On conjunctival transplantation from the rabbit / J.R. Wolfe.

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CONJUNCTIVAL TRANSPLANTATION

FROM THE RABBIT.

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J. R. WOLFE, M.D., F.R.C.S.E.,

SURGEON TO THE GLASGOW OPHTHALMIC INSTITUTION:
LECTURER ON OPHTHALMIC MEDICINE AND SURGERY IN ANDERSON'S UNIVERSITY.

(*Read before the Medico-Chirurgical Society, December 6th, 1872.*)

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MR PRESIDENT AND GENTLEMEN,—It was not my intention to monopolise the whole evening by reading a paper. I merely proposed to show to this meeting a successful case of conjunctival transplantation from the rabbit, and make a few remarks; but as I have the offer of the whole sederunt I shall enter more fully into the consideration of the subject.

Like the organs which move in shut cavities, the eye is covered with a secreting membrane—conjunctiva. This membrane, after lining the parieties, *i.e.*, the posterior surface of the tarsal cartilages, makes a fold, and is continued over the anterior surface of the sclerotic, and is ultimately lost in the superficial layer of the cornea near its border.

In its *ensemble*, therefore, the conjunctiva represents a shut cavity, and was, on that account, formerly considered as a serous membrane. But it is properly a mucous membrane, covered with epithelium, and consists of three parts, which differ somewhat in structure, namely, the palpebral conjunctiva, the *cul-de-sac*, and the conjunctiva of the eyeball.

By experiments which I made upon animals, some years ago, I proved, contrary to the current opinion, that the ordinary secretion of tears for lubricating the eyeball is derived from the conjunctiva, and is not formed in larger quantity than

can be got rid of by evaporation, while the lachrymal gland, like the salivary gland to which it approaches in structure, secretes only periodically, and is intended as a reservoir to afford a large supply of fluid under the influence of irritation, when required to rid the eyeball of foreign bodies, or in cases of mental excitement.*

From its being the proper secreting membrane, it is necessary to the healthy condition of the eyeball that the conjunctiva, especially the palpebral conjunctiva, should be in a healthy condition. Any change of its structure may, by friction, endanger the transparent cornea. As an instance, I may mention the disease called trachoma, or granular lids, in which the change of structure and vitiated secretion of the palpebral conjunctiva give rise to trachomatous pannus, ulcerated cornea, and shrinking of the eyeball.

When both the conjunctiva of the eyeball and the corresponding palpebral conjunctiva are destroyed by a burn with hot metal, gunpowder explosion, quicklime, or other chemical substances, adhesion or symblepharon is the result. Iron-moulders, puddlers, and labourers in chemical works being most exposed to such accidents, hence, cases of symblepharon are numerous in Glasgow. This patient, a foundry boy from Airdrie, came to the institution two days ago for the relief of symblepharon. You see the lower eyelid fixed to the eyeball covering very nearly the whole cornea, the eyeball completely tied down, for even the levator palpebrae, instead of lifting the upper eyelid drags the eyeball and imparts to it an awkward rotatory motion. Vision is completely abolished. This case is highly unfavourable to operative interference.

To cure symblepharon is generally admitted to be exceedingly difficult, if not impossible. Numerous are the expedients which have been resorted to for the cure of that affection. They have all for their object the mechanical separation of the lid and eyeball until the raw surfaces cicatrize. Some operators try to affect this by simply dissecting

* Read at the annual meeting of the British Medical Association in Oxford August, 1868. See also my letter to Mr Lawrence in *British Medical Journal*, October, 1868.

the adherent lid, and then tearing up the wound daily, for a certain period until it no longer united. Others, again, try to keep the surfaces separate by interposing foreign bodies, as sealing-wax, leather, glass shields, &c.

Diefenbach's method is the most ingenious. He detaches the lid from the eyeball, shaves the lashes, and then folds the eyelid upon itself, so that the skin comes in contact with the eyeball. He fixes it in this position with sutures until it heals.

After repeated trials of these methods I came to the conclusion that the proper operative method was still to be discovered.

(1.) Repeated tearing of the surfaces is useless. We always found that nature frustrated our attempt of the previous day to keep them asunder. I watched the process very carefully, and noticed that union does not take place by exudation of lymph (as taught by the Vienna School), but strictly according to Virchow's theory—viz., by proliferation of the cells, or, if I may use the expression, by parenchymatous agglutination.* There is therefore no plastic membrane to tear or tease out.

(2.) The interposition of foreign bodies must appear a vain attempt to any one who has ever tried to insert an artifical eye after dissecting an adherent eyelid. The foreign body is in such cases invariably squeezed out by gradual constriction. Indeed, I may say with regard to these and similar methods, that they are based upon the supposition that a delicate physiological action can be replaced by a coarse mechanical contrivance. Nature, which supplies the organism with lymph, synovia, mucin, and tears for smoothing the various membranes, abhors every motion upon rusty hinges or friction of surfaces. Whenever these surfaces rub upon each other they ultimately adhere.

For the last few years I have practised an operation for the radical cure of symblepharon by plastic operation of the conjunctiva. I take a portion of the neighbouring healthy conjunctiva of the eyeball, wherever I can get it, to supply the palpebral conjunctiva which has been destroyed. For experience has

* In contrasting the doctrine of Virchow with that of the Vienna School, which is still current among some medical writers, I am aware that Rokitanski himself became at an early date an adherent to the Cellular Pathology, which he enriched with his new and valuable observations.

taught me, that loss of conjunctiva oculi, even to a very large extent, is generally regenerated without prejudice to the neighbouring tissues, whilst loss of the conjunctiva of the eyelid is followed by such disastrous results as pannus, ulcerated cornea, &c., &c., above referred to.

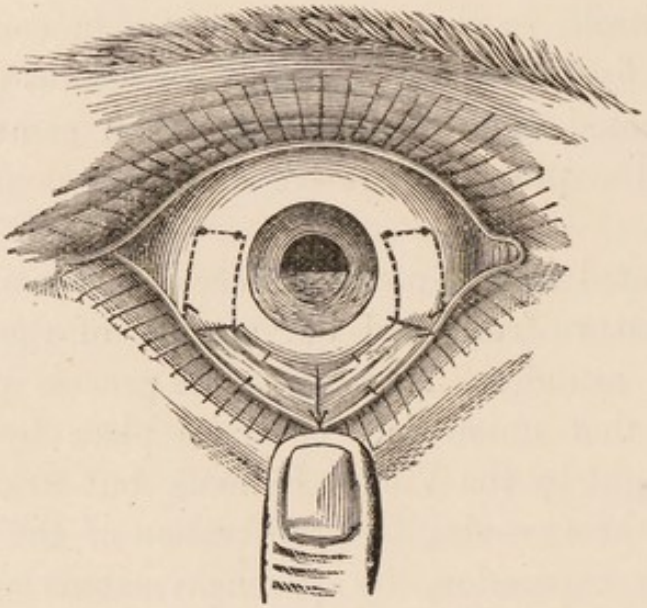

Fig. 1.

FIG. 1 represents the case of Simon M'K., aged 20, moulder, who, three years ago, had his eye burnt with molten lead, resulting in adhesions of the lower eyelid, which covered the lower half of the pupil. I dissected carefully the eyelid from the eyeball, separating it as far as the *cul-de-sac*, to make quite sure that I had liberated the eyeball completely. I then passed two fine silk threads through each side of the conjunctiva at the outer aspect, which ligatures marked the breadth of the conjunctival flap to be removed. These two I put on the stretch, and with a pair of scissors I first cut horizontally, and then on each side of the ligatures, then putting the scissors behind, I cut it from the eyeball. In cutting the flap on the stretch by means of the ligatures, I take care that the conjunctival flap is removed without any of the sub-conjunctival tissue. The same process is followed at the inner side, and these two flaps are brought together in the middle line, and secured with stitches, as marked in the diagram.

The operation was performed in September, 1869, and it will be seen that he has the free movement of the eyeball. There is scarcely any perceptible trace upon the eyeball whence the flaps were borrowed. The cornea only presents some traces of leucoma where the adhesion formerly was, and these latter are also gradually disappearing.

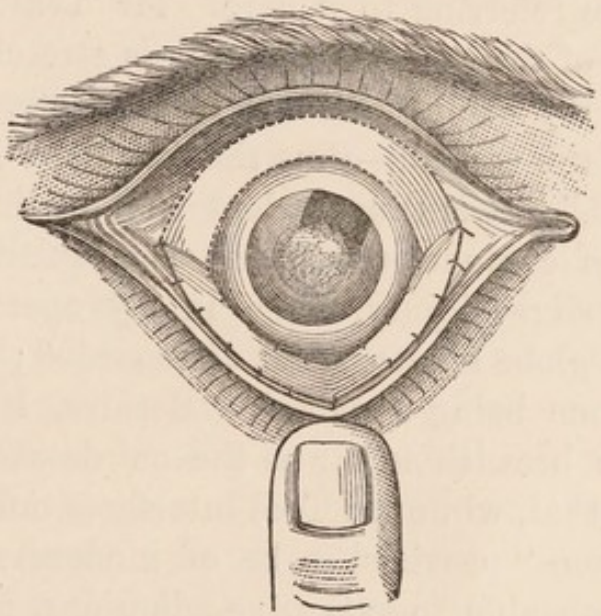

Fig. 2.

FIG 2 represents the case of John Muir, age 15, tinsmith, who burnt his eye with strong hydrochloric acid two years ago, resulting in extensive symblepharon. On presenting himself at the Institution in June last, I found the lower eyelid completely covering the upper margin of the pupil; vision was therefore impossible. The first step accordingly was to make an iridectomy upwards and inwards, and in August last we proceeded to the plastic operation of the conjunctiva.

But it will be seen that the lateral flaps were, in this case, impossible, because the burn extended above the meridian. I therefore took one large flap from the upper hemisphere of the ball, and secured it upon the eyelid as above described.

About three years ago, after I prepared a paper for the press on the subject, I became aware that Mr P. Teal, of

Leeds, published a paper on a similar operation in the Ophthalmic Hospital Report. Although Mr Teal's operation differs from my own, yet, such is my repugnance to squabbles about originality and priority, that I did not publish my paper. But having had an opportunity, in August last, to explain to the Ophthalmological Congress the nature of my operation as distinct from that of Mr Teal, I can have no hesitation in referring to it here. Mr Teal takes "a flap from each side of the conjunctiva, one is stretched across the raw surface of the eyelid, and the other is fixed across the raw surface of the eyeball—thus the two flaps are dovetailed into the wound." It is thus evident that in this operation a large supply of conjunctival tissue is requisite to repair a comparatively slight injury, while in my operation the conjunctiva of the globe is altogether disregarded; the palpebral conjunctiva alone being repaired. Besides, I take my flap from the whole breadth as far as the cul-de-sac, if necessary. The result is that, while Mr Teal interferes only with a case of symblepharon, "provided it be of moderate extent," my operation is applicable to extensive adhesions, provided there be sufficient transparent cornea to make an artificial pupil, as shown in figure 2.

This is fully borne out, not only by the drawings in Mr Teal's paper on the subject,* but also by comparing the patients which Mr Teal brought up to London to show to the Congress with those which I have the pleasure of submitting to the Society this evening.

It is right, however, to bear in mind that there is a limit to the extent to which we may go in borrowing conjunctival substance from an eye which has already been injured. If we surpass that limit, the corneal opacity is sure to extend still further, and we lose the last chance of saving vision. Indeed, we sometimes meet with cases in which the infliction of a new wound amounts to the destruction of the eye. This leads me to speak of the last case which I submit, as it is of peculiar interest:—

Ed. M'In., age 31, labourer in ironsmelting, Coatbridge, was

* Ophthalmic Hospital Report. Vol. iii, pp., 254.

struck by a ball of red-hot iron in the left eye on the 17th Sept., 1872, which caused the destruction of the lower conjunctiva and the greater part of the cornea. When he first came to the institution on the 24th September, seven days after the accident, the conjunctiva of the lower eyelid was completely destroyed, and the corresponding conjunctiva of the eyeball—the whole conjunctival sac was in a state of serous chemosis, and the greater part of the cornea burnt. Emollient applications were used. After a week's stay in the institution he was sent home to come back when the swelling had subsided. He returned five weeks ago. On examination, the lower eyelid was found completely covering the cornea above its upper pupilary margin, the eyeball, quite fixed by the upper and lower eyelids, and sunk in the orbit. On lifting the upper eyelid with the finger, the sclerotic was seen as it were receding, and no dragging upon the eyeball could turn the upper border of the cornea sufficiently forward and downward even for making an iridectomy. The attempt to take a conjunctival flap from the upper hemisphere of the eye, as done in the previous case, was altogether out of the question, for there was no room to manipulate either with scissors or bistouri. Indeed, it was pretty certain, considering the narrow strip of transparent cornea, that its opacity would certainly have ensued, even if section at its periphery had been practicable.

I was about to give up all idea of surgical interference, when it occurred to me, that I might give the patient some chance by supplying him with conjunctival substance from a rabbit.

I would request the gentlemen present to take a careful view of this patient. You see that both eyes are naturally too deeply set. The upper hemisphere is set too closely behind the roof of the orbit. You will notice therefore, that owing to the natural formation of the parts the portion of the cornea which escaped destruction could not be turned into account. Besides, seeing the narrow strip of transparent cornea left, to have removed a conjunctival flap from its vicinity would have resulted in rendering even it opaque.

Fig. 3 represents the eye before the operation, the upper

eyelid being raised to show the portion of the cornea which escaped the burn.*

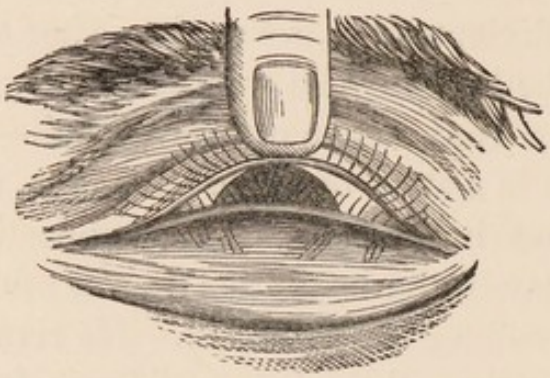

Fig. 3.

The operation was performed on the 3rd Nov., in the following manner:—Both patient and rabbit being put under chloroform, I separated the adhesions, so that the eyeball could move in every direction, and everting the lower eyelid and turning it downwards, I took from the rabbit that portion of the conjunctiva which lines the inner angle, covering the *membrana nictitans* and extends as far as the cornea, the portion to be removed having been previously defined by four fine silk threads, which enabled me at the same time to transfer it

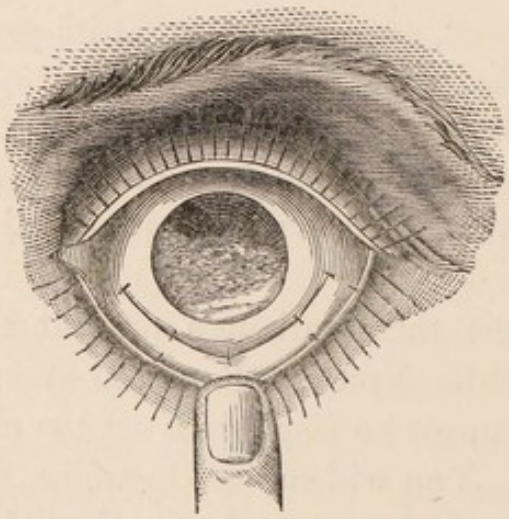

Fig. 4.

quickly to replace the lost conjunctiva palpebrae of the patient, in which place it was secured with stitches, as shown in Fig. 4.

* All these engravings were taken by Mr Stephen Miller, from the patients, in order to ensure the faithful portraying of the various parts.

I take this portion on account of its vascularity and looseness. The eye was covered with a bandage and dry lint.

Next morning, Nov. 4, the eye was found tolerably quiescent. The whole conjunctival sae was not more inflamed than was to be expected would result from the extensive dissection and from the presence of ligatures. The transplanted conjunctiva had a greyish look. Ordered warm fomentations.

Nov. 5. Complains of great pain and lachrymation, wound more tender. New conjunctiva lost its greyish appearance with the exception of isolated patches here and there, the rest is swollen and glistening, and in some parts looks not unlike exuberant granulations. Ordered warm fomentations, with vin. opii., and belladonna, and strong purgatives.

Nov. 6. Swelling subdued. The grey patches decreased to two in number, and these are very small, about the size of a hemp seed.

Nov. 7. Appearance of the eye improving, irritation subdued. The new conjunctiva red and adherent. I removed the ligatures, after which the eye continued to improve. Patient remained in the hospital for a week, during which time he was carefully noted by me, assistant, and students. The eyelid remained separated through its whole extent, the eyeball movable in every direction, while the transplanted palpebral conjunctiva retained its vitality, as shown by its red appearance and comparatively smooth surface. There was only one grey spot, the size of a pin's head, visible. Was dismissed on the 11th Nov. He returned three days ago, last Tuesday, Dec. 3. The eye was found in a satisfactory condition. The conjunctiva has a healthy look, the free motion of eyeball maintained, which enabled me at once to make an artificial pupil, which is also shown in Fig. 4.

Here, then, an eye which had been rendered immoveable and totally blind by disorganization of its conjunctiva, and of the greater part of the cornea, and owing to the natural formation of the parts as well as to the extent of the loss of tissue, even the portion of cornea which escaped could not be turned to account, has, by this new procedure, been rendered a useful organ, the eye being movable in every

direction. He reads No. 16 with the new pupil made three days ago.

Our first attempt in this direction being thus encouraging, I think I am justified in saying that, if further experiments should establish the adoption of this method, we would not only possess a valuable expedient for curing an affection which has hitherto been deemed incurable, but I would consider it as an important step towards a greater surgical achievement, namely, corneal transplantation.

There is a large class of patients in blind asylums and elsewhere whose eye tissues are perfectly healthy, with the exception of corneal opacity. Now, the question is, shall we ever be able to supply them with transparent corneæ by transplantation? All attempts formerly made in that direction have failed on account of the impossibility of measuring the size of the flap. Mr Power, of St Bartholomew's Hospital, London, informed me last spring that he was engaged in corneal transplantation from the rabbit. Indeed, in August last, he exhibited to the Ophthalmological Congress a case which was so far successful that the cornea from a rabbit grew upon that of a child, but, unfortunately, it was opaque. Mr Power informed me of one case, namely, that of a soldier, in which the transplanted cornea kept its transparency for about six weeks. Now, it appears to me in experimenting with these instruments which Mr Power kindly sent me, that the occasion of its becoming opaque may be partly owing to the isolation of the corneal flap from the neighbouring tissues, for Mr Power's instrument removes a complete corneal circle. Our chance might be improved if we could make a cornea-conjunctival flap. Here is an instrument made for me by Mr Hilliard, consisting of two revolving lancets moving within a cylinder, and of two picks to fix the eyeball. The lancets cut the larger segment of a circle, leaving a corneal bridge. From this point the corneal incision is further carried on with a narrow knife, and prolonged to the conjunctiva, the conjunctival portion having previously been prepared by dissection. The conjunctival portion will not only give the cornea a point of attachment, but render

it less isolated, and improve its chance of vitality. The first thing therefore to ascertain, was whether the conjunctiva would live. Seeing now, as this case shows, that conjunctival transplantation is feasable, we have an important point gained.

In answering, therefore, the question put above, I can only say that we are nearer to the point we are aiming at, to-day than we were yesterday.

Since the above went to press, I have had another successful case of conjunctival transplantation from the rabbit, which goes far to confirm the views expressed above, for it is not merely a repetition of the same method, but a new element has been introduced with the view of checking the result obtained on the former occasion.

Peter C., 20, Furnace Quarry, Argyleshire, received an injury upon his face and eyes from a gunpowder explosion when blasting rocks, fourteen months ago. When he first came to the Institution, four months after the accident, his face was quite riddled and discoloured by the powder. Both upper and lower eyelids of the right eye were considerably everted, and the left eye was completely closed and blinded by a symplepharon analogous to fig. 2. I made an iridectomy upwards, which resulted in a little sight when the upper eyelid was raised. On his returning this time to seek further relief, I thought it expedient to resort to our new method. I performed the operation, assisted by Mr Nairne and Mr Wm. M. Campbell, as on former occasions, on the 23rd January. The conjunctival flap from the rabbit I made larger than was requisite to supply the palpebral conjunctiva. It was fixed with stitches as before, but instead of cutting off the superfluous portion, I left it attached. In examining the case daily, in presence of the gentlemen above mentioned and our students, that loose portion indicated clearly to us, beyond any possibility of mistake, the vitality of the transplanted portion. Whilst it remained greyish, we could notice the gradual changes which the fixed portion was daily undergoing; and on February 3, nine days after the ligatures were removed, the loose

portion was still floating upon the conjunctiva a greyish flap, whilst the fixed part had almost entirely assumed a shining appearance.

During the whole course of treatment the eye was quiescent, there was neither pain nor lachrymation, and I may say that it united by agglutination. Free motion and improved vision have been established; and although this case was not so aggravated as the last, yet it may be regarded as a corroborative instance of the efficacy of the operation.

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