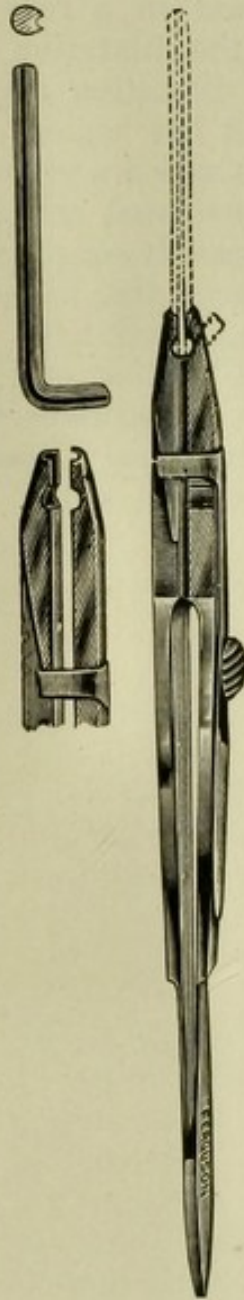


Fig. 7.—Ziegler's lead style introducer with grooved lead style.

IN CONCLUSION

Rapid dilatation of the lacrimonasal duct is by no means a panacea, but if used with judgment and discretion will undoubtedly prove a most valuable addition to our treatment of tear-duct disease. Its value lies in the rapidity of the dilatation, the avoidance of repetition in probing, and the retention of the capillarity of the duct. In some cases, however, the capillarity must be sacrificed, and in a very few cases it will be necessary to repeat the dilatation. In cases of periostitis or caries a second dilatation may be necessary, after the lining of the duct has healed. Stretching is likewise repeated in cases in which a prolonged course of nasal treatment has been instituted and completed. These cases of repetition probably constitute 1 per cent. of all cases treated. I abandoned the use of lacrimal probes nearly twenty years ago and have since relied almost exclusively on rapid dilatation of the tear-duct in order to secure the permanent patulous lumen which the radical treatment of lacrimonasal disease demands.

1625 Walnut Street.

