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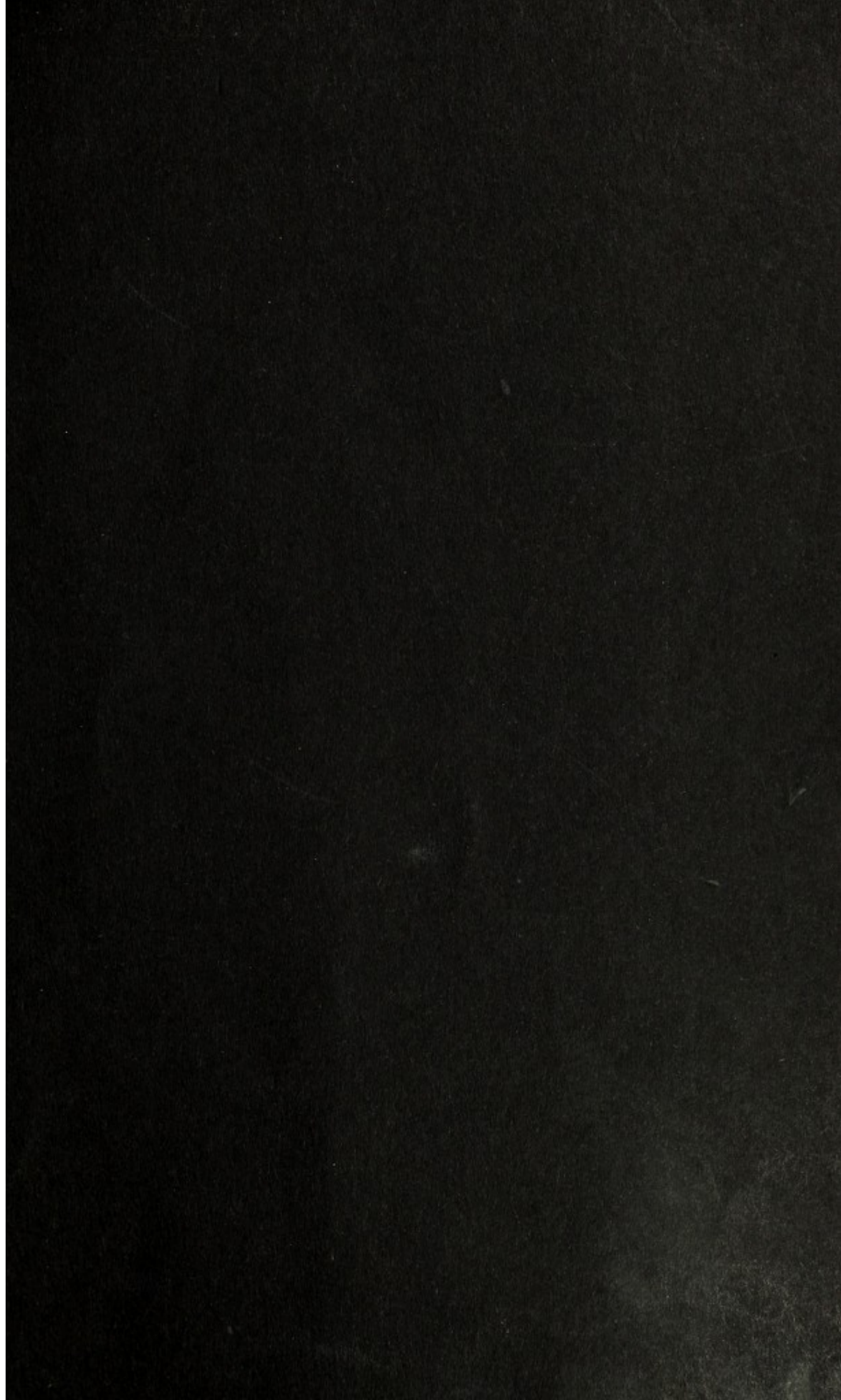
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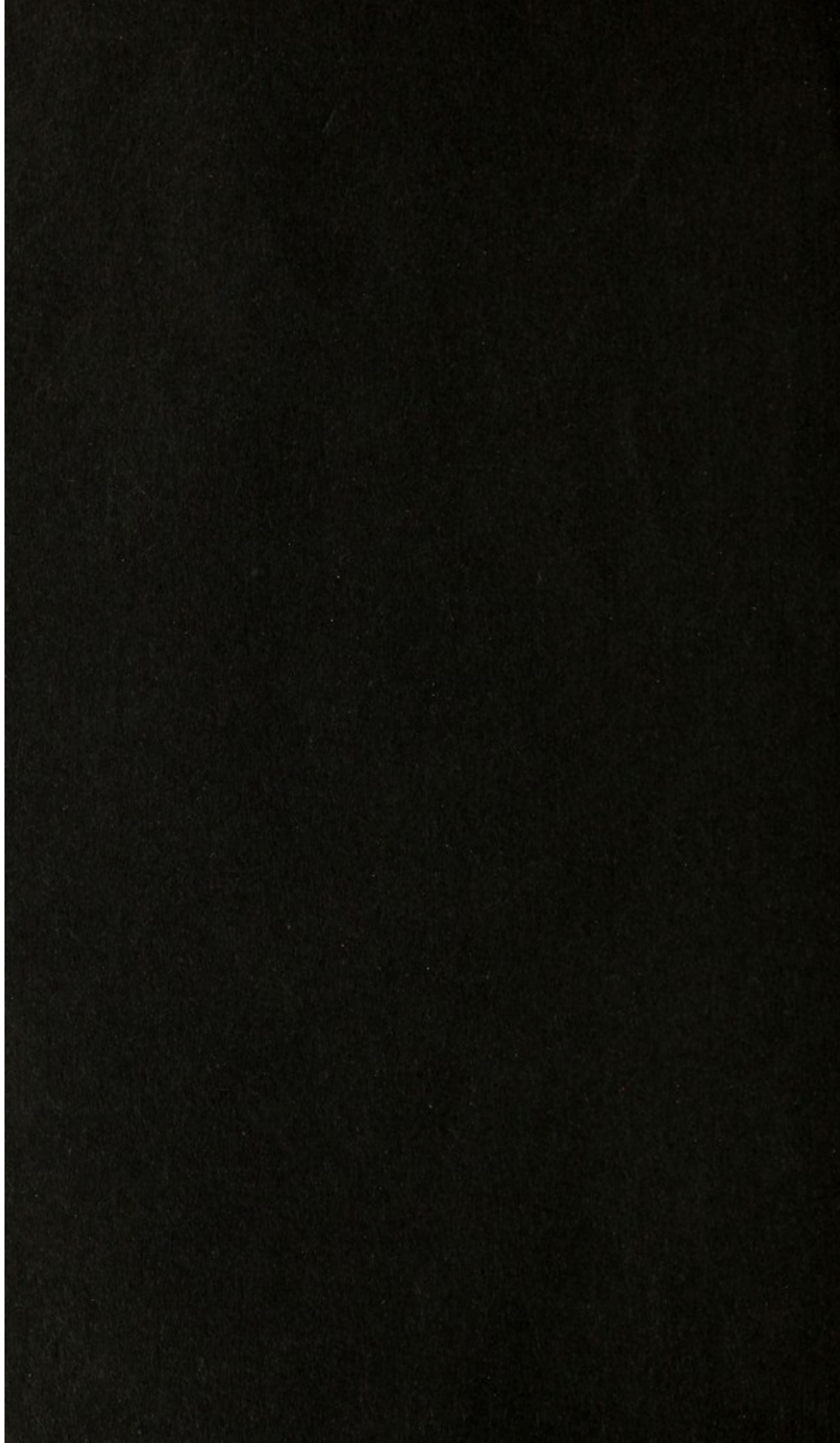
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PREFACE.

The Committee of Arrangements of the Section on Ophthalmology of the Thirteenth International Congress of Medicine, held in Paris August 2-9, 1900, adopted several subjects for special discussion, among which was the following: "Valeur comparative de l'enucleation et des opérations susceptibles de la remplacer." According to the request of Professor Panas, the President of the Section, my contribution endeavored to present the opinions of American ophthalmic surgeons on this subject and to place on record the collected American evidence respecting the various operations which may replace enucleation of the eyeball. This paper, sent to the Committee last April, has been printed in the "Rapports de la section d'ophtalmologie" and was read in résumé at the opening session of the Section. I now beg to present this English version, because it enables me to correct some errors which not unnaturally crept into the French report, and chiefly because it gives me the opportunity of expressing my hearty thanks to those colleagues who so kindly furnished me with their experience. The report does not contain data received later than the end of February of the present year; indeed, some of the material was on hand as early as December, 1899.

PHILADELPHIA, 1401 LOCUST STREET.
September, 1900.



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THE
COMPARATIVE VALUE OF ENUCLEATION AND THE OPERA-
TIONS WHICH HAVE BEEN SUBSTITUTED FOR IT.

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The present paper is based upon the opinions of American surgeons on the subject announced in the title, and is in part a report similar to the one recently published by the Ophthalmological Society of the United Kingdom,* and in part a series of deductions from the collected evidence.

The following operations have been investigated from this standpoint: (1) Abscission; (2) evisceration (Noyes, Graefe); (3) evisceration with the insertion of an artificial globe into the emptied scleral cup (Mules's operation); (4) the implantation of an artificial globe into Tenon's capsule after the removal of the eyeball (Frost-Lang operation; Morton-Oliver operation); (5) implantation of a sphere of sponge after enucleation (Claiborne-Belt operation); (6) opticociliary neurotomy and neurectomy; sclero-optico neurectomy (E. Hall); evisceroneurotomy (Huizinga); (7) methods of preparing the stump after complete enucleation which best secure mobility of the prothesis and cosmetic results; (8) implantation of glass balls into the orbit after remote enucleation of the eyeball (L. Webster Fox's operation).

ABSCISSION.

Twenty-eight operators give evidence upon this procedure, sixteen of them recording 186 operations, while twelve do not state the number of their operations.

Technic.—Critchett's, de Wecker's, or Knapp's method has been employed when special mention of the technic is made, except by

*"Trans. of the Ophth. Soc. of the United Kingdom," vol. XVIII, 1898, pp. 233-306.

J. L. Thompson,* of Kansas City, who, after the introduction of the primary sutures and before the staphyloma is removed, makes a complete division of the tendon of the superior and inferior recti muscles in order to remove their tension from the flaps, and thus secures complete coaptation and healing by first intention.

Indications.—There is universal agreement that noninflamed staphylomatous eyes, especially when these occur in children, furnish the most suitable and almost the only indication for this operation; it may also be performed in megalophthalmos (Knapp).

Contraindications.—If the pathologic process extends deeply into the globe, the operation is contraindicated, and it should not be employed when there is ciliary irritation, iridocyclitis, shrunken globe, chalky or ossified choroid, neoplasm, sympathetic irritation, or sympathetic inflammation.

Complications.—These are excessive hemorrhage, loss of vitreous and subsequent shrinking of the globe, slow healing of the wound, undue reaction, primary and late irritability of the stump, sympathetic irritation, and sympathetic ophthalmitis.

Primary irritability of the stump is best avoided by passing the stitches, as Knapp suggests, through the episclera or sclera, but never through any part of the uvea. Late irritability of the stump, rendering its removal necessary from seven to fifteen years after abscission, is reported by Knapp and ascribed by him to gradual ossification. Dr. George C. Harlan, on the other hand, who still advocates some form of abscission or complete keratectomy as the best operation with which to replace enucleation, has no untoward results to report out of a large experience.

Sympathetic inflammation after abscission must be uncommon, although, from the character of the operation, it might be expected. The English Committee reports only three cases, and I have secured only one positive expression of opinion upon this complication, and that is from Dr. Richard Derby, of New York, who says: "My experience has led me to regard the operation of abscission as an unsafe surgical procedure, and one that both in my hands and in the hands of other surgeons has been followed by sympathetic ophthalmitis." No particulars are given. Dr. Suker, of Toledo, reports a case of persistent sympathetic irritation following abscission which was cured by enucleation of the stump.

EVISCERATION.

Forty-one operators give evidence upon this procedure, recording 478 operations, while four do not state the number of their operations.

* "St. Louis Courier of Medicine," vol. xv, 1886, p. 111.

Technic.—The ordinary Graefe operation, without special modification, appears to have been used by all the surgeons except two. Dr. Harold Gifford, of Omaha, points out that so-called simple evisceration—that is, the Graefe operation—is an evisceration plus a keratectomy. He operates by what may be denominated a strictly simple method, as follows: “I turn back a large conjunctival flap and make a long meridional incision through the sclera and eviscerate through that opening, leaving the cornea intact. In cases in which the cornea is wounded I use a purse-string suture instead of a triangular flap. The reaction is less and the stump better than where the cornea is excised. The latter shrinks to a mere patch on the anterior surface of the stump.” A similar procedure is employed by A. H. Voorhies, of San Francisco.*

Prince's suggestion, to relieve pain by painting the inside of the scleral cup with carbolic acid, is well known. It has also been suggested to pack the cavity with boric acid and iodoform, or a mixture of the two substances.

Indications.—Panophthalmitis is given the greatest prominence as an indication for evisceration, in deference to the teaching of Alfred Graefe that meningitis was less likely to follow than after enucleation, although this disease must be a comparatively infrequent complication after complete removal of the eyeball. I have references to fifty-two cases † terminating fatally from meningitis, thirty-three of which certainly—and more probably—followed enucleation for one stage or another of suppurative disease of the globe.

If meningitis ever follows the operation of evisceration, it must be exceedingly rare. No case occurred among 478 of which I have notes, nor in the 768 reported by Wolkomitch (quoted in the English report). One instance with which I am familiar probably ought to be excluded, as the patient suffered from purulent cerebrospinal meningitis from pneumococcus-infection, and it is likely that the suppurative disease for which the evisceration was performed had the same etiology as the meningitis.

Meningitis after enucleation of a nonsuppurating globe is exceedingly rare. The English Committee could not find a single in-

* Both of these methods will be referred to again in the description of the technic of Mules's operation.

† Risley, “Trans. of the Section on Ophthalmology of the Amer. Med. Assoc.,” Chicago, 1893, p. 123. Nettleship, “Trans. of the Ophth. Soc. of the United Kingdom,” vol. VI, 1886, p. 445. Andrews, “New York Med. Jour.,” vol. XLVIII, 2, 1888, p. 700. Marshall, Roy, “London Ophthalmic Hosp. Reports,” vol. XIV, 1895-'97, p. 312. Six of these were cases of malignant disease which, it seems to me, should be excluded. Recently some cases of meningitis following enucleation have been published which are not included—*e. g.*, “Lancet,” March 17, 1900.

stance among 10,734 cases collected from various sources. In Andrews' list* this complication is recorded after enucleation for foreign body in the eyeball, detachment of the retina without chorioidal changes, phthisis bulbi without suppuration in its center, and painful total staphyloma of the cornea with no note of pus in the globe. Two cases have been described by McHardy. In two of these instances the patients escaped from hospital control almost immediately after the enucleation, and therefore they ought not to be counted.

Enucleation during panophthalmitis may be performed almost with impunity, as witness the following table:

REPORTER.	INSTITUTION.	NUMBER OF ENUCLEATIONS.	NUMBER OF SUPPURATIVE DISEASE.	RESULT.
D'Oench †	Knapp's clinic New York Eye and Ear Infirmary Wills Eye Hospital	578	32	No death.
Noyes ‡		1164	161	No death.
Risley §		1131	85	One death.
	Total,	2873	278	One fatal.

How far advanced the suppurative disease was in each of these 278 cases it is impossible to ascertain. D'Oench says it was just beginning in some of his cases, but was active in two-thirds of them, a proportion which doubtless would apply to the others.

Meningitis may be started by primary ophthalmitis without excision of the eye, as in Webster's || case of panophthalmitis after extraction of cataract, with meningitis on the twelfth day and death in coma on the twentieth day. An attempt to ascertain the relative frequency of meningitis and death in purulent panophthalmitis with

* "New York Med. Jour.," vol. XLVIII, part 2, 1888, p. 700.

† "Archives of Ophthalmology," vol. XVI, 1887, and "New York Med. Jour.," vol. XLVIII, 1888, part 2, p. 701.

‡ "Trans. Amer. Ophth. Soc.," vol. V, p. 314.

§ In his communication Risley says: "Three of my colleagues report each one case of fatal meningitis as having occurred in their practice during the years mentioned,—that is, twenty-five years,—but no details of them could be found in the hospital records." If these cases are to be included, then there are three deaths among 1131 enucleations, but Risley does not say whether the deaths occurred after an enucleation for panophthalmitis or from some other cause. In Risley's case the enucleation was not certainly responsible for the fatal issue; the meningitis may have been an antecedent condition.

|| "Trans. of the Medical Society of the State of New York," 1888, p. 365.

and without enucleation, by Andrews, was unsuccessful, the data being too untrustworthy.

Finally, in a certain number of instances meningitis may have been present before the operation was performed, and may not have manifested itself by symptoms sufficiently accurate to permit a diagnosis, or the symptoms may have been masked by those produced by the suppurating globe.

It is evident that suppuration within the globe should not be permitted to continue without interference, and the surgeon must decide between enucleation and evisceration. Although the risk of meningitis or of a fatal termination from any cause after enucleation for any pathologic process within the globe is exceedingly rare, being about 1 in 1600 operations,* it must be remembered that in the majority of instances the lethal issue has occurred when the pathologic condition of the eyeball at the time of enucleation was one of partial or complete suppuration. Now, while it was not always possible to connect the meningitis directly with the operation, in some instances this connection was definitely established; hence the claims of evisceration must be considered. Discussing this question, Pooley,† while in favor of enucleation in panophthalmitis under certain circumstances, believes that it is contraindicated—and presumably evisceration indicated—where the purulent process has reached too great a height, the eyelids and conjunctiva participating in the swelling; where not only the eye is filled with pus, but where there is purulent inflammation of the orbital tissues and where the purulent infiltration has begun posteriorly, as in some varieties of septic iridochoroiditis. With these recommendations I am entirely in accord, and I would not hesitate to enucleate an eyeball in which there is suppuration if the surrounding orbital tissues are not involved in the process.

It has been demonstrated that meningitis may develop from infection which has traveled along the optic nerve, through the various tissues which pass through the sphenoid fissure, or through the veins. Therefore if the evisceration is performed, it is incumbent upon the surgeon to secure a scleral cup as aseptic as possible, and if enucleation is performed, the purulent material must not come in contact with the freshly incised orbital tissues.

The other indications enumerated for evisceration are corneal and scleral staphyloma, absolute glaucoma, injuries of the anterior portion of the globe (Ayres), and great prominence of the un-

* Noyes places it as 1 in 4000, which is too low a percentage, while W. Adams Frost ("British Med. Jour.," vol. 1, 1887, p. 1153) states that death does not occur probably more than three times in 1000 operations, which is much too high.

† "Annals of Ophthalmology and Otology," vol. VI, 1897, p. 243.

affected eye, presumably to enhance the chances of a larger stump—indications which are better fulfilled by other substitutes for enucleation.

Contraindications.—These are: Sympathetic ophthalmitis, sympathetic irritation, malignant disease, marked phthisis bulbi, ossified choroid, and foreign bodies penetrating the orbit. Curiously enough one surgeon (Dodd) considers panophthalmitis a contraindication, a view which is perhaps shared by Hale, who suggests as one of the indications for the operation “complete destruction of the cornea, whether by scar or recent injury, without suppuration,” and by Suker if the panophthalmitis has produced sloughing of the sclera.

Complications.—These are: Excessive reaction, recorded seventy-four times. If we add the comments of “frequent,” “most of the cases,” and “all” which are given in lieu of figures by three of the reporters, this percentage would be still higher. The amount of reaction after an evisceration is often difficult to determine, because the operation is most frequently done when the inflammatory process is already high and when the orbital tissues are secondarily involved.

Sloughing of the sclera is noted four times, without particulars; painful or irritable stump, sixteen times. No cases of meningitis have occurred. Sympathetic ophthalmitis or irritation is reported seven times. In view of the statement of the English Committee*—“We have not found a record of any case of sympathetic ophthalmitis following evisceration without the insertion of an artificial globe (Graefe’s operation)”—it becomes important to investigate these cases.

CASE I. SYMPATHETIC OPTIC NEURITIS AFTER EVISCERATION OF THE EYEBALL.—The following case is recorded by F. C. Hotz:† A man, aged twenty-one, when two years of age injured his right eye with a penknife, piercing the lower corneoscleral border. After a mild iridocyclitis the eye became quiet, although it was sightless, and remained quiet for eighteen years, when it became red and tender to the touch and the other eye sensitive to light. When he consulted Dr. Hotz, four attacks of this character had occurred. The eye was red and sensitive to slight pressure. The opposite or left eye was normal in all respects. The injured eye was eviscerated, the contents being partly calcareous. Sharp reaction followed the operation, with much pain in the head. Ten days later, however, the patient was discharged, with a good stump and the photophobia of the left eye gone. Nine days later he appeared, complaining of dull pain over the right eye, and some pressure deep in the orbit of the left side. Vision of the left eye was normal, but the nerve-head was redder

* Evidently the Committee’s attention was not directed to the case of Hotz or of Pfister, published in the Dissertation of Waldispühl (“Correspondenzblatt f. Schweizer Aerzte,” Bd. XVI, 1896, S. 3).

† “Trans. of the Section on Ophthalmology of the Amer. Med. Assoc.,” 1893, p. 93.

than at previous examinations. The next day the papilla was decidedly hyperemic, and within a week there was moderate optic neuritis and vision had been reduced to one-half of normal. Under the influence of hot compresses and the internal administration of calomel improvement began, and three weeks later vision had returned to normal and the papilla had regained its natural color and well-defined borders. The first signs of this neuritis occurred nineteen days after the operation. The reporter thinks there is no doubt of the sympathetic nature of the affection.

CASES II AND III. SYMPATHETIC OPTHALMITIS FOLLOWING EVISCERATION.—These cases are reported by Dr. Fleming Carrow, of the University of Michigan, who in a letter gives the following particulars: "When I say I have seen sympathetic ophthalmitis in two cases after simple evisceration, I mean that an artificial vitreous was not inserted, but that a stump was made of the sclera on which to place an artificial shell. In both cases the eyes had been extensively injured by a recent accident. There was not the slightest symptom of sympathetic trouble when the operation was made. When the sympathetic disease began, the stumps were enucleated because the sympathizing eyes showed ophthalmitis—that is, ciliary injection and iritis. In one case useful vision was restored by treatment, including iridectomy; in the other the sympathizing eye was lost. Had I enucleated these eyes, I believe I would not have encountered sympathetic ophthalmitis in the opposite eye, and therefore credit the scleral stump with the trouble."

CASE IV. SYMPATHETIC IRRITATION FOLLOWING EVISCERATION.—The evisceration was performed by Dr. Suker on account of an ectatic cornea the result of gonorrheal conjunctivitis, a condition, therefore, not liable to produce sympathetic trouble. The eye was perfectly quiet when the operation was done. From the report it would seem that it was not necessary to enucleate the stump, but, to quote the words of the letter, "after careful nursing the eye quieted."

CASE V. SYMPATHETIC IRRITATION OF THE OPPOSITE EYE FOLLOWING EVISCERATION.—The evisceration was on an eye with painful chronic glaucoma. Dr. Wood's notes follow: "A. E., aged fifty-two, merchant, consulted me February 18, 1895, for loss of sight and recurrent 'neuralgia' affecting his left eye and supra-orbital region. He had always seen well with both eyes until five years previously, when the sight in the left eye began to fail as the result of an inflammation in it, accompanied by redness of the globe, foggy vision, pain, and 'spots in front of him.' After applying some domestic remedies the injection, etc., disappeared within ten days, but the visual defect became more and more marked as time went on, especially after occasional 'neuralgic' attacks, from which he still suffers. The patient, early in life, had acute 'articular rheumatism,' and at intervals has pains and stiffness in the ankles and hands. Several finger-joints are enlarged. The right eye is practically normal: V.R. = I with correction; reads Jaeger 7.

"The left eye is slightly divergent; shows enlargement of the anterior perforating vessels, the cornea dull, its anterior epithelium being rough; pupil semi-dilated and reactions *nil*; lens translucent only; no clear view of the fundus: L.V. = p.l. (?). Tension +2. There is no tenderness of globe, although the patient had an inflammatory attack within a month.

"Evisceration was done February 20, 1895, and healing progressed kindly and without any untoward symptoms worthy of mention. Examination of the globe showed the usual appearances of a chronic inflammatory glaucoma. The patient returned home in two weeks.

"May 16th patient presented himself saying that he was unable to read without discomfort in his remaining eye, and that although he could always see without effort heretofore, there were lacrimation and blurring after using his eyes a short time for any kind of near-work; some photophobia, especially by artificial light. The eye itself appeared normal, there was no scleral or ciliary injection, tension was not increased, and there were no fundus changes. After correcting

the slight hyperopic astigmatism noted, the accommodative range was found to be two-thirds of normal; field of vision unrestricted; pupillary reactions normal. He was ordered to avoid using his eyes for reading and writing, was given distant correction, smoke-tinted; hot fomentations to the eye and simple boric lotion. In a week he seemed better, but was still unable to read without a feeling of discomfort in forehead and eyes, blurring, and lacrimation. State of accommodation and eye much the same. Ordered pilocarpin (one-fifth per cent. solution) three times daily. There is no tenderness in the left stump, for which no prosthesis is yet ordered.

"March 19, 1895: Patient reports that the eye now waters in the sunlight and wind and whenever he attempts to fix for distance or near. His health generally is good, and the stump is not tender. *Tn.* normal. I can not find any organic change in the eye. Sent him to a convenient hot spring for baths, as he complained of rheumatic pains, with orders to drink freely of the water. Continued pilocarpin. He remained away a month, the symptoms gradually disappearing. I was able in about three months after the operation to order an artificial eye, which he still wears with comfort. He now reads and writes well, and the eye, as well as the stump (much reduced in size), seems in all respects normal."

Dr. Hobbs, of Atlanta, records two cases of sympathetic trouble after evisceration, but gives no particulars, not even whether the condition was one of irritation or inflammation; therefore they can not be included. Dr. Hotz's case was not one of true infectious neuritis, but merely, as Gifford suggests, a toxic inflammation, which recovered spontaneously. The eyes of Carrow's patients had been injured, and therefore might of themselves have been the cause of the sympathetic inflammation. His cases prove nothing more than that the evisceration failed to prevent sympathy, just as we know an enucleation sometimes fails to check this complication. In brief, with the possible exception of Carrow's cases, which are, however, open to doubt, sympathetic inflammation is not proved to have been caused by evisceration.

The two cases of sympathetic irritation following evisceration reported by Suker and C. A. Wood are interesting, although it does not seem to me, in Wood's case, at least, that the evidence is sufficient to convict the operation of having caused the sympathetic irritation, especially when we remember that the symptoms disappeared under the influence of antirheumatic treatment. Suker's case is not given in sufficient detail to decide its relationship to the sympathetic trouble.

The Relation of Simple Evisceration to the Wearing of an Artificial Eye.—The cosmetic effect of the operation is considered to be better than that of enucleation by fourteen of the operators, no better by fifteen, primarily better, but within the first year, or even sooner, owing to shrinking of the stump, no better by seven; no comment is made by five. One operator thinks the result is not so good as after enucleation, and one that the adhesions which may form may interfere with the rotations of the artificial eye. While three of the surgeons are outspoken in their preference for

this operation over enucleation in so far as a cosmetic effect is concerned, it is evident that a number of those who believe that the effect is better than after enucleation are not in favor of the operation. At least six of the operators expressly state that they have abandoned the procedure. The cosmetic effect of evisceration, as will appear later, is not better than, and probably not so good as, after enucleation with suture of the tendons.

The comparative value of the rotations of the artificial eyes after evisceration and enucleation is given in the following table from Hotz*, which is important because the measurements were made some time after the operation was performed, and they tend to show that the contention that the stump after evisceration shrinks and is later no better than one after a well-performed enucleation, is correct:

STUMP.	WHEN OPERATION WAS PERFORMED.	DEGREES OF ROTATION.	
		Inward.	Outward.
Enucleation, . . .	Ten years ago	15	25
Evisceration, . . .	Three months ago	20	20
Enucleation, . . .	One year ago	15	15
Evisceration, . . .	Four months ago	15	25
Enucleation, . . .	Five and one-half months ago	20	25
Enucleation, . . .	One month ago	20	20
Enucleation, . . .	Six weeks ago	15	20

The following average of the measurements by Truc, comparing the rotations after evisceration and enucleation, and by myself, add further testimony to these facts:

STUMP.	OUT-WARD.	UP-WARD.	IN-WARD.	DOWN-WARD.	REMARKS.
Enucleation, . . .	15	15	12	25	Average of Truc's and my measurements.
Evisceration, . . .	15	18	23	35	Average of Truc's and my measurements.
Enucleation, . . .	14	14	7	25	Rotations three and one-half years after an enucleation.
Evisceration, . . .	10	15	10	30	Rotations seven months after an evisceration.

* *Loc. cit.*

Histology of the Stump after Evisceration.—One of the most interesting of the examinations belonging to this category has been described by Waldispühl, in which an evisceration produced sympathetic ophthalmia four months after the operation; in the enucleated stump the staphylococcus pyogenes albus and citreus were found.

The following is an experience of my own: Seven months after an evisceration for panophthalmitis the patient returned to me, and as there was some tenderness on deep pressure, I enucleated the stump and submitted it to microscopic examination, with the following result:

After hardening in formalin, meridional sections which measured 2 cm. in their longest and 1.5 cm. in their shortest diameter were stained with thionin, eosin, and according to Weigert's method.

Externally there is an envelop composed of loose connective tissue, fat-cells, and in some places muscular tissue, the last being the remnants of the recti muscles. Remains of the conjunctival covering are not visible. The main body of the stump exactly repeats the structure of the sclera, being composed of interlacing bundles of fibrous tissue, elastic fibers, and many spindle connective-tissue cells. Along the irregular line formed by the apposition of the borders of the scleral cup where they were united by sutures at the time of the operation a few deposits of uveal tissue are evident. One deposit consists of branched pigmented cells, derived from the stromal cells of a bit of choroid which was not entirely removed; between these pigmented cells are collections of small round cells, which are a representation of the inflammatory process which was universal at the time of the operation. A second deposit, of greater size than the first, is entirely composed of these small round cells, and is bounded by a rim of pigmented tissue. In another deposit, narrower than the others, the small-celled infiltrate is not so thick, but numerous narrow capillaries, like those seen in a process of organization, are visible, and the pigment cells, instead of being branched, are oval and round. Traces of nerve tissue—*i. e.*, of ciliary branches—could not be found in any of the section, nor was the optic nerve found, unless in one section a small piece of tissue which somewhat resembled its structure and which was uninflamed, could be so designated. While one could not argue from the conditions found within this stump that it would have produced sympathetic disturbances, they are interesting in so far as they demonstrate the difficulty of entirely removing all traces of uveal and inflamed tissue from the scleral cup after evisceration—traces of tissue which might be the source of an inflammation which would travel from the stump to the opposite eye.

EVISCERATION WITH THE INSERTION OF AN ARTIFICIAL GLOBE INTO THE EMPTIED SCLERA (MULES'S OPERATION).

Thirty-three operators give evidence upon this procedure, thirty-two of them recording 317 operations.

Technic.—That followed by the operators of the greatest experience is the following: 1. Dissection of the conjunctiva from its corneoscleral attachment to the equator of the eyeball.

2. Removal of the cornea with a triangular portion of the sclerotic above and below (Buller), or with a millimeter of the sclera attached to its edge; or, by means of a horizontal ovoid abscission, including the iris (Risley).

3. Evisceration of the contents of the globe with absolute thoroughness, either with a scoop devised for the purpose (Fox) or with gauze sponges twisted on the end of a stick, and which are given a rotary movement so as to check hemorrhage (Voorhies). Hemorrhage may be checked by packing the scleral cavity with gauze strips soaked in hot sterile water, or with dry, sterile gauze sponges. Strong antiseptics are unnecessary and sometimes harmful (Todd). As an irrigating fluid, Fox uses a mixture containing bichlorid of mercury and sulphocarbolate of zinc. Sometimes hemorrhage need not be checked before the introduction of the ball, which by pressure upon the stump of the optic nerve may control the bleeding from the central artery (Fox, Buller).

4. The introduction of a thoroughly sterilized artificial vitreous, usually glass, the scleral wound being united by a number of stitches, so that the union is close and the coaptation of the edges perfect. In most instances the scleral wound is united vertically, either with catgut sutures or with black silk sutures, operators of the largest experience (Fox, Todd, Buller, Allport) preferring silk sutures. The conjunctival wound should be united with a few interrupted sutures. A compress bandage placed either over a wet or a dry antiseptic dressing should cover both eyes and remain in place, unless there are signs of unfavorable reaction, for forty-eight hours. Should there be decided reaction, iced compresses, carbolyzed or rendered aseptic with bichlorid of mercury, are advised; dry cold may also be used (Risley). As Fox insists, it is wise to retain the bandage over both eyes until there is firm union of the wound,—that is, for five or six days,—although it is difficult to persuade patients to submit to this measure.

The preference for glass balls is decided. On this point the advice of Dr. L. Webster Fox is important, his experience in the operation being greater than that of any other surgeon in the country. "I prefer, first, glass balls, then gold balls. Silver balls

produce argyria and undergo oxidization. Aluminium globes become disintegrated, as was shown in one case where I used a perforated aluminium sphere, as suggested by Dr. Bryant. This caused great pain, because the tissues surrounding it grew through the opening."

The glass sphere must be perfect. S. C. Ayres has reported a case in which it was necessary to remove the glass globe at the end of a few days on account of severe irritation, when it was discovered that there was pus inside of the globe, which had found entrance through a small aperture. A similar instance is related by the English Committee.

Variations from this generally followed *technic* are: Suturing of the conjunctiva and scleral edges together (Mittendorf); swabbing the scleral cavity with carbolic acid and alcohol just before the ball is introduced (Black); finally, irrigating the scleral cup after the first few stitches are introduced and before they are tied (Buller). The last-named surgeon dusts powdered iodoform upon the stump and dresses the eye with iodoformated cotton, a dressing to which most private patients, in my country at least, would seriously object and probably not submit. Todd, on the other hand, urges a dry antiseptic dressing without the use of any powder, a method which I myself prefer. Both Gifford, of Omaha, and A. H. Voorhies, of San Francisco, have performed Mules's operation without removal of the cornea, the eyeball being first eviscerated through a long meridional incision, as is described on page 3, and have reported satisfactory results. The latter operator, in performing the ordinary Mules's operation, keeps the sclera from retracting by introducing steel pins above and below.

Indications.—The chief indications for this operation are: (1) Ruptured or injured eyeballs, when the sclera is not too much lacerated and when the accident is of recent date. (2) Staphyloma of the cornea and sclera or complete leukoma. (3) Absolute glaucoma. (4) Buphthalmos. (5) Nontraumatic chronic iridocyclitis. Buller asserts that "with the exception of much-shrunken eyeballs, intra-ocular growths, and panophthalmitis, the result of Mules's operation is all that can be desired in every case," a sentence which implies a willingness to extend the scope of this operation more widely than the previous paragraph would imply. Operators of experience are in accord that evisceration with the implantation of an artificial vitreous is most successful in eyeballs recently, but not too extensively, injured, painful glaucomatous eyes, and where the pathologic process affecting the fibrous coats is confined to the cornea alone or to the cornea and ciliary zone.

Contraindications.—The following contraindications are enumerated by the various operators: Suppuration of the eyeball; morbid growths; much-shrunken eyeballs, the contents of which

have undergone bony or calcareous change; sympathetic ophthalmitis, sympathetic irritation, and pathologic conditions of the eyeball which are likely to produce either of the last-named affections; buphthalmos; extensive injuries of the eyeball with much bruising and laceration of the sclera; foreign bodies embedded in the orbit behind the globe; gun-shot wounds of the eye; injuries to the eye after the third week; dacryocystitis; ocular conditions demanding enucleation or its equivalent in very old persons.

Each surgeon does not admit all of these contraindications. Sympathetic irritation and pathologic conditions likely to cause this affection are not considered contraindications by Fox, Allport, Buller, Todd, Ring, and other operators. Apropos of this, Dr. Buller writes: "In one case sympathetic ophthalmia was certainly threatened at the time of operation. A large fragment of iron had been lodged in the eye for nine weeks, and was found embedded in a mass of connective tissue. The result of the operation at the end of three weeks, when the patient was last seen, was entirely satisfactory." Therefore the purpose of the operation of evisceration, as conceived by Dr. Mules,—viz., the prevention of sympathetic ophthalmitis,—is accepted by these surgeons as safely established.

None of them, however, is prepared to substitute for enucleation a Mules's operation after sympathetic inflammation has developed. In this connection the following letter from Dr. L. Webster Fox is important:

"I have had but one opportunity to perform a Mules's operation where sympathetic ophthalmitis had begun in the opposite eye. I performed the operation and the sympathetic ophthalmitis disappeared, and the patient left the hospital at the end of ten days. Seven months later the patient, a woman about thirty-five years old, had another attack. There was now slight exposure of the glass globe, and I enucleated the ball with the sclerotic covering, making a deep excision of the optic nerve. This attack did not respond to treatment as rapidly as the former one. Since this attack the patient has had three other attacks, two mild ones and the third, a very severe one, began on January 13, 1900;* she is still in the hospital, and now convalescing. This case proves that one may perform a Mules's operation at the time of a sympathetic attack, although it will not prevent a recurrence of the attack; but neither will an enucleation prevent such a recurrence. Still, I believe a Mules's operation is contraindicated when sympathetic ophthalmitis has once developed."

A. W. Calhoun has also been obliged to resort to enucleation after having tried some of the substitutes because of a continuance or return of the sympathetic symptoms.

Buphthalmos as a contraindication is not recognized by Buller, who states that in several of his cases a high degree of this affection with great attenuation of the sclerotic was present, and that the ultimate result was just as good as when the sclera was of normal

* This letter was received early in February, 1900.

thickness. This agrees with my own experience in one case. All surgeons agree that shrunken globes from which the remains of the uveal tract can not be removed are unsuited for this operation. On the other hand, according to Buller and Ring, a moderate degree of calcareous degeneration of the lens and choroid without much shrinking of the globe may be followed by satisfactory results. Only one surgeon (F. Allport*) "would not hesitate to use this method in a suppurating case."

Complications.—The following were encountered: Excessive reaction, 77 times; sloughing of the sclera, 16 times; escape of the artificial globe, 54 times; painful stump requiring removal, 3 times; sympathetic inflammation or irritation, 6 times.

Excessive reaction manifests itself usually by one or all of the following symptoms: Great swelling of the lids; marked chemosis of the conjunctiva; pain in the head; elevation of temperature, with restlessness, nausea, and vomiting. It is probably always caused by imperfect asepsis; by failure sufficiently to control hemorrhage; by the use of excessively strong antiseptics; by too prolonged an operation and too much dragging on the parts; and by too early removal of the dressings. As experience with this operation increases excessive reaction decreases. Thus, Fox's first cases were failures from this cause, and the same is true of Buller.†

Elevation of temperature, which was reported a number of times in the earlier cases, particularly in two recorded by Fox where the temperature reached as high as 105° F. (41° C.), is now exceedingly unusual. I have never seen in my own experience or in that of my colleagues a rise of temperature beyond 99° F. (37° C.).

Excessive vomiting, on the other hand, is occasionally of serious moment, and is attributed by Bickerton to undue dragging upon the optic nerve. I have seen it once. Sloughing of the sclera, considered by the English Committee an unusual complication, occurs in 5 per cent. of the cases, the operator of the largest experience (L. W. Fox) reporting 8 per cent. of sloughing sclera. Evidently there is a difference of opinion as to what condition should be so designated: the American reporters have included all cases in this category where the scleral stitches cut out on account of disintegration of the scleral tissue around them ("stitch-hole abscesses").

Escape of the artificial vitreous is reported only fifty-four times, or in 17 per cent. of the cases, while the individual operators with the largest experience report respectively 13.5 per cent. of escape

* "Annals of Ophthalmology and Otology," vol. VI, 1897, p. 557.

† Neither L. W. Fox nor F. Buller has included his earlier cases in his list of Mules's operations. Dr. Buller, before he improved his technic, lost one ball in three operations.

(Fox) ; no escapes (Allport *) ; 7.6 per cent. of escape (Buller) ; 11 per cent. of escapes (Voorhies), or an average of 8 per cent. of failures. Doubtless the percentage of escape of the artificial vitreous will be reduced much lower than this, either by improved technic or more careful selection of cases. Thus, the two "escapes" recorded by Buller occurred from eyes which properly belonged to the class which contraindicates the operation—viz., suppuration and excessive phthisis bulbi. Both the "escapes" which I have described could have been avoided—in one case the socket was infected by an unruly patient, in the other the quality of the catgut used to suture the sclera was later shown to be bad.

The chief cause of escape of the glass ball is failure of the edges of the scleral wound to unite, which in turn may be brought about by a poor quality of catgut, by badly placed or insufficient sutures, by infection of the sutures, causing sloughing around the scleral puncture (stitch-hole abscesses), and by excessive reaction from the improper use of strong antiseptics. Another important cause of extrusion of the artificial globe is its size. If it is too large, it may favor retraction of the sclera before cicatrization is complete, or press unduly on the line of sutures. But according to the observations of Risley and Suker, too small a glass globe is also a cause of early extrusion.

Usually extrusion of the globe takes place during the first week or ten days after the operation, but sometimes the escape is deferred to a much later period. To show the various periods at which this may occur the following experiences may be tabulated :

SURGEON.	LATEST DATE OF ESCAPE OF MULES'S SPHERE AFTER OPERATION.
L. J. Love,	Six weeks.
H. Gifford,	Six weeks.
C. A. Wood,	Two months.
F. Carrow,	Two months.
H. F. Hansell,	Six months.
G. E. de Schweinitz,	Nine months.
G. H. Suker,	One year.
A. H. Voorhies,	Fourteen months.
L. W. Fox,	Two years.

Doubtless in some of these cases there was original failure of scleral union, but the conjunctival covering retained the ball until the time named ; in others the wound may have reopened. This

* This result in a series of twenty-seven cases is most gratifying. Allport expressly states that he did not select his cases. Risley, Ring, and others in smaller series have also not had escape of the ball (see table).

may be caused by continuous wearing of an artificial eye, as I have noted in a case which came under my observation.

Referring to the artificial vitreous used in Mules's operation, Czermak* says: "All such foreign bodies sooner or later will be cast off." This remark is not justified by the American experience, as may readily be seen from the following table:

SURGEON.	LONGEST TIME ARTIFICIAL GLOBE IS KNOWN TO HAVE BEEN RETAINED.
F. Buller,	Eleven years.
L. W. Fox,	Six years.
S. D. Risley,	Five and one-half years.
G. Oram Ring,	Five and one-half years.
Frank Allport,	Five years.
A. H. Voorhies,	Five years.
G. E. de Schweinitz,	Five years.
G. H. Suker,	Four years.
H. B. Chandler,	Four years.

A painful or irritable stump requiring removal, which should be distinguished from a removal necessitated by excessive reaction or sympathetic trouble, is reported only three times, and in two of these cases it is possible that the reporters did not make the distinction just stated. Dr. Baker has seen a case of this kind and removed the stump, the original operation having been performed by another surgeon. I know of a similar instance. Doubtless there are many others, as it is impossible always to follow patients.

Sympathetic trouble is reported six times, and as it is most important to know whether or not Mules's operation can of itself produce sympathetic ophthalmitis, these cases are given in some detail:

CASE I. SYMPATHETIC OPHTHALMITIS FOLLOWING MULES'S OPERATION.—The case is reported in a letter by Dr. Fleming Carrow, of the University of Michigan. The patient, age and sex not given, suffered from extensive corneal and scleral staphyloma, the exact etiology of which is not described, but it was apparently not due to injury. There was not the slightest evidence of sympathetic trouble when the operation—that is, the evisceration with the insertion of an artificial vitreous—was made. Marked irritation, followed by iritis, began in the other eye, which recovered after enucleation of the scleral stump on the opposite side.

CASE II. SYMPATHETIC OPHTHALMITIS FOLLOWING MULES'S OPERATION.—These notes are kindly furnished by Dr. W. T. Coleman, of Chicago. "A miner, aged thirty-four, six weeks before he presented himself for treatment was struck in the left eye, which was defective from an injury received seventeen years previously, causing a corneoscleral wound with iris prolapse. The right eye was normal, vision being $\frac{6}{6}$. Six days later the ciliary injection of the injured eye increased, and Mules's operation was performed. There was little or no reaction,

* "Die augenärztlichen Operationen," Wien, Hefen 7 und 8, 1894, S. 447.

and the patient was discharged from the hospital seven days later, and on the fifteenth day after the operation the artificial eye was inserted. Seven weeks later a small opening was discovered in the stump, exposing the glass ball. The edges of this aperture were freshened and sutured together, but six days later the stitches gave way and nearly the whole of the glass globe was exposed. Two days later, or one week after the stitching of the separated scleral edges, the patient was awakened by severe pain in the right eye, which continued all day, and in forty-eight hours there was well-developed iritis, the posterior synechiæ being most marked below. Eleven days later there was a moderate deposition of opaque dots upon the posterior capsule, or, in other words, punctate keratitis. Seven weeks later all signs of iritis had disappeared and vision was restored to normal. The patient now stated that ever since the evisceration there had been a blue or dancing shadow before the right eye."

CASE III. SYMPATHETIC OPHTHALMITIS FOLLOWING MULES'S OPERATION.—This case is reported in a letter by Dr. George H. Suker, of Toledo, O. The patient, a man aged thirty, suffered from a perforating wound of the cornea which became secondarily infected. Mules's operation was performed, and ten days later—*i. e.*, four weeks after the original accident—iridocyclitis of the opposite eye began. The treatment, in addition to the usual local remedies, required enucleation of the Mules-stump. The ultimate vision secured for the sympathetically affected eye was $\frac{20}{80}$.

CASES IV AND V. SYMPATHETIC DISEASE FOLLOWING MULES'S OPERATION.—Two cases are recorded by Dr. A. G. Hobbs, of Atlanta, but he gives absolutely no particulars and has not replied to additional request for information.

For reasons already stated the cases recorded by Hobbs must be—temporarily, at least—excluded. In Suker's case the seeds of the sympathetic disease had undoubtedly been planted before the Mules operation was performed, as this surgeon himself expressly states. The eye of Coleman's patient was injured, and the Mules operation was performed about the time sympathetic trouble might have been expected to arise—*i. e.*, seven weeks after injury. It is possible that sympathetic trouble may have begun the first few days after the operation, and hence could not have been caused by it. Carrow's case is the only one in my list which illustrates sympathetic inflammation after Mules's operation when the eye on which the operation was performed presented a pathologic condition which of itself excluded the probability of its being the originator of the sympathetic disease. It is to be regretted that the details of this case are so meager. W. E. Hopkins reports sympathetic irritation three weeks after Mules's operation.

The formation of a cyst in the center of the scleral scar six months after operation, which was cured by incision and injection of iodine, is reported by H. Chandler. I have seen a small cyst form in the conjunctiva at the position of a suture.

The lengthened stay in the hospital required by Mules's operation has been used as an objection. Twenty-three surgeons give evidence upon this point. The average stay in the hospital of their patients has varied from six to twenty-one days, an average of the entire series being fourteen and one-third days. The cosmetic results presently to be described would seem to justify this additional time.

Special Advantages with Relation to the Wearing of an Artificial Eye.—The testimony is almost universal that the mobility of the stump and shell after Mules's operation is much better than that after enucleation and simple evisceration. Only one operator thinks the shell-movement is not better than after simple evisceration (Carrow), while another (Hansell) states that the mobility in a single case, where the ball was retained only six months, was not notably increased over ordinary enucleation cases. Fox records 75 per cent. more rotation of the artificial eye than after enucleation, and Suker 50 per cent. more rotation than after enucleation and 25 per cent. more than after evisceration.

The following table of perimetric measurements after Mules's operation may be interesting :

SURGEON.	ROTATIONS.			
	Outward.	Upward.	Inward.	Downward.
Buller,*	20	8	20	30
Todd,	15-45	15-40	5-20	20-50
de Schweinitz, . .	28-30	20-30	10-28	15-60
Coleman,	10	25	25	25
Ring,	38		20	

Even when the rotations do not exceed those found after enucleation, the other advantages of Mules's operation remain—viz.: fullness of the stump and proportionate prominence of the shell, so that the enophthalmic appearance is wanting; healthy conjunctiva and the absence of the accumulation of mucus and tears, and the universal satisfaction of patients.

IMPLANTATION OF AN ARTIFICIAL GLOBE IN TENON'S CAPSULE AFTER REMOVAL OF THE EYE-BALL (FROST-LANG OPERATION).

Fifteen operators give evidence upon this procedure and record seventy-two operations, fifteen of which were failures in the sense that there was an escape of the glass ball.

Technic.—The plan pursued in implantation, when mentioned, is usually the one described by W. Lang,[†] or some modification

* The rotations in Buller's case were measured with the tropometer of Stevens.

† "Trans. of the Ophth. Soc. of the United Kingdom," vol. VII, 1887, p. 247.

of this method. Two have been suggested in America, by Dr. H. McI. Morton* and Dr. C. A. Oliver,† respectively. The former surgeon endeavors to suture the opposing recti muscles so that they shall maintain the same relationship to the implanted ball which they did to the eye; the latter surgeon secures the lateral and vertical recti by long, continuous catgut sutures, and after enucleation and implantation sutures the divided recti together, thus inclosing the sphere within the capsule.

Ordinarily, glass balls have been used; more rarely, celluloid or silver balls. Dr. D. C. Bryant, of Omaha, has suggested and employed a fenestrated aluminium sphere, the cavity of which becomes filled with granulation tissue.‡ The objection to these aluminium balls urged by Dr. Fox has already been recorded (p. 12).

Indications and Contraindications.—This operation may be performed whenever it is necessary to enucleate the eyeball completely, except in the presence of panophthalmitis, malignant disease, sympathetic ophthalmitis, and in extreme old age. One surgeon (Wescott), favorably impressed with implantation, considers it especially desirable after enucleation in children, while another (Howe) suggests as the chief indication greatly enlarged globes: for example, buphthalmos, a pathologic condition which, curiously enough, is recorded by Butler as a contraindication—why, it is hard to understand.

Complications.—These are: Difficulty in securing central location of the implanted eyeball; cicatricial contraction of the orbital tissues, causing extrusion of the ball; tearing out of the stitches, either from too great tension or from sloughing with escape of the ball; hemorrhage; orbital cellulitis; and sympathetic irritation. The last-named affection has been recorded by Suker, who states that the condition was one of irritation, not of inflammation, and was cured by the removal of the implanted globe.

Special Advantages with Relation to the Wearing of an Artificial Eye.—The testimony of Risley is that the operation gives better results than enucleation in so far as the movability of the stump and of the shell is concerned, and that in this respect it has some of the advantages of the Mules operation. The good cosmetic

*"New York Med. Jour.," October 30, 1897.

†"Philadelphia Medical Journal," May 27, 1899, and "International Clinics," vol. 11, tenth series, p. 221. This paper thoroughly explains the method and is well illustrated.

‡ These aluminium frames have been used by Dr. Bryant for Mules's operation also, and by other surgeons. Unfortunately, Dr. Bryant himself was absent from the country when the American statistics were collected, and could not give his individual views. Consult "Trans. of the Section on Ophthalmology of the Amer. Med. Assoc.," 1898, p. 117.

effect is attested by other reporters,—for example, W. E. Hopkins,—although only one (Pischl) thinks that it is as good as after insertion of a glass ball into the scleral cup.

H. McI. Morton and C. A. Oliver speak enthusiastically, in their papers (references to which are given on p. 19) on this subject, of the advantages of this operation as they have modified it. As neither of these gentlemen has replied to the circular letter, I am unfortunately unable to add their experiences in the tables. L. W. Fox, who has recently modified the method of placing the sutures after implantation of the artificial globe, is decided in his belief of the value of this operation over enucleation. I have had no personal experience with the method, hence my opinion possesses little value. Oliver's procedure seems to me to promise the best results, but I confess it is difficult for me to understand what advantages implantation of a glass ball into Tenon's capsule can have over enucleation, properly performed, as will be explained later on, and the wearing of a reformed artificial eye.

IMPLANTATION OF A PIECE OF SPONGE IN THE ORBIT AFTER ENUCLEATION.

On the basis of experiments on animals this procedure was suggested in 1889 by J. Herbert Claiborne, Jr.,* of New York, and seven years later was again described and practised by Dr. E. Oliver Belt, † of Washington. By this means it was hoped to gain fullness of the stump and improvement in adapting prothesis. For the same purpose, it will be remembered, Bourgeois advocated a small ball of silk. Sponge implantation is not likely to find a permanent place in ophthalmic surgery. In other words, the late results of this operation, as Risley has demonstrated, are no better than those of a well-performed enucleation, while the period of convalescence is too prolonged to be satisfactory. It is, however, proper to state that some surgeons besides Dr. Belt speak well of the operation: for instance, H. Chandler, of Boston, who has thus operated nine times and secured results which he regards as rating next to those following Mules's operation.

To overcome the objections raised in the first part of this subject, Dr. G. H. Suker ‡ has substituted the following operation. It is a modification, or rather a combination, of Belt's and the others, excluding Mules's:

* "Gaillard's Medical Journal," May, 1889.

† "Jour. of the Amer. Med. Assoc.," November 7, 1896; "Medical News," June 27, 1896.

‡ "The Ophthalmic Record," June, 1900, p. 281.

"The eyeball is removed as in the ordinary method, care being taken to save as much of the conjunctiva as possible. The recti muscles are severed as close to the eyeball as possible, and each provisionally anchored by a black silk suture. The cavity, after the eyeball has been removed, is completely evacuated, and any hemorrhage checked before the artificial combination globe is inserted. Avoid using even the weakest solution of bichlorid of mercury during the operation, but instead use a sterilized normal salt solution. This for the reason that the former agent is prone to attack the vitality of the tissues and cause more or less annoyance.

"A suitable and sufficiently large artificial globe (of glass, silver, aluminium, etc.), properly sterilized, is embedded or wrapped up in a layer of very fine surgeon's sponge, likewise aseptic, and tied or sewed with catgut. This embedded globe is inserted into the capsule cavity. The capsule is next sutured with catgut (chromicized). The recti muscles are now brought together in pairs, and the whole fixed by an annular ligament. The black silk sutures are now removed from the recti muscles. Next, the conjunctiva is brought over the muscles, and sutured with silk or catgut. It is best to employ two sets of sutures for the conjunctiva: a so-called edge suture and an anchor suture alternating. This anchor or retention suture is placed as far back as possible from the cut edge of the conjunctiva, in order to relieve any strain upon the continuous or interrupted edge suture.

"The eye is now dressed with a dry dressing,—gauze pad immersed in one part boric acid and four parts amyloform,—and if everything has been thoroughly aseptic during the operation, very little reaction or consequent suppuration supervenes. Above all things avoid using pressure bandages. It is advisable to employ an ice-bag for the first twenty-four or thirty-six hours. Great caution must be observed in preparing the sponge and globe so as to have each thoroughly aseptic—especially is this true of the sponge.

"An artificial shell—the ordinary or Snellen's—can be inserted at the expiration of a month or six weeks, for by this time complete absorption of the sponge has been obtained."

OPTICOCILIARY NEUROTOMY AND NEURECTOMY.

No collective investigation of American opinions upon these operations has been attempted, largely because I believe, with Noyes,—and this belief is, I know, shared by many American surgeons,—that they represent operative procedures which have not gained the confidence of the profession. On this subject Dr. Hiram Woods writes: "In the Presbyterian Eye, Ear and Throat Hospital of Baltimore, in 1883, Dr. Julian J. Chisolm and his assistants began to perform opticociliary neurotomy when the eye was lost but was fairly good looking and not painful. In all there have been ninety such operations, but only one case since 1894." Dr. Woods abandoned the operation because convalescence was slow and because he did not regard the procedure as surely preventing pain or sympathetic trouble. He has, however, seen no case of sympathetic disease after this operation. If a patient should decline enucleation, the operation might be tried to prevent sympathetic inflammation or to relieve pain, but otherwise it is not to be commended. I have never employed either of these procedures, nor are they in vogue among my colleagues.

SCLERO-OPTICONEURECTOMY AND EVISCERO-NEUROTOMY.

These operations are practically identical, or, at least, very similar, and consist of an evisceration of the eye with removal of a posterior segment of the globe, the muscular attachments being undisturbed. By this means it is hoped to gain the advantages of evisceration and avoid the dangers, however remote, of sympathetic ophthalmitis. The former operation was described by Dr. Ernest Hall* in 1896, and the latter by Dr. J. G. Huizinga,† of Chicago, in 1899. Dr. Huizinga recommends that the operation terminate with the introduction of Bryant's fenestrated aluminium sphere.

So far as I am aware these operations have seldom been repeated, and it is impossible to give any evidence in regard to their advantages.

The Preference Expressed for the Operation Which may Replace Enucleation.—To the question, "Which operation do you prefer shall replace enucleation and from which operation have you obtained the best cosmetic results?" there have been twenty-six replies, as follows: Nine surgeons prefer evisceration with the insertion of an artificial vitreous (Mules's operation); one surgeon, Mules's operation, or if not, implantation; five, implantation of a glass ball in Tenon's capsule; two, implantation of Bryant's aluminium artificial vitreous in Tenon's capsule; five, evisceration without implantation of a glass ball into the scleral cup (Graefe's operation); one, evisceration of the eyeball without removal of the cornea, either with or without the insertion of a glass ball (Gifford's method); two, some form of abscission or complete keratectomy; two, implantation of a sponge ball after complete enucleation. It must be distinctly understood that none of these surgeons believes that any operation can entirely replace enucleation, but each expresses his preference for that one which may replace it when the indications are suitable. Twenty-six surgeons have failed to reply to this question.

Fifty-three surgeons do not think that any of these operations, with certain exceptions to be noted hereafter, should replace enucleation. The analysis of their replies yields the following result:

Five surgeons expressly state their preference for enucleation because they fear that the substitutes may be followed by sym-

* "Amer. Jour. Surg. and Gynec.," 1895-'96, vol. VIII, p. 96. "Annals of Surgery," Phila., 1898, vol. XXVII, pp. 640-642.

† "Jour. of the Amer. Med. Assoc.," vol. XXXIV, 1899, p. 394.

pathetic inflammation, while nine urge the element of safety as the cause of their preference, and therefore indirectly imply that they have the same fear. As has already been pointed out, this is a remote possibility, practically all of the cases thus far recorded being open to doubt—that is to say, doubt whether the operative procedure was the cause of the sympathetic inflammation. Twenty-five surgeons perform only enucleation, but give no special reason for their unwillingness to abandon this operation. Three surgeons are largely influenced in their adherence to enucleation by the time element, especially as this affects laboring men. Two perform enucleation only, except in advanced cases of panophthalmitis; five, except in the staphylomatous eyes of children, when they present such pathologic conditions as permit abscission or complete keratectomy; and three because they are satisfied with their cosmetic results. (Ten millimeters of mobility of shell in all directions—F. Valk.) One surgeon performs enucleation only, but is willing to substitute for it the implantation of a glass ball in Tenon's capsule. Several surgeons—for example, Noyes and Grüning—believe that improvement in technic and in the manufacture of artificial eyes will render the substitutes for enucleation, particularly Mules's operation, unnecessary.

Methods of Preparing the Stump after Complete Enucleation Which Best Secure Mobility of the Prothesis and Cosmetic Results.—In a well-performed enucleation the operator disturbs as little as possible the relations existing between the conjunctiva, the capsule of Tenon, and the ocular muscles.

Subsequent suturing of the conjunctiva is a common, but not universal, practice, although few, like Czermak, would be willing to state that it does not hasten recovery and that it occasions diminution of the stump, a statement certainly not in accord with the general experience. The sutures are usually interrupted ones placed in a horizontal line, in a vertical direction (Meyer*), or as is the draw-string of a purse (de Wecker†). It does not positively appear whether the muscles are included in this draw-string or not, but apparently not. For reasons which will appear more distinctly later such inclusion of the muscles is important.

This it would seem H. V. Würdemann‡ realized, who makes a pouch suture by weaving the needle along the cut edge of the

* "Rev. générale d'Ophthalmologie," May, 1898.

† "Ocular Therapeutics," edited by Litton Forbes, London, 1879, p. 512.

‡ "Ophthalmic Record," vol. III, 1893-'94, p. 177.

divided conjunctiva and Tenon's capsule. In passing the recti tendons each one is picked up on the needle.

A few years later G. F. Suker* suggested the following method of forming the stump after an enucleation :

"The conjunctiva is divided as close to the cornea as possible, and it, with the capsule of Tenon, is dissected as far back as permissible; next the recti muscles are cut close to their insertion, and each one secured with a black silk suture which is to act as a guide. After removing the eye the severed ends of the recti are brought together by means of the silk suture guides and sutured one to the other with catgut, and the silk guides then removed. Finally, the conjunctiva from above and below is brought over the muscle-stump and sutured with a continuous suture, which also fastens the conjunctival covering to the muscle-stump."

Dr. Suker maintains that the stump thus formed transmits freer movement to the shell than an ordinary stump, and that it obviates in part the shrunken appearance so often presented by artificial eyes. I have twice operated in a manner analogous to this and the result was satisfactory, although I am unprepared to say whether ultimately it will be more satisfactory than is the result of an ordinary carefully performed enucleation.

In 1897 H. Schmidt, in Aachen,† suggested a method of enucleation with movable prothesis. He secures each rectus tendon with a catgut suture, and makes a slit in the conjunctiva over each muscle in which then the divided tendon is fastened. The conjunctiva is brought together with a continuous suture. Dr. H. F. Hansell informs me that he has operated according to Schmidt's method with entire satisfaction.

Acting on Schmidt's suggestion, Priestley Smith‡ has described a method of suturing the tendons to the conjunctiva after enucleation, as follows :

"A narrow horizontal fold of the conjunctiva over the internal rectus is pinched up so as to include the subjacent connective tissue and muscle, and a black silk suture is carried through these structures by means of a curved needle. The suture is then tied firmly but not too tightly. A second suture is applied in like manner to the external rectus. The upper and lower recti may be treated in the same way, but this is of less importance. The enucleation is then carried out and the conjunctival aperture may or may not be closed by one or more vertical sutures."

The effect of this operation, according to its author, is to give greater mobility to the conjunctival bed, at least during the first

* "Annals of Ophthalmology and Otology," vol. IV, 1895, p. 484.

† "Monatsbl. f. Augenheilk.," vol. XXXV, 1897, p. 383.

‡ "The Ophthalmic Review," vol. XVIII, 1899, p. 123.

few days after the operation, than is usual after ordinary enucleation. Incidentally it may be remarked that Mr. Smith commends Snellen's thickened artificial eyes.

For the last year and a half I have sutured the recti muscles to the conjunctiva in the operation of enucleation, very much after the manner described by Schmidt and Priestley Smith. Briefly, I operate as follows :

The conjunctiva is divided as close as possible to the corneal margin ; each rectus tendon is next exposed and caught upon a hook, precisely as in the operation for strabismus, and is secured with a double-armed black silk suture, which is knotted upon it. The eyeball is now enucleated with the least possible disturbance of the relations between the conjunctiva and the underlying structures, and a small ball of sterilized gauze is inserted into the capsule of Tenon, precisely in the manner in which a Mules sphere would be so placed in the operation of implantation. Each rectus tendon is now drawn forward to the edge of the cut conjunctiva, and securely fastened with the ends of the same suture which had originally secured the tendon and which have been left long : that is to say, the tendon is brought forward somewhat as it would be in the operation of advancement. The wad of sterilized gauze, which has served its purpose of checking entirely the hemorrhage and keeping, for the time being, the cavity bulged out as it was when occupied by the globe, and therefore facilitating the advancement of the tendons, is now removed, and the edges of the conjunctiva and capsule of Tenon are united with interrupted sutures.

Primarily, the movement of the conjunctival bed is certainly very much greater than after ordinary enucleation, as Schmidt, Saker, Priestley Smith, and all others who have so sutured the tendons have found. Indeed, this is to be expected, as we know that the capsule of Tenon moves freely with the movements of the eye, but that the eye does not move freely in the capsule. Now, although the eye is gone, the movement of the conjunctival bed is brought about by the contractions of the straight muscles which have been sutured to it. Certainly it is reasonable to suppose that sutures, which may be applied in any of the ways described, will prevent the tendons from retracting, which they will do to the extent of from seven to ten millimeters (Bock, Meyer), after ordinary enucleation. This retraction Edward Meyer thinks he prevents without suturing the tendons by great care in removing the eyeball, and thus preserving intact the adherence between the conjunctiva and the surface of the muscles. Whether the later results of these operations will be no better than after enucleation I can not say, as sufficient time has not yet elapsed to establish this point.

The rotations of the shell placed upon the stump of several such cases exceed those usually obtained after ordinary enucleations, are practically equal to those after the best eviscerations, and are better than those after some eviscerations ; but they are not equivalent to those after the best Mules's operations, although they quite equal

those after some Mules's operations. If these facts are put in a tabular manner, we have the following :

	OUT.	UP.	IN.	DOWN.	REMARKS.
Average rotations,	45	31	50	55	Average of Landolt's and Stevens's measurements.
Rotations after enucleation with suture of tendons,	19	22	20	50	Average of my cases.
Evisceration, . . .	15	18	23	35	Average of Truc's and my measures.
Enucleation without suture of tendons,	15	15	12	25	Average of Truc's and my measures.
Mules's operation, .	25	30	23	58	Average of my cases.

But the transmission of increased movement to the shell after a Mules operation is only one of the gains in the enhanced cosmetic result, the other two important ones being the preservation of the natural contour of the lids and the absence of unhealthy conjunctival secretion. It seems to me, after enucleation performed in the manner just described, that the upper lid sulcus is not so pronounced and that there is much less abnormality of conjunctival secretion than after the ordinary operation for complete removal of the eyeball ; in some cases it is absent.

IMPLANTATION OF A GLASS BALL INTO THE ORBIT AFTER REMOTE ENUCLEATION OF THE EYEBALL (L. WEBSTER FOX'S OPERATION).

In order to improve the support of an artificial eye in a socket from which the globe had been removed at some remote period, Dr. L. Webster Fox, in 1897, suggested the following method : *

An incision is made through the conjunctiva and tissues of the orbit in the horizontal direction two millimeters shorter than the diameter of the glass ball to be inserted. The upper lip of the conjunctiva is raised, and with sharp-pointed curved scissors the conjunctiva and such connective tissue as lies close to it are dissected off in all directions around the incision, making a pouch into which the glass ball will fit. After bleeding has been stopped, the glass ball is inserted into the culdesac. The edges of the wound are brought together by five or six stitches, and the orbit is covered with a pressure bandage which is to remain for from forty-eight to seventy-two hours.

Dr. Fox has performed this operation forty-eight times, with 15

* "Trans. of the Section on Ophthalmology of the Amer. Med. Assoc.," Chicago, 1898, p. 80.

per cent. of failure. It has also been performed by other surgeons—for example, G. H. Suker and L. H. Taylor—with good results. Dr. Fox himself points out that it is difficult to prognosticate how permanent the implanted ball will be, because sometimes there is posterior contraction of the orbital tissues, so that the artificial eye is pressed against the conjunctiva, which is gradually attenuated and ruptures. He has seen escape of the artificial ball from this cause a year after its implantation. Fox, Taylor, and other surgeons give evidence that if the ball does escape, another one may be planted successfully in its place. This operation does not seem to have gained great vogue, and is, I think, performed seldom except by its originator. *

In this connection it will be interesting to relate the special method pursued by Dr. Russell Murdock, of Baltimore, who places a glass ball in the healed socket, upon which in turn is placed the artificial eye. These balls are oval in shape and are made of toughened glass in three sizes. The result, according to the author, is improvement in the sunken appearance of the lids, removal of the irritation from the socket, and probably some increase in the rotation of the shell.

PATHOLOGIC CONDITIONS IN THE EYEBALL WHICH DEMAND ENUCLEATION TO THE EXCLUSION OF OTHER OPERATIONS.

There is general accord that intra-ocular malignant growths and diseased or injured eyes which have already excited sympathetic ophthalmitis demand enucleation to the exclusion of other operative interference. Other affections which are believed by some of the surgeons to require enucleation are: Painful glaucomatous eyes unrelieved by sclerotomy; chronic painful iridocyclitis; sclerociliary staphylomata; eyes so injured that they are liable to produce sympathetic disease, especially if there is a retained foreign body; eyes with extensively lacerated or diseased scleras; phthisis bulbi; if the shrunken stump is painful; excessive hydrophthalmos; extreme old age; and when the cosmetic results are not important. It should be distinctly noted that there is not universal agreement on the above-named conditions for enucleation. Ten operators expressly include suppuration within the globe among the diseases requiring enucleation; others place themselves on record against evisceration for the relief of this condition. The latter do not, however, state whether they would enucleate if the suppurative process had extended beyond the scleral cup and involved the orbital tissues.

* Dr. Fox tells me that he has recently much improved the technic of this operation, and is more than ever gratified with his results.

CONCLUSIONS.

1. Eyes so diseased or injured that they have already excited sympathetic ophthalmitis, or eyes which contain malignant growths, should be enucleated.

2. Eyes in which a suppurative process has begun may be enucleated with safety provided the process has not involved the surrounding orbital tissues or already begun to extend posteriorly so that it would be difficult to obtain an aseptic socket; otherwise evisceration is the safer operation.

3. Eyes so wounded that they are likely to excite sympathetic ophthalmitis should be enucleated if two weeks or more have elapsed since the reception of the injury, because under these circumstances enucleation affords a greater security to the patient than any of its substitutes. If the eye is so injured that the sclera is extensively lacerated, enucleation is also indicated.

4. Eyes so wounded that they are likely to excite sympathetic ophthalmitis, if seen before two weeks have elapsed, need not be enucleated—that is, evisceration or Mules's operation may be performed, because, with perhaps the exception of a single case, there is no positive proof that these operations have of themselves excited sympathetic disease. They may fail to arrest the development of sympathetic ophthalmitis, just as enucleation may meet with a similar failure.

5. Staphylomatous eyeballs, especially when they occur in children, need not, in fact should not, be enucleated. When uninflamed, they may be treated by the operation of abscission or complete keratectomy primarily with safety, but it can not be promised that subsequently, it may be years afterward, the stump will not undergo calcareous or osseous change, which may excite sympathetic irritation in the other eye and require enucleation. Staphylomatous eyes are suited to Mules's operation.

6. Eyes which are greatly shrunk (excessive phthisis bulbi) should be enucleated, as they do not lend themselves with safety either to evisceration or to Mules's operation.

7. Painful blind glaucomatous eyeballs, or eyeballs blind from chronic nontraumatic iridocyclitis, may be treated by evisceration, with or without the insertion of an artificial vitreous, in the place of enucleation, with safety. They furnish one of the few indications for opticociliary neurotomy or neurectomy if enucleation or one of its substitutes should be refused by the patient.

8. Enucleation is preferable in very old patients, when the time element is important, and when the physical condition is such that the prolongation of convalescence is undesirable.

9. Evisceration as a substitute for enucleation is a safe operation,

and temporarily yields a stump which is better than the stump after ordinary simple enucleation. Subsequent shrinking of this stump, however, ultimately renders the cosmetic effect of the operation no better than ordinary enucleation, while its inconveniences are much greater.

10. The best cosmetic results among the substitutes for enucleation, if successful abscissions are excluded, are secured by Mules's operation, which is only positively contraindicated by malignant disease, sympathetic ophthalmitis, extensive laceration of the sclera, and extreme phthisis bulbi. But it should be remembered that the primary excellent cosmetic effect of Mules's operation slowly lessens, owing to atrophy of the tissues of the orbit and sinking in of the artificial globe. This diminution in the volume of the stump is, however, much less marked than after simple evisceration.

11. Whenever a complete enucleation is performed, there is no objection to the implantation of a glass ball or of a piece of sponge into Tenon's capsule, except perhaps after enucleation for sympathetic and malignant disease, but it is doubtful if the ultimate cosmetic advantage of the operation exceeds that of a carefully performed enucleation.

12. There is no perfect substitute for enucleation, and necessarily this operation must continue to be performed in many, if not in the majority of, cases. When it is performed according to the rules of improved technic, which include suture of the severed tendons to the conjunctiva, the cosmetic effect of the operation is, primarily at least, as good as any of the substitutes, with the exception of Mules's operation and abscission, and is free from the objections which surround them. It seems likely that with further improvement in technic, and particularly in the manufacture of artificial eyes, the cosmetic effect will be enhanced and render less objectionable the operation of enucleation and less necessary the substitutes for it.

13. An enucleation which pays no attention to the preservation of the relationship between the conjunctiva, ocular tendons, and capsule of Tenon, is a brutal operation which should not be performed unless the disease of the globe and surrounding orbit is of such a character as to render this precaution impossible.

The foregoing conclusions seem to be warranted by the statistical information gathered in this paper, although I fully realize that some of them will not be acceptable to all of the 117 surgeons who have contributed their experience. For example, a number of operators undoubtedly would reject conclusions 2 and 4, although they are in accord with the surgical beliefs of others. So, too, the final sentence in conclusion 5 is in direct discord with some of the recorded opinions, but in equally direct accord with the views of others. In

other words, in these conclusions I have endeavored to epitomize the opinions which have been expressed by the various surgeons, although necessarily it was impossible to construct a series of deductions which would be equally acceptable to all contributors. Personally, they seem to me to represent a safe line of practice. In those cases in which complete enucleation is not demanded—and in my opinion they are in the minority—Mules's operation, when successful, certainly furnishes admirable results, but I feel sure that although at the present time, from the cosmetic standpoint, it seems to be one of the best, if not the best, of the substitutes for enucleation, it is not likely to endure as an operative measure in ophthalmic surgery unless the percentage of failure is greatly reduced. I believe, as I have stated in conclusion 12, that improvement in the technic of performing the operation of enucleation and in the manufacture of artificial eyes will probably be so great in the future that this and other substitutes for enucleation will seldom be required.

APPENDIX TO THE REPORT.

The following questions were sent to 275 ophthalmic surgeons in various portions of the United States and Canada :

I. SIMPLE EVISCERATION OR EXENTERATION.

1. How many operations have you performed?
2. How often have you encountered any of the following complications—(a) excessive reaction; (b) sloughing of the sclera; (c) painful or irritable stump; (d) meningitis; (e) sympathetic ophthalmitis or irritation.
3. Describe the mobility of the stump and shell as compared with the mobility of the stump and shell after simple enucleation, with measurements, if possible.
4. State the chief indications.
5. State the chief contraindications.

II. EVISCERATION WITH INSERTION OF ARTIFICIAL GLOBE IN THE EMPTIED SCLERA (MULES'S OPERATION).

1. How many operations have you performed?
2. How often have you encountered any of the following com-

plications—(a) excessive reaction; (b) sloughing of the sclera; (c) escape of artificial globe; (d) breakage of artificial globe; (e) painful or irritable stump requiring removal; (f) sympathetic inflammation or irritation.

3. State the average length of stay of patients in hospital; also longest time; shortest time.

4. How long have you known the artificial globe to be retained?

5. What is the latest date after operation at which you have known the artificial globe to escape?

6. What do you consider the chief causes of the escape of the artificial globe, either early or late?

7 and 8. State the chief indications and contraindications.

9. Which cases give the best results in Mules's operation?

10. Describe the mobility of the stump and shell as compared with the mobility of the stump and shell after evisceration and simple enucleation, with measurements, if possible.

11. Describe briefly the technic of the operation; kind of artificial globe preferred (silver, glass, aluminium, etc.); sutures preferred; methods of stopping hemorrhage; antiseptics preferred, etc.

III. INSERTION OF GLASS OR OTHER GLOBES INTO TENON'S CAPSULE AFTER COMPLETE ENUCLEATION (FROST, LANG, MORTON, OLIVER, FOX OPERATIONS, ETC.).

1. How many operations have you performed?

2. State the chief complications which you have encountered.

3. State the chief indications.

4. State the chief contraindications.

IV. OPERATION OF ABSCISSION OR COMPLETE KERATECTOMY.

1. How many operations have you performed?

2. What complications have you encountered?

3. State the chief indications.

4. State the chief contraindications.

1. Which operation do you prefer shall replace enucleation, and from which operation have you obtained the best cosmetic results?

2. Please enumerate the class of cases in which the operation of enucleation to the exclusion of all other methods is imperative.

3. Please give references to papers which you already have published bearing upon these topics.

4. Please state any other facts that you may wish recorded not covered by the questions already asked, and please furnish abstracts of cases illustrating important complications, etc.

The following 117 surgeons replied :

F. W. Abbott,	George Friebeis,	A. E. Prince,
A. E. Adams,	E. Friedenberg,	J. S. Prout,
L. A. W. Alleman,	H. Friedenwald,	B. A. Randall,
F. Allport,	B. E. Fryer,	J. M. Ray,
Joseph A. Andrews,	H. Gifford,	J. O. M. Reynolds,
S. C. Ayres,	G. M. Gould,	S. O. Richey,
A. R. Baker,	E. Grüning,	C. E. Rider,
W. C. Bane,	A. B. Hale,	G. O. Ring,
A. Barkan,	H. F. Hansell,	S. D. Risley,
D. B. D. Beaver,	G. C. Harlan,	E. C. Rivers,
Melville Black,	Herbert Harlan,	S. B. St. J. Roosa,
F. Buller,	David Harrower,	G. C. Savage,
Swan M. Burnett,	C. W. Hawley,	G. E. de Schweinitz,
W. K. Butler,	A. G. Hobbs,	H. L. Shaw,
A. W. Calhoun,	C. M. Hobby,	W. F. Southard,
P. A. Callam,	Ward Holden,	James Spalding,
W. H. Carmalt,	C. R. Holmes,	H. M. Starkey,
F. Carrow,	W. E. Hopkins,	G. S. Stevens,
H. B. Chandler,	F. C. Hotz,	A. W. Stirling,
W. Cheatham,	Lucien Howe,	G. H. Suker,
J. J. Chisolm,	I. W. Ingalls,	T. Y. Sutphen,
C. F. Clark,	E. E. Jack,	J. O. Tansley,
Anton Coe,	W. B. Johnson,	L. H. Taylor,
David Coggin,	H. Knapp,	S. Theobald,
W. T. Coleman,	J. A. Lippincott,	J. L. Thompson,
Leartus Connor,	L. J. Love,	F. R. Todd,
C. M. Culver,	E. M. Marbourg,	F. Valk,
Hasket Derby,	F. W. Marlow,	A. H. Voorhies,
Richard Derby,	R. J. McKay,	O. F. Wadsworth,
J. L. Dickey,	B. L. Millikin,	Lyman Ware,
L. S. Dixon,	W. F. Mittendorf,	D. Webster,
Charles W. Dodd,	W. O. Moore,	J. E. Weeks,
J. C. Dunlavy,	H. Moulton,	J. A. White,
F. B. Eaton,	Russell Murdock,	W. H. Wilder,
E. C. Ellett,	H. D. Noyes,	C. H. Williams,
H. B. Ellis,	R. J. Phillips,	C. A. Wood,
J. E. Emerson,	C. Pischel,	H. Woods,
A. E. Ewing,	T. R. Pooley,	H. V. Würdemann,
L. W. Fox,	G. H. Price,	M. W. Zimmerman.

Sixty-seven surgeons gave their experience with the substitutes which have been proposed for enucleation. Forty-nine had not performed any of these substitute operations.

In the following tables the most important facts are condensed :

ABSCISSION OR COMPLETE KERATECTOMY.

SURGEON.	NUMBER OF OPERATIONS.	COMPLICATIONS.	REMARKS.
S. C. Ayres.	Many.	Once hemorrhage. Kind healing, the rule.	Indicated in cases of staphyloma of cornea. Contraindicated in ciliary staphyloma, liquefaction of vitreous, and sensitive globes.
S. M. Burnett.	A number.	No serious ones.	Indicated in corneal staphyloma, but not advisable if there has been much cyclitis and the ciliary region is extensively involved.
R. Derby.		Has seen sympathetic ophthalmitis.	Considers operation an unsafe surgical procedure.
J. C. Dunlavy.	3	Slight reaction.	Indicated for staphyloma of cornea.
A. B. Hale.	1		Operation for cosmetic reasons; no prothesis afterward.
H. F. Hansell.	Great many.		Suited to cases in which there is disease limited to the anterior portion of the eyeball.
G. C. Harlan.	Large number.	No serious ones.	Indicated when disease or deformity is confined to anterior segment of eyeball; contraindicated in inflamed or shrunken eyeballs or suppuration of choroid.
L. Howe.	1	Irritable stump.	Indicated in extreme staphyloma.
E. E. Jack.		Commonly excessive reaction.	Uses Critchett's operation, but prefers evisceration.
H. Knapp.	Many.	Late irritability of stump, 7-15 years after operation by ossification.	Has performed this operation by his method in staphyloma and megalophthalmos, but eyes must be free from inflammatory irritation.
Manhattan Eye and Ear Infirmary.	72		These operations done from 1881 to 1889; no particulars; probably mostly for staphyloma.

ABSCISSION OR COMPLETE KERATECTOMY.—(*Continued.*)

SURGEON.	NUMBER OF OPERATIONS.	COMPLICATIONS.	REMARKS.
W. O. Moore.	28	Imperfect healing of wound and moderate reaction.	Indicated in anterior staphyloma of cornea, especially of children; in all other cases prefers enucleation.
H. D. Noyes.			Suitable for total staphyloma; sutures sclera and conjunctiva separately.
T. R. Pooley.	Good many.		Indicated in complete staphyloma of cornea, but contraindicated when there is iridocyclitis.
S. D. Risley.	2	Loss of fluid vitreous, causing shrinking of globe.	Indicated in corneal staphyloma, but prefers Mules's operation.
D. B. St. J. Roosa.			Performs keratectomy or abscission in noninflamed staphylomatous eyes.
J. A. Spalding.	8		Indicated in cases of large or small staphyloma of cornea, or when cornea is totally or more than half leukomatous.
G. H. Suker.	2	Sympathetic irritation and irritable stump.	Objects to the operation, except possibly in the anterior staphyloma of infants.
J. O. Tansley.	20	None serious; occasional slow healing.	Chiefly indicated when there is a not too greatly diseased condition in childhood.
S. Theobald.	A number.		Staphylomatous eyes in children indicate the operation; Critchett's or de Wecker's operation preferred.
J. L. Thompson.	Many.		Special technic of his own; 60 per cent. of success in primary healing of wound.
D. Webster.	12	Severe hemorrhage once.	Indicated in total staphyloma of cornea; contraindicated in sympathetic ophthalmitis, bony or chalky vitreous, neoplasms, etc.

ABSCISSION OR COMPLETE KERATECTOMY.—(*Continued.*)

SURGEON.	NUMBER OF OPERATIONS.	COMPLICATIONS.	REMARKS.
J. E. Weeks.	4	Slow healing of wound.	Indicated in total staphyloma with absence of inflammation; not to be used if pathologic process extends deep into globe.
C. A. Wood.	12	Once slow closure of wound and shrinking of globe.	Indicated in progressive corneal and ciliocorneal staphyloma, and where remainder of globe is normal or nearly normal.
H. Woods.	2	None of special note.	Operations done for staphyloma following ophthalmia neonatorum.
W. V. Würdemann.	12		Useful in staphyloma of cornea without disease of posterior portion of globe; otherwise contraindicated.
M. W. Zimmerman.	3	No serious ones.	Indicated in large anterior staphyloma in young children.
H. B. Chandler.	4		Indicated in corneal staphyloma of children.

SIMPLE EVISCERATION OR EXENTERATION.

SURGEON.	NUMBER OF OPERATIONS.	EXCESSIVE REACTION.	SLOUGHING SCLERA.	PAINFUL STUMP.	MENINGITIS.	SYMPATHETIC OPHTHALMITIS OR IRRITATION.	REMARKS.
L. A. W. Allerman.	25	3					Cosmetic effect and mobility of stump and shell much better than after enucleation
F. Allport.	6	4		2			Mobility of stump and shell better than after enucleation; does not now perform the operation.

SIMPLE EVISCERATION OR EXENTERATION.—(*Continued.*)

SURGEON.	NUMBER OF OPERATIONS.	EXCESSIVE REACTION.	SLOUGHING SCLERA.	PAINFUL STUMP.	MENINGITIS.	SYMPATHETIC OPHTHALMITIS OR IRRITATION.	REMARKS.
S. C. Ayres.	5						The stump is of slight value.
M. Black.	1						
F. Carrow.	18	4		4		2	
J. Chisolm, H. Harlan, H. Woods.	24			1			These operations done between 1883 and 1893 in the Presbyterian Eye and Ear Hospital, Baltimore; none since. Primary gain in mobility lost later by shrinking of stump; gains over enucleation not worth trouble of operation, hence abandoned.
A. Coe.	1						Fair motion, but prefers that after simple enucleation.
D. Coggin.	4						
W. T. Coleman.							Does not think mobility of stump is greater than after enucleation.
C. W. Dodd.	6	6					Stump more movable and much less shrinking of artificial eye than after simple enucleation.
J. C. Dunlavy.	25						As a rule, more mobility of stump and shell than after enucleation; adaptation of artificial eye easier.
E. C. Ellett.	6						Better mobility and cosmetic effect than after simple enucleation.
E. Friedenbergl.	6	2					Both stump and shell are more mobile than after enucleation.

SIMPLE EVISCERATION OR EXENTERATION.—(Continued.)

SURGEON.	NUMBER OF OPERATIONS.	EXCESSIVE REACTION.	SLOUGHING SCLERA.	PAINFUL STUMP.	MENINGITIS.	SYMPATHETIC OPHTHALMITIS OR IRRITATION.	REMARKS.
H. Gifford.	100	2					On the whole, mobility of stump and shell decidedly better than after enucleation, but can not give enough measurements to be of value. Now always does this operation according to his special method (<i>q. v.</i> , p. 3).
A. B. Hale.	3	1					Mobility of stump and shell not so good as after enucleation.
G. C. Harlan.	Considerable number.	Frequent.					Mobility of stump not much greater than after enucleation.
C. W. Hawley.	1						
A. G. Hobbs.	12	3	2	3		2	Mobility better in 3, about the same as after enucleation in 6, not so good in 3. No particulars of sympathetic cases given.
F. C. Hotz.	A few.	All.				1	In a few months evisceration-stump shrinks, and is no better than socket after enucleation.
L. Howe.	2			2			Little or no increase in mobility of stump and shell as compared with enucleation.
E. E. Jack.	3						Mobility of stump and shell greater than after simple enucleation.
H. Knapp.	Small number.	1					Once saw noninfective thrombosis of orbital veins as a sequel; stump not much better than after enucleation.

SIMPLE EVISCERATION OR EXENTERATION.—(*Continued.*)

SURGEON.	NUMBER OF OPERATIONS.	EXCESSIVE REACTION.	SLOUGHING SCLERA.	PAINFUL STUMP.	MENINGITIS.	SYMPATHETIC OPHTHALMITIS OR IRRITATION.	REMARKS.
W. F. Mitten- dorf.	4	4		3			Mobility not much better than after enucleation, but depression of stump less marked.
W. O. Moore.	49	2					Mobility of stump and shell about the same as after simple enucleation.
New York Eye and Ear Infirm- ary.	17						All performed for panophthalmitis.
C. Pischl.	6	1					Mobility of stump and shell better than after simple enucleation.
J. M. Ray.	6						The stump is of advantage in the adaptation of an artificial eye.
G. E. de Schweinitz.	9	1					Primary effect better than after enucleation; later no advantage.
G. H. Suker.	10	3	1	2			Mobility of stump and shell greater than after simple enucleation, and accumulation of tears less marked; has seen one case of sympathetic irritation.
L. H. Taylor.	2						Mobility of stump equally good, but not better than after a carefully performed enucleation.
J. L. Thompson.	20	4					Within one year artificial eye more prominent and mobility better than after enucleation; afterward atrophy of stump and result no better.

SIMPLE EVISCERATION OR EXENTERATION.—(*Continued.*)

SURGEON.	NUMBER OF OPERATIONS.	EXCESSIVE REACTION.	SLOUGHING SCLERA.	PAINFUL STUMP.	MENINGITIS.	SYMPATHETIC OPHTHALMITIS OR IRRITATION.	REMARKS.
A. H. Voorhies.	20						No details given.
O. F. Wadsworth.	12	I	I				Mobility of stump and shell not greater than after enucleation; all operations performed during acute inflammation of eye.
L. Ware.	24	4					Mobility of stump and shell somewhat greater than after enucleation; not much gain in lateral rotations.
J. E. Weeks.	6						The stump shrinks so that it is little larger than after enucleation, and mobility about the same.
C. D. Wescott.	10						Possibly a little more mobility of stump and shell than after enucleation, but not sufficient to warrant the disadvantages of operation, which he now no longer performs.
W. H. Wilder.	18	Most of cases.					Mobility not greater than after enucleation; when there was much reaction, adhesions were formed which limited mobility.
C. A. Wood.	14	4	I			I	Mobility of shell slightly greater than after ordinary enucleation; in some cases palpebral sulcus not so deep as after enucleation; has not recently done operation.
W. E. Hopkins.	12	I		I			One case five months after operation could not wear artificial eye; increase in mobility of prothesis.

MULES'S OPERATION.

SURGEON.	NUMBER OF OPERATIONS.	EXCESSIVE REACTION.	SLOUGHING SCLERA.	ESCAPE OF GLOBE.	PAINFUL STUMP.	SYMPATHETIC INFLAMMATION.	AVERAGE STAY IN HOSPITAL.	SUCCESS.	FAILURE.	REMARKS.
F. Allport.	27	4					2 weeks	27		Cosmetic effect better than in any other operation.
A. R. Baker.	3	3					21 days	3		Cosmetic effect not sufficient to compensate for pain and extra time.
M. Black.	2						10 days	2		Movement of stump and shell two to four times greater than after enucleation.
F. Buller.	26			2			11 days	24	2	Mobility of shell much better than after enucleation. The two failures were practically unavoidable—one a shrunken globe and the other a panophthalmitis case.
W. K. Butler.	1	1					10 days	1		Movement of stump better than after enucleation.
F. Carrow.	7	3		1	2	1	3 weeks	3	4	Rotation of shell not better than after simple evisceration.
W. T. Coleman.	2	2		2		1	10 days		2	Doubts the advisability of the operation.
E. C. Ellett.	1			1					1	Scleral wound did not unite.
L. W. Fox.	118	24	10	16			12 days	102	16	At least 75 per cent. more rotation of artificial eye than after enucleation.
G. Friebis.	7						6 days	7		Mobility of stump and shell is markedly greater than after enucleation.

MULES'S OPERATION.—(Continued.)

SURGEON.	NUMBER OF OPERATIONS.	EXCESSIVE REACTION.	SLOUGHING SCLERA.	ESCAPE OF GLOBE.	PAINFUL STUMP.	SYMPATHETIC INFLAMMATION.	AVERAGE STAY IN HOSPITAL.	SUCCESS.	FAILURE.	REMARKS.
E. Friedenberg.	1			1					1	Globe was retained one week.
H. Gifford.	2			1				1	1	Cosmetic result including mobility improved directly with size of stump.
H. F. Hansell.	4	4		4			3 weeks		4	Mobility of shell was not noticeably increased over enucleation cases; one ball was retained six months.
G. C. Harlan.	1						13 days	1		Movement better than after enucleation.
A. G. Hobbs.	3	2	2	2		2		1	2	Movement of shell almost perfect.
H. Knapp.	several									All patients did well, but were lost sight of and operator uncertain how long balls were retained.
L. J. Love.	1			1			2 weeks		1	Ball retained six weeks.
W. F. Mittendorf.	1						3 weeks		1	
J. Morgan.	6	1						6		In one case the first globe was removed and a smaller one substituted.
C. Pischl.	1							1		Used glass globe, but prefers metal.
A. E. Prince.	7	7		6				1	6	Gives no details of cause of failures.
G. O. Ring.	12						3 weeks	12		Mobility of stump and shell much better than after enucleation.

MULES' OPERATION.—(Continued.)

SURGEON.	NUMBER OF OPERATIONS.	EXCESSIVE REACTION.	SLOUGHING SCLERA	ESCAPE OF GLOBE.	PAINFUL STUMP.	SYMPATHETIC INFLAMMATION.	AVERAGE STAY IN HOSPITAL.	SUCCESS.	FAILURE.	REMARKS.
S. D. Risley.	11						10 days	11		Mobility of stump and cosmetic results better than after enucleation.
G. E. de Schweinitz.	12	1		2			10 days	8	2	Rotations more extensive than after enucleation: outward, 25-30; upward, 30-35; inward, 30-40; downward, 45-50. Ball exposed in one case.
G. H. Suker.	8	2	3	5	1	1	18 days	3	5	Mobility of stump 50 per cent. greater than after enucleation, and 25 per cent. greater than after evisceration.
F. C. Todd.	10						10 days	10		Average rotations: upward, 15-40; downward, 20-50; inward, 5-20; outward, 15-45.
A. H. Voorhies.	18	14		2			12 days	16	2	No description of rotations.
J. E. Weeks.	2	1					2 weeks	2		Mobility of stump and shell greater than after enucleation.
C. A. Wood.	2	1		1			2 weeks	1	1	Excursion of artificial cornea slightly greater than after enucleation.
H. V. Würdemann.	4	4	Yes	4			3-4 weeks		4	Attributes failures to necrosis of tissue and defective technic in placing stitches.
H. B. Chandler.	8	3		3			9 days	5	3	Cosmetic effect satisfactory.
W. E. Hopkins.	4					1	2 weeks	3	1	One stump caused sympathetic irritation and required enucleation.
E. M. Marbourg.	5							5		No complication except slight reaction.

INSERTION OF GLASS OR OTHER GLOBE INTO TENON'S CAPSULE AFTER COMPLETE ENUCLEATION.

SURGEON.	NUM- BER OF OPERA- TIONS.	COMPLICATIONS.	REMARKS.
W. K. Butler.	6	Tendency to sloughing in one case, from which glass globe escaped.	Prefers it in all cases requiring removal, except malignant disease and cases of excessive hydrophthamos.
W. T. Coleman.	1	None.	Good results eighteen months after operation.
E. C. Ellett.	12	Occasional difficulty in separating and securing muscles. Three balls extruded.	Indicated whenever it is necessary to perform complete enucleation, except in extreme phthisis bulbi, panophthalmitis, and malignant disease. Oldest case two years.
L. W. Fox.	12	Cicatricial contraction of orbital tissues. Two balls came out.	Indicated in all cases where eyeball has been removed or where Mules's operation can not be performed.
L. Howe.	3	Hemorrhage once.	Two cases quite satisfactory. Chiefly indicated when a greatly enlarged globe—for example, buphthalmos—has been removed.
C. Pischl.	1	Slow closure of wound caused opposite eye to be sensitive to light for a month.	Thinks less dangerous than Mules's operation. Cosmetic effect as good.
A. E. Prince.	1	Escape of ball at end of a week.	
J. M. Ray.	3		Two balls extruded, one at end of ten days and other at end of three months. One success furnished excellent stump.
S. D. Risley.	4	Difficulty of retaining glass globe in proper position in orbit.	Gives better and more movable stump than simple enucleation, presenting some of the advantages of Mules's operation.
G. H. Suker.	8	Excessive reaction, sympathetic irritation, and orbital cellulitis.	Thinks this operation is the one which will replace enucleation, if it ever is replaced. It is contraindicated in sympathetic trouble and extreme old age.

INSERTION OF GLASS OR OTHER GLOBE INTO TENON'S CAPSULE AFTER
COMPLETE ENUCLEATION.—(*Continued.*)

SURGEON.	NUM- BER OF OPERA- TIONS.	COMPLICATIONS.	REMARKS.
F. C. Todd.	1	Glass globe escaped at end of a week.	
C. D. Wescott.	1		Favorably impressed with op- eration, which he thinks espe- cially desirable after enuclea- tion in children.
H. B. Chandler.	6	Secondary hemor- rhage; escape of globe in three cases.	Operation may be tried in all cases where the orbital tissues are healthy.
W. E. Hopkins.	12	Sutures gave way in one case.	Uses Lang's operation; results most satisfactory.



