DELIMITING KERATOTOMY.

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The three cases here reported illustrate the practical value of delimiting keratotomy in checking the spread and progress of corneal ulcers. The principles on which the treatment are based are pointed out, and the technic of treating such cases is illustrated.

The object of this paper is to call further attention to a procedure described by H. Gifford in 1918,¹ which has proved of great value in the treatment of certain severe corneal ulcers and which is not, I believe, used as widely as it deserves to be. I have even heard an ophthalmologist condemn in unqualified terms the use of knife or cautery in the treatment of any corneal ulcer.

The following cases are chosen as severe corneal affections which would, I believe, have run a much more severe course, with serious loss of vision, without the use of a delimiting keratotomy.

CASE I. Small Pox Infiltrate of Cornea: Mr. B., aged 51, was referred by Dr. S. M. Shramek of Omaha, complaining of pain and poor vision in R. E. He had recovered from small pox about two weeks before, and his eye symptoms had been growing worse since then. Examination revealed two small infiltrates of the right cornea, one at the inner limbus covered by epithelium and apparently quiet; the other about 2 millimeters from the limbus at eleven o'clock. This stained slightly with fluorescein, and congestion was most marked near it. Vision R. E. 20/100; L. E. V. = 20/50, was apparently normal. The staining area was touched with trichloroacetic acid. Atropin, argyrol and hot applications were prescribed. The following three days, in spite of similar treatment, the infiltrate continued to increase in size, while congestion and pain were more severe. The ulceration remained superficial, but the infiltrate was much deeper and

extended ahead of the staining area in the manner of a typical small pox infiltrate, in which the loss of epithelium is a secondary and minor affair. Having seen a number of these lesions progress to severe loss of vision unaffected by treatment applied to the surface of the cornea, an early delimiting keratotomy was decided upon. This was done on the fourth day, the cut being made in healthy tissue just ahead of the infiltrated zone and extending beyond it on either side. It was kept open daily for twelve days by touching one edge of the cut gently with the point of a knife and allowing 1/2 to 2/3 of the aqueous to escape. The area was touched with liquefied iodine before being opened, and sometimes this application itself could be made to open the wound. The pain was almost entirely relieved after the cut was made, and the infiltrate never progressed beyond the cut. Some congestion remained for about three weeks. After the wound had closed, massage with yellow oxid ointment was prescribed daily and the opacity diminished considerably in size. After six weeks, vision was 20/30; with -0.25 $\ominus$ -1.00 cyl. ax. 20° = 20/20.

To oculists who have not seen many of these small pox infiltrates, it may seem that this result might have been obtained by less radical methods. In our region, however, we have seen a considerable number in the past three years and their course, in spite of cauterization, the thermophore, and other local and general measures, has invariably been very severe. This is

the only one in my experience which did not suffer severe loss of vision.*

CASE II. Mooren's Ulcer (?): Mr. L—, aged 65, came in complaining of pain in R. E. The trouble had begun about four days before, after he had gotten something, probably a piece of plaster or brick, in the eye. Vision was 20/30. Both eyes showed an unusually broad arcus senilis. In the right eye, near both the inner and outer

slowly towards the center. Smears of corneal scrapings were negative. There was not much more congestion than at first, and only a little more pain, the course resembling a rodent or Mooren's ulcer. On the 6th day, Dr. Harold Gifford applied the actual cautery over the whole affected surface, undermining at the limbus well back into the healthy conjunctiva. In spite of this the central border con-

Fig. 1. Result of delimiting keratotomy for Mooren's Ulcer Case II.

limbus, the arcus was broadened into a white plaque about 4 millimeters in diameter. At the inner limbus, the surface of the plaque was roughened and stained with fluorescein. There was but moderate congestion and little pain, only the sensation of a foreign body. The staining area was touched thoroly with trichloroacetic acid. Atropin and heat were prescribed. The next few days, in spite of local cauterization and this treatment, the stained area progressed. It remained about four millimeters in diameter, healing towards the limbus and progressing

tinued to progress. On the 13th day, I made a delimiting keratotomy just beyond the central border, the patient having been hospitalized. This incision was kept open twice daily for about ten days, with applications of iodine, atropin and instillations of strong and weak zinc. The pain, which had increased, before the keratotomy, now became much less severe, and the ulcer continued to heal from the periphery, never advancing beyond the line of incision. When first refracted, corneal astigmatism was marked (7 D.) but finally vision of 20/30 was recovered with +0.25 cyl. ax. 20°, and the eye was perfectly quiet.

*This subject of small pox infiltrates is more fully discussed in a paper now under preparation by Dr. James M. Patton. It is interesting that C. L. Smith, in a recent article (A. J. O. 1922; 5, p. 32) reports that the only eye saved in three cases was one in which he performed the Saemisch incision.

CASE III. Serpent Ulcer: George C—, colored, aged 30, was seen at the Douglas County Hospital. Five days before he had been hit in the left

eye by a stick, since when it had been inflamed and painful. Examination revealed a corneal ulcer about 1 1/2 millimeters in diameter just temporal from the center of the left cornea. After cocainizing, a careful curettage showed that the ulcer extended almost to Descemet's and was undermined at the edges. Trichloroacetic acid was applied thoroly on a fine cotton point, and atropin, argyrol and heat prescribed. After three days of such treatment, the ulcer continued to extend slightly in all directions, pain was severe and a slight hypopyon developed. Smears of scrapings showed no organisms. After curetting and applying iodine, a cut was made thru the cornea just medial to the ulcer. This was kept open daily and local treatment continued. Trichloroacetic acid, iodine, carbolic acid, and solid optochin were all used for cauterization. In spite of this, the ulcer extended upwards slightly, reaching 4 millimeters in diameter, without, however, crossing the cut. Pain was relieved after opening the chamber each time, but returned some hours after, and for several days, it was opened twice daily. On the 12th day, the chamber was found empty. From this day, pain stopped almost entirely and healing began. When the chamber began to refill three days later, it was allowed to remain so, with no return of pain or congestion. Daily massage with yellow oxid ointment was begun a few days later. When last seen, the eye was quiet with a leucoma about 3 millimeters in diameter, not involving the pupillary space.

The principles underlying keratotomy of any kind in severe ulcers are well understood by users of the Guthrie-Saemisch incision. They are the same as those used by the general surgeon who incises any swollen, inflamed part. The affected cornea is at once relieved of the pressure exerted upon it by the intraocular fluids. The lymph flow, kept at a very low rate by the normal tension upon the cornea, is at once accelerated in the direction of the cut part, bringing in a fresh supply of antibodies, leucocytes and nutri-

tion. It is well known that when an ulcer perforates spontaneously in gonorrheal ophthalmia, it often begins at once to heal, especially if there is a leakage of aqueous for a few days.

While the idea of making the incision a "delimiting" one was apparently used by Alfred Graefe and Meyerhofer, H. Gifford arrived at it independently, and his explanation of its action as distinct from that of any keratotomy, is, so far as I know, original. This explanation he found in the rapidity with which the wound is filled with corneal epithelium. From the fact that most severe ulcers progress by undermining the epithelium, he assumed that it is more resistant than the stroma and that an epithelial plug might act as a barrier to further infection. According to Parsons², after a keratotomy, the anterior triangle left by the gaping of the edges is filled with epithelium in 24 hours, including half or sometimes more of the thickness of the cornea. If the wound is kept open for several days it would seem likely that this epithelial plug would extend almost thru the cornea. This factor, of course, if effective, is so in addition to the other factors described as playing a part in any keratotomy.

The cut is made with a thin Graefe knife thru the entire thickness of the cornea, being tangential to the ulcer and as close as possible to its most central edge without touching it. Keeping the wound open once or twice a day is usually sufficient, without making a more permanent opening with the cautery. Case III, however, tho the ulcer never passed the line of incision, did not begin to heal until the chamber remained empty by continuous leakage. Each opening should be made after careful inspection in a good light to be sure that the chamber is not already empty, in which case the lens might easily be injured. The possibility that a cataract might result from prolonged contact between lens and cornea I have not seen realized.

One hesitates to inflict such additional trauma to a cornea unless it is necessary, and a great number of ulcers, of course, do well without it.

It is important in any case, however, to realize quickly when ordinary treatment is proving ineffective and to adopt more radical measures before vision is permanently damaged. I believe there are a great many such cases

in which the most valuable radical measure is keratotomy, and there seem to be reasons, brought out strongly by results in my limited experience, why this keratotomy should be made "delimiting."

BIBLIOGRAPHY.

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HYPERSENSITIVENESS TO LENS PROTEIN. PATIENT DESSENSITIZED AND SUCCESSFULLY OPERATED ON FOR IMMATURE CATARACT.

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The case here reported furnished a clinical test of the importance of the views presented at the International Congress (see p. 737.) Desensitising injections of lens protein are not recommended for all cases of cataract; but for those proven sensitive and over fifty years of age, who may be operated on with intentional or accidental opening of the lens capsule.

In a paper presented before the recent International Congress of Ophthalmology (see *Trans.*), we have shown that about eight per cent of individuals are hypersensitive to lens protein; and that when in a hypersensitive individual the lens capsule is opened thru operation or injury, there results an intraocular inflammation which we have termed phacoanaphylactic endophthalmitis. Owing to the danger of rupture of the lens capsule in the intracapsular operation in patients under fifty years of age, we suggested that in a hypersensitive patient under this age, with immature cataract, an attempt be made to desensitize the patient to lens protein, and then to remove the cataract by discission followed by simple linear extraction. In an addendum we stated that we had successfully carried out this procedure in a recent case, and it is the purpose of this communication to relate the details of this case.

CASE: Robert S., Hebrew, aged 46, first consulted Dr. Verhoeff, July 18, 1921. The vision of the right eye had been failing for 2 1/2 years, that of the left eye for 2 years. General health, excellent.

Examination: The lens of each eye shows a diffuse opacity in the posterior

cortex, but is elsewhere perfectly clear. Both eyes are otherwise apparently normal. The irides are heavily pigmented. V. O. D. = counting of fingers at three feet, unimproved by lenses.

V. O. S. = 20/100; with +3 S. $\odot$ -1 cyl. ax. 60° = 20/30.

General physical examination and urine examination, negative.

Oct. 6, 1921. V. O. S. with correction = 20/50.

Operation upon right eye by Dr. Verhoeff. Intracapsular extraction by capsule forceps, with iridectomy. Scleral suture. The patient proved to be a "bad actor" and squeezed out a considerable amount of vitreous just as the lens was being delivered. After tying the scleral suture, a small pair of scissors was introduced thru one side of the wound and the iris sphincter cut below, to prevent subsequent drawing up of the pupil.

Healing was uneventful, except that on Oct. 29th, the eyelids showed evidence of atropin irritation. The vision ultimately obtained was, V. O. D. with +12.25 S. $\odot$ +1. cyl. ax. 23° = 20/15.

Nov. 1, 1921. Intradermal test with pig lens protein was strongly positive.

[The lens protein is prepared as follows: One dozen pigs' eyes are ob-