Conical cornea : its surgical evolution / by Anderson Critchett.

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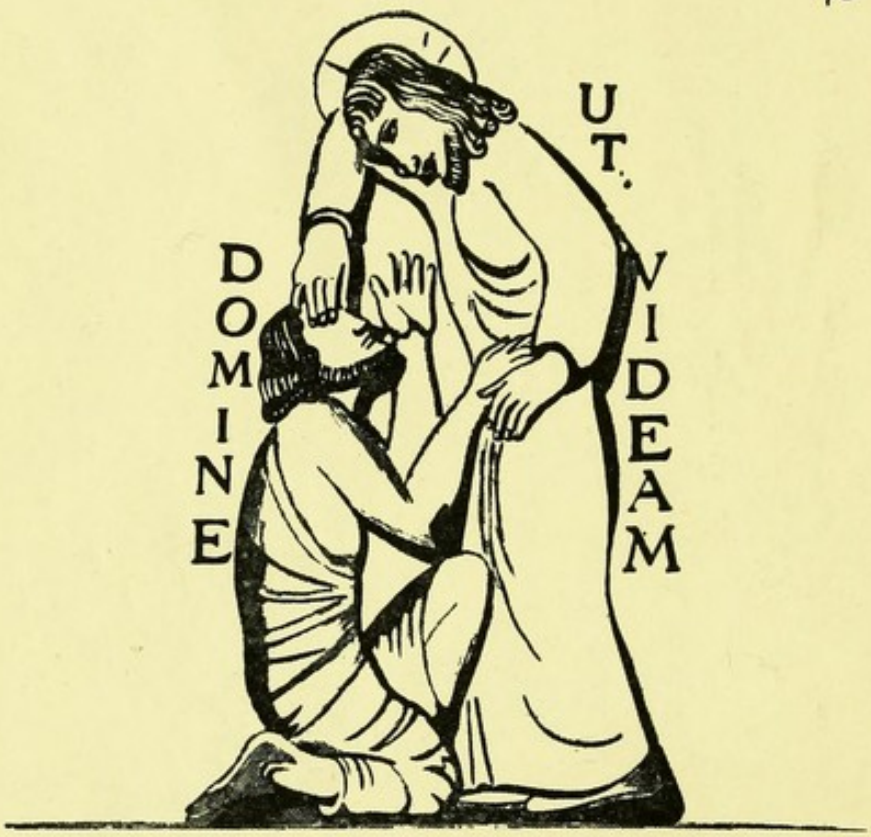
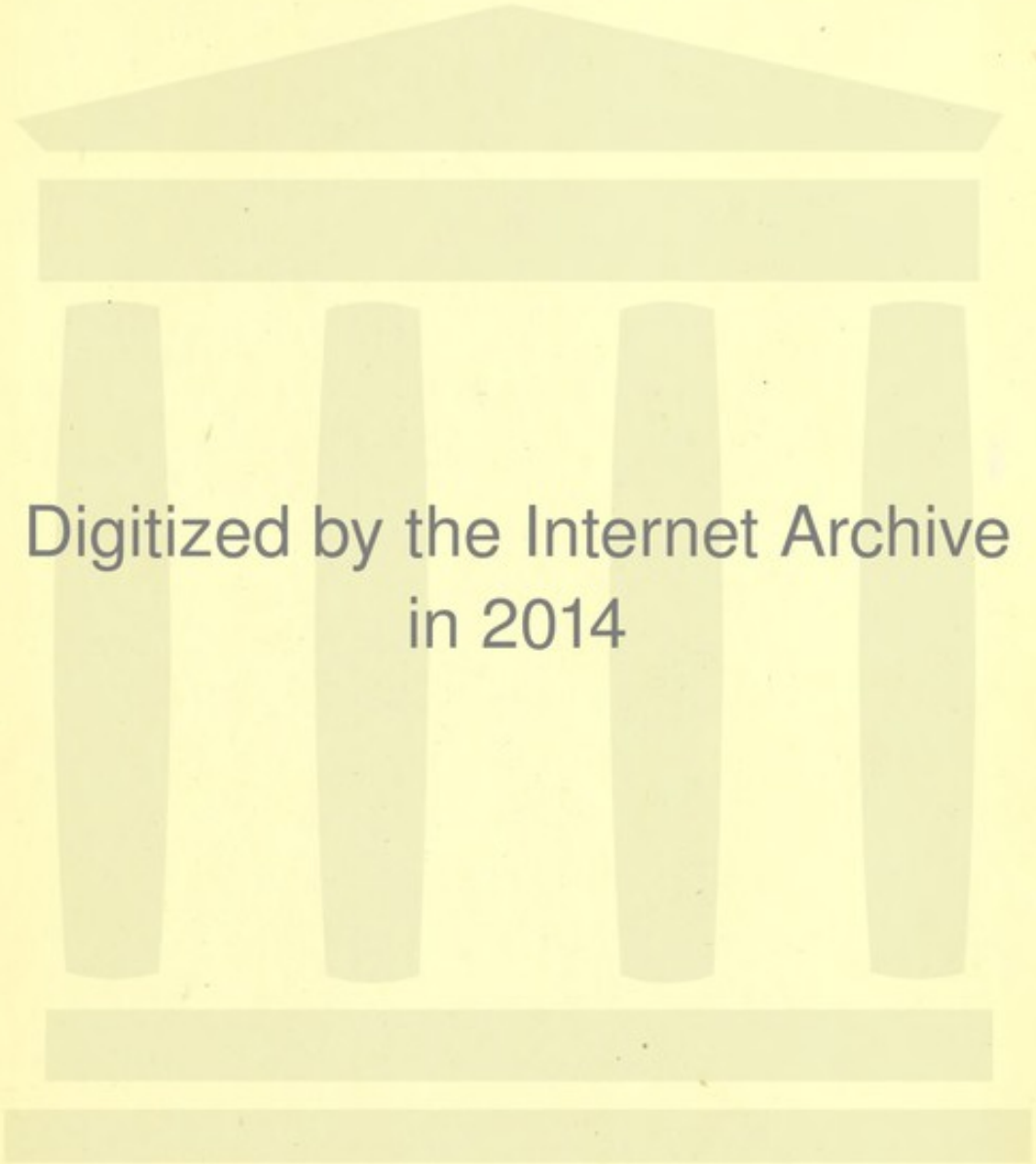
Sir ANDERSON CRITCHETT.





CONICAL CORNEA:

ITS SURGICAL EVOLUTION.

BY

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I am so often asked to furnish details of my operative method in cases of keratoconus that I have decided to reprint extracts from the short papers which I contributed to "The Practitioner," in 1895, and to the "Transactions" of the International Ophthalmic Congress in 1899. To these I have added some brief notes which embody more recent experiences of the operation.

A. C.

21, Harley Street, W.,

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CONICAL CORNEA:

Its Surgical Evolution.

By Sir ANDERSON CRITCHETT, M.A. Cantab. F.R.C.S.E.

Letting my memory drift back over nearly thirty years, I recall an October afternoon and the surgical out-patients' room at Addenbrooke's Hospital. The class was a small one, for the great Cambridge Medical School was then only in its infancy; but our interest was aroused by the entrance of a young girl who evidently had such extremely defective sight that she experienced some difficulty in finding her way about the room.

Her mother, who accompanied her, explained that her daughter had always been somewhat short-sighted, but that during the last three or four years the vision had so rapidly deteriorated that her education could scarcely be completed, as the girl was obliged to stoop

so closely over her paper when writing that she had a tendency to smear the manuscript with the tip of her nose, and needlework was attended not only by manifold difficulties but also by possible dangers.

Our revered teacher, Sir George Humphry,* having ascertained the nature of the case, asked us for a diagnosis; and as I from my earliest boyhood had watched my father's work at Moorfields, I was able to recognise that we had to deal with a very marked case of double conical cornea. The great surgeon confirmed my opinion, and added, "This, gentlemen, is a terrible disease of the eye, for which no remedy has yet been found, though I trust some of you may live to see the problem successfully solved." I rejoice that he is still here to share in the triumphs of modern surgery, and I trust that he may long remain to practically illustrate in his own person one of his favourite subjects, longevity.

The first definite essay to remedy the optical defects associated with conical cornea was made by Sir William Bowman, who, having noticed that vision was somewhat improved when the patient looked through a stenopœic

* Sir George Humphry died in 1898.

slit, endeavoured to supply the latter permanently by an ingenious double application of my father's then recently suggested operation iridodesis. When the operation was accomplished to perfection the result was a long narrow horizontal pupil. Apart from its possible dangers, this method was open to two important objections. First, it required such exceptional skill for its successful performance as to render it the exclusive property of a few specially gifted operators; and secondly, the practical results by no means realised the theoretical expectations, so, after a sufficiently extended trial, it was reluctantly abandoned.

The next attempt to solve the problem came from Von Graefe, who endeavoured to shave off the apex of the cone, if possible without entering the anterior chamber, and then applied a mitigated stick of nitrate of silver to the cut surface, in order gradually to promote the flattening of the cornea by cicatricial contraction. In a few exceptionally fortunate cases this plan gave excellent results; but its attendant disadvantages soon became apparent. It was extremely difficult to limit with accuracy the area over which the action of the caustic took effect, and occasionally the resulting eschar was so large and irregular as to preclude the

possibility of obtaining a good visual result even by the subsequent addition of an artificial pupil.

Moreover, the proceeding always induced severe and sometimes protracted pain for the patient, and in not a few instances, especially where the anterior chamber had been unconsciously invaded, or where the remaining protective layer of cornea was exceptionally thin, the operation involved danger to the lens and not infrequently severe destructive cyclitis. It therefore became evident that the true surgical goal had not yet been reached, and Sir William Bowman again came to the rescue with a most ingenious suggestion. Borrowing an idea from general surgery, he had small corneal trephines constructed of different sizes, each containing a solid but moveable metallic cylinder, by means of which the depth of the cutting surface of the trephine could be accurately limited. Having placed the little instrument over the apex of the cone, gentle rotatory pressure divided the upper layers of the cornea, the edge of the cut surface was seized with a pair of small blunt-pointed forceps, and the involved portion was carefully dissected off. For a few years this became the favourite and generally recognised plan; but the results were not

entirely satisfactory. In the majority of cases the amount of contraction which followed seemed wholly insufficient adequately to remedy the defect, and in others, where a fair amount of success had been achieved, the eye after a few years partiaily relapsed towards its former condition, so that even the talented author of the new method admitted that it had not fulfilled his expectations.

My father then conceived the idea of removing a small elliptical piece of cornea at the apex of the cone, and he ingeniously devised several instruments for this purpose. They all, however, proved either too cumbrous or too complicated, and he as a rule elected to make the upper portion of his small section with a very narrow Graefe's knife, and to complete it with curved scissors, the fragment of severed cornea being removed with small blunt-pointed forceps.

The chief objection to this operation was the tendency to the formation of anterior synechiæ, with the risk of subsequent secondary glaucoma and other complications; but in cases where these misfortunes were avoided, the result was often exceptionally brilliant, especially as regards vision; and for this reason the method is still held in high esteem, and is often prac-

tised by many eminent ophthalmic surgeons. My friend Dr. Meyer* of Paris recently told me that he is in the habit of using a small sharp gouge to cut out the elliptical piece of cornea, and that he is able to accomplish his purpose without entering the anterior chamber. Finally, the discovery of cocaine and the introduction of the galvano-cautery into ophthalmic surgery placed it within our power to produce the necessary flattening of the cone painlessly with the minimum degree of risk from subsequent complications; and I believe I am correct in stating that this method of operating is now more generally adopted than any other. It is one which essentially brings home to the mind of ophthalmic surgeons the marvellous boon which cocaine has proved to them and to their patients, for without it this particular proceeding, which has already proved of so much value, would have been absolutely impossible; while under present conditions the galvano-cautery can be applied with ease, safety, and accuracy. I remember that the first patient for whom I used it was an exceptionally sensitive nervous girl, and on my afterwards inquiring whether she had felt

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* Dr. Meyer died in 1902.

the slightest pain she gave the satisfactory alliterative reply, "I only heard the horrid hiss." Till about three years ago the universally accepted plan of applying the cautery in cases of conical cornea was to use it almost at red heat, and to persevere till a spurt of aqueous showed that the anterior chamber had been entered. The subsequent healing process was often rather protracted, and was usually attended by somewhat severe pain. In 1892 I determined to try the effect of commencing with my cautery at a very low heat, and applying it gradually and deliberately over such an area of the cone as I wished to deal with.

The result of this was to char, but not to penetrate, the corneal tissue; and when I had carried this process as far as I desired, I used a smaller cautery at rather a higher degree of heat, and applied it to the apex of the cone, thus making a small cup in the centre of the depression I had already created, for the gradual application of the cautery at a low heat materially lessened the amount of aqueous, and the cornea became absolutely concave.

I went as near as I could to Descemet's membrane, but purposely stopped short of entering the anterior chamber. The recovery was exceptionally speedy and almost painless,

and the final result was most satisfactory. I showed the patient at the Ophthalmological Society, and I have since then followed this plan in nine other cases.

I am also glad to hear from colleagues who have adopted my modification that it has proved very successful in their hands, and that they intend to give it a thorough trial. In cases where a somewhat extended eschar has been unavoidable it may subsequently be necessary to make a small artificial pupil, an operation which is best accomplished with a small broad needle set at an angle and a Tyrrell's hook; but in many instances it is possible to limit the central cicatrix to a small area, and in such cases no further operation is needed. The best situation for the small iridectomy is usually inwards and slightly downwards, and the most perfect optical result is obtained when the operation leaves the peripheral portion of the iris intact. It would be beyond the scope of the present short paper if I were to attempt any statistical statement of the results which have already been achieved, but within my own knowledge they have been most satisfactory.

In a few isolated instances the vision has come up to the normal standard, and in the

majority of cases the improvement has been so marked that the patient was able to take an active share in the duties and pleasures of life.

I have traced briefly, and I fear very imperfectly, the various steps which have hitherto been taken in the operative treatment of conical cornea; and I think it will be generally admitted that, even in these days of advanced and advancing surgery, the progress which has been made deserves to be placed on record.

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* LATER DEVELOPMENTS IN THE TREATMENT OF CONICAL CORNEA BY GALVANO-CAUTERY.

The results which I obtained with my earlier method were so encouraging that in 1895 determined to try the following modification which experience has shown to have additional advantages. I made my first and most extensive application of the cautery at a very low heat; within this area I then destroyed a little more tissue at a slightly increased heat, and

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* Reprinted from the Transactions of the International Ophthalmic Congress, 1899.

finally within this second zone I burnt deeper still with a smaller point at a dull maroon heat stopping short of perforation.

I therefore created two zones and a small central spot, the whole bearing some resemblance to a target, and these exercised a graduated but most efficient pressure on the part affected, so that when sufficient time had elapsed for cicatricial contraction to take place the results were very satisfactory. Over the area of the outer ring where only the superficial layers have been affected, the cornea has in almost every instance regained its former transparency, and only in two cases on which I have operated by this my latest plan, have I found it necessary to perform an optical iridectomy. The improvement in vision has of course varied in degree; but in every instance it has been very encouraging, and in one case which I showed last year at the Ophthalmological Society, the sight which before the operation $=\frac{6}{60}$, at the end of six months $=\frac{6}{9}$ without any glacial correction. The patient's age was twenty-one. The method which I have described needs careful and delicate manipulation, and the cautery must be kept well under control; but I have found the ultimate issues of my latest operative plan

to be so entirely satisfactory that I venture, in all modesty, but with a confidence justified by experience, to recommend it to my colleagues.

SINCE the above was written I have operated on six additional cases of kerato-conus, and I gratefully acknowledge that my ability to quote so large a number in such a short space of time is largely due to the generosity of colleagues who, knowing the special interest which I take in this subject, have kindly sent me cases.

The results have strengthened my faith in the operation: for in two of the cases the vision was brought without glasses from $^{6}/_{60}$ to $^{6}/_{12}$, and in the remaining cases, where correcting glasses were used, the improvement was in two instances from $^{6}/_{36}$ to $^{6}/_{18}$, in one case from $^{6}/_{24}$ to letters of $^{6}/_{9}$, and in the last case, where the patient was strumous and unable to compass a firm cicatrix, from $^{6}/_{60}$ to $^{6}/_{24}$. In only one instance was it necessary to perform an optical iridectomy.

In an interesting paper published in August, 1900, in the "Journal of the American Medical Association," Dr. Herman Knapp of New York relates his experiences of twelve cases

of kerato-conus which he treated with galvano-cautery.

In the first three cases he perforated the cornea with the result that in one of them the lens became cataractous, and had to be needled, and in another case repeated attacks of glaucoma supervened, for the relief of which it became necessary to perform iridectomy. The severe reaction in these cases determined Dr. Knapp to avoid perforation in future, and in the last four cases of the series he adopted my plan of making three distinct zones of varying depth and opacity. I am glad to note that in each instance the result was most satisfactory.

I usually employ flat electrodes, as I find that with them I can more accurately gauge the effect which I am producing, but Dr. Knapp prefers them of convex form, and he kindly sent me specimens of these which he designed for use in my operation. He thus describes their application :—" With a convex disc-like burner at dull-red an area reaching from the centre of the well-holocainized cornea down and outward about 4 mm. in diameter is superficially singed, holocain is dropped in again. After a few minutes a smaller zone within the former is treated the same way, and

holocain dropped in again. Lastly, the disc is placed cold in the cornea opposite the outer-lower quarter of a moderately dilated pupil, the current is closed, and the disc withdrawn the moment it is red. These three areas differ distinctly in colour according to the intensity of the effect." Dr. Knapp for a time thought that perforation was a necessary factor in securing the desired effect, but the perforation was in some cases followed by serious consequences; slow healing, repeated openings and closures, anterior synechia and glaucoma. The cautious and progressively deeper cauterization without perforation obviated these prejudicial consequences and proved efficacious. These facts are now so generally recognized that it was with a feeling akin to dismay that I read in a text book on Ophthalmology recently published in America the following laconic but emphatic directions:—"In the treatment of kerato-comus by galvano-cautery the cornea should always be perforated." Two years ago Mr. Mc.Hardy brought me a case of kerato-comus for consultation, and I advised an operation. In February, 1902, he wrote as follows:—"On the 31st ult., that is one year and three days since I practised at one sitting only your target operation for conical cornea

on the left eye of a lady aged 50, whom you had seen with me in consultation on the 14th of January, 1901. I know you will be pleased to have a note of the case which has been so entirely satisfactory to the patient and to me. I had this lady's left eye under observation from January, 1890. The vision without glasses was less than $^{6}/_{60}$ths, and no glasses would give vision better than $^{6}/_{24}$ths. However, for ten or eleven years the right eye was quite useful and adequate; but in 1900 there was a marked deterioration of vision and evidence of progressive conicity in its cornea. Hence the consultation with you and the decision to operate on the left eye. There was little inconvenience from the operation, her convalescence was rapid, and the eye gave little or no anxiety after the operation, or in connection with its subsequent care. On the 31st ult., or one year and three days after the single operation, with spherico-cylindrico lens + 1 D spherical — 5·50 D cylinder axis 10 degrees off vertical, the vision of the left operated eye, which had been of no practical use since 1890, was $^{6}/_{9}$ths well and $^{6}/_{6}$ths partly."

In October, 1902, Dr. Maitland Ramsay, of Glasgow, kindly sent me the following notes of a case :—" A. R., aged 24, first came under

my care at the Ophthalmic Institution in August, 1889, when it was found that she could make out Jaeger 16 with the right eye and Jaeger 19 with the left eye. There was well-marked conical cornea in each eye, and the ophthalmoscope revealed posterior staphyloma and choroidal changes in each fundus oculi. On October 5th I cauterised the apex of the cone in the left eye, perforating the cornea with the cautery. The operation was followed by great pain, and healing was exceedingly slow. She left the hospital in November, and I did not see much of her again till the 25th of August of this year. The eye operated upon had given much trouble for a long time, and there was now a dense central leucoma. On the 30th of August I performed an iridectomy downwards and inwards in the left eye, and a week later I cauterized the apex of the cone in the right cornea. On this occasion however the operation was performed according to the method advised by Anderson Critchett, and the cornea was not perforated. The ulcer healed slowly, but there was not nearly so much pain as had followed the cautery operation on the left eye. On September 24th the leucoma on the left eye was tattooed, and six days afterwards the patient

left the hospital. A fortnight later the vision of the left eye was $^{6}/_{18}$, and of the right eye $^{6}/_{24}$, and with a convex lens each eye read Jaeger 4 at 10 inches. The case is interesting in that one eye was operated upon by the old method, and the cornea was perforated intentionally. The result is now very good, but it has been obtained after two years, and necessitated an optical iridectomy and a tattooing operation; on the other eye, where Critchett's operation was performed, an equally good result was obtained after six weeks, and no iridectomy was required."

In March, 1903, Dr. Ramsay sent me notes of a more recent case. R. B., aged 44, a miner, was admitted to the Ophthalmic Institution 20th January, 1903. He had suffered for many years from conical cornea, and had undergone an operation seven years ago, but no improvement in sight had resulted. The patient says he cannot recognize his own wife as she is walking about a room, and he is unable to read No. 20 in Jaeger's test types. On January 21st the galvano-cautery was applied after Critchett's plan to the apex of the cone, the cauter extending through the substantia propria, but stopping short of perforation. Healing took place without the slightest

pain or discomfort, and five days after the operation the patient was able to return to his own home, the sight being greatly improved. On the 13th of February the cautery was again applied, this time very lightly, and ten days after the operation the visual acuity was $\frac{6}{36}$. The patient could read Jaeger 8, and was able to recognize people on the opposite side of the street. Time will doubtless produce still further improvement.

Mr. Tatham Thompson, of Cardiff, writes that in his earlier cases of kerato conus he passed a very fine horsehair or silkworm gut suture through the cornea. Then, holding the two ends and drawing them tight, he with a Graefe's knife cut out an elliptical piece of cornea which was lifted out in the bight of the gut, the edges of the wound falling together. On one occasion he used a second single suture to hold them together for three days. During the last seven years he has employed my method with the galvano-cautery, and has had most gratifying results. In one case the patient could only read Jaeger 16 and count fingers at a distance of two feet. Both eyes were operated on, and a year later he was driving a hotel omnibus. In another equally bad case the patient could after operation

see $\frac{6}{24}$ and read Jaeger 1. In some instances Mr. Tatham Thompson has elected to perform an iridectomy first, utilizing the area of cornea least affected, and cauterizing later on. He believes that it is essential to push the small central area of deep cauterization just to the point of perforation. He concludes his record with the following kind words : " I owe much to your teaching in dealing with what used to be a terrible bête noir."

I am very glad to find that my colleagues have achieved such satisfactory issues with the method which I initiated, and I venture to hope that it may have before it a useful and successful future.

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