On the localisation of foreign bodies in the eye by x-rays / by Karl Grossmann.

ON THE LOCALISATION OF FOREIGN BODIES IN THE EYE BY X-RAYS,

BY

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The desirability of a method — and a simple one if possible — for determining the existence of a foreign body within the eyeball and its position there has often appealed to many of us very strongly. The following is a case in point:

> On Wednesday Nov. 30th 1898 W. J., aet. 23, was hit on the left eye by some "chip of steel which did not enter the eye"; the "scratch wound" bled but not freely. Patient had

his wound dressed at the hospital and was told to come the following day; but he did not return until Dec. 5th when I saw him for the first time. I found on the left eye a finely drawn wound of about 3 millimeter length in an oblique direction, just over the ciliary region, on the inner (nasal) side of the cornea. The pupil, not dilating well under atropine, formed a kind of horizontal oval. A pink pericorneal injection looked rather cyclitic. The fundus reflex is of a dull red. The optic disc is visible and apparently normal. I notice downwards and outwards 2 darkish streaks but the media are not sufficiently clear there to admit of a more accurate examination.

Patient is quite positive about the bit of steel not having entered (but only scratched) the eyeball, Vision = fingers in 2 yards.

On December 7th two radiographs were taken by Dr. Holland, demonstrating the presence of a foreign body. Patient thereupon consents to the removal of the eye which was enucleated on Dec. 9th; 6 days afterwards he goes back to his work.

On Dec. 11th the enucleated eyeball was skiagraphed by Dr. Holland — to whom my thanks are due for the great trouble he has taken in carrying out my suggestions and wishes with regard to the various skiagraphs he took for me.

The eyeball being hardened in a fluid of 4 parts Mueller to 1 part formalin — recently recommended very highly — had shrunk on its inner side; placed in a weaker afterwards it expanded again to normal size.

The shadow is clear and sharp in outline. The position of the foreign body was found to be in the outer half, near the sclerotic, near the insertion of the external rectus muscle.

This case was of great interest in so far as the presence of a foreign body once being established there was no reasonable alternative left but to remove the eyeball. The patient's positiveness about the non-entrance of any foreign body made it possible to believe that the fine wound on the ciliary region might have been nothing but a superficial cut very nearly healed by the time he showed himself. As soon as the skiagraphs had demonstrated the presence of a foreign body the fact of that ciliary wound being a penetrating one was also established, and the removal of the eyeball became advisable. The cyclitic symptoms and the opacity of part of the vitreous could not be passed

over, and the extraction of the foreign body by help of the electro-magnet had therefore to give way to enucleation. The decision in this case was simple and easy. Had, however, the wound not been in the ciliary region, the removal of the foreign body from within the eyeball might have become advisable. But there might have been a doubt as to whether the foreign body was in the eye itself, or in the orbital cavity outside the eyeball.

In the *British Medical Journal* of January 1st 1898 and Febr. 4th 1899 M. Mackenzie Davidson published a method of localisation by Roentgen Rays by means of taking two skiagraphs from two different points. These two skiagraphs have to be combined into one stereoscopic image, thereby giving the locality of the foreign body. (See also *Brit. Med. Journ.* 1898 Febr. 12th and April 2nd, George Harrison, Roentgen Rays and localisation). This method is probably irreplaceable for other parts of the body. But for the eye, another method is applicable which has given me excellent results, and which is distinguished by its great simplicity both in taking the skiagraphs and in interpreting them.

The desirability of obtaining two different skiagraphs representing planes which are if possible perpendicular to one another, is manifest. I may mention en passant that amongst other means I have tried to accomplish this by placing a lead ring on the closed eye and having a skiagraph taken through the whole diameter of the skull. But although the ring throws a recognisable shadow, the mass of bone and brain and blood is too opaque to give a serviceable shadow of a small foreign body at some distance from the plate. Other skiagraphs were taken from behind and temporally in a slanting direction, above the zygomatical arch, with a plate which I cut so as to admit a position monocle fashion. However the shadow of the lead wire ring falls partly outside the plate, the ring in all these instances having a clear diameter of about 26 millimeter.

After various other attempts the following method was at last resorted to:

For the purpose of obtaining a workable parallax of the shadow of the foreign body in the eye *the eye itself is used as the movable body, while the head, the sensitive plate and the Crookes' tube remain in a fixed position.*

The patient is first instructed to look downwards at a given point of fixation while the first skiagraph is taken; then the plate is changed

without disturbing the head of the patient and a second skiagram is taken with the eye looking upwards.

These two skiagraphs to be taken either from side to side, or better with the tube placed somewhat forwards.

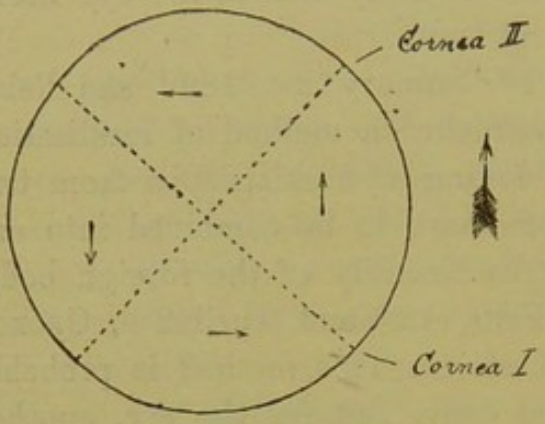


Fig I

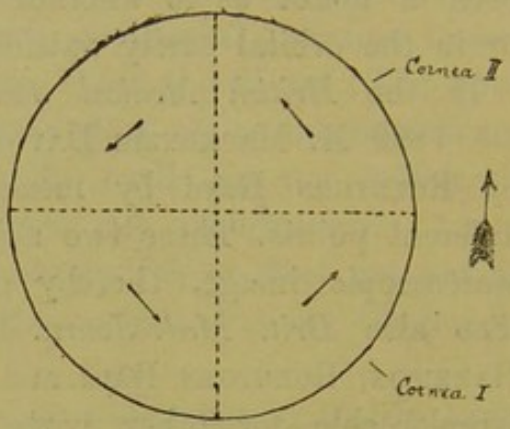


Fig II

If the foreign body is in the eye and throws a shadow, we can see from the change in the position of the shadow where the foreign body is situated. If the shadow has moved upwards, the foreign body is in the anterior half hemisphere, if downwards in the posterior, if

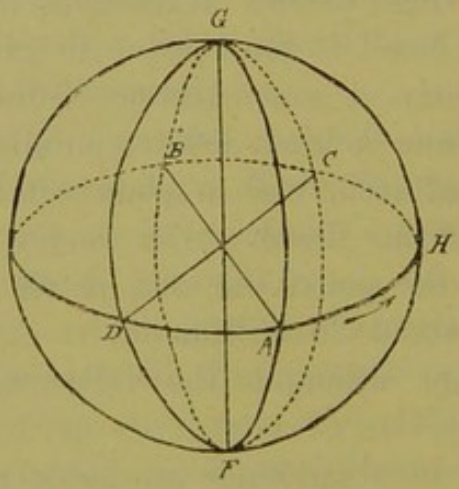


Fig III

forwards in the lower, if backwards in the upper half hemisphere. Fig. I gives a diagrammatical explanation »cornea I« meaning the

eye looking downwards, and »cornea II« upwards. If we care to go still more into detail we can conclude similarly that a ↗ movement refers to the lower anterior, a ↖ movement to the upper anterior, a ↙ movement to the upper posterior, and a ↘ movement to the lower posterior half hemisphere.

If the shadow has not moved at all, two possibilities remain: either the foreign body is not in the eye at all, or it is practically in the axis of rotation (including the centre of rotation of the eyeball.)

In that case a second pair of skiagraphs should be taken, the eye looking (*a*) temporalwards and (*b*) nasalwards. Fig. III illustrates this. If from (*a*) to (*b*) the shadow has moved forwards the foreign body is in the temporal, if backwards in the nasal hemisphere. If Fig. III represents the right eye and *DA* the temporal, *BC* the nasalside, the arrow shows the direction of movement from (*a*) to (*b*). The forward movement (towards *H*) will take place in the blacklined hemisphere, the backward movement in the dotted (nasal) hemisphere.

If the shadow has not moved at all the foreign body is either in the centre of rotation itself, or not in the eye at all.

B. There is another possiblity for the position of the foreign body, if the shadow has not moved from (*a*) to (*b*) viz. in a plane the position of which can easily be construed: the meridional plane which halves the angle of (lateral) rotation will be perpendicular to the direction of the X-rays (the latter to be considered as parallel). But in that case the first pair of skiagraphs will already have shown movement of the shadow.

In order to facilitate the orientation of the shadow, I have used thin lead wire and foil so as to give a profile outline. In one skiagram shown the outline of my nose and of the closed right eye is given. The curve of the closed lids is very clearly obtained thereby and the centre of the eyeball can be spotted fairly accurately from the curve. The lead acts as a simple landmark and can be easily fixed with a bandage which does not interfere with the skiagraph. It must be remembered however that no diachylon plaster should be used for fixing the lead strip, or in fact for any bandage; I have seen folds in the lead plaster giving shadows which completely looked like the shadow of a foreign body. — If desirable, these lead marks can be placed into the conjunctival sac.

It may be mentioned as one of the great advantages of this method that it admits of selecting, and retaining, for all skiagrams such a

direction for the X-rays as to meet with as little obstruction as possible from the part of opaque bony substance.

I have not thought it necessary to refer specially to the other ophthalmoscopic and clinical signs for helping to make the diagnosis as certain as possible in cases where any doubt might exist as to the interpretation of the skiagrams.

Where a parallax has been obtained the foreign body may be either subconjunctival where hæmorrhage may obscure it for a time, or it may be in one of the muscles. The clinical symptoms would help there.

Fig. IV to Fig. IX illustrate a very interesting case in which the foreign body was situated below but near the centre of rotation. Fig, IV shows the eye ($5^1/_2$ years previously injured) looking up, Fig. V looking downwards. The CROOKES' tube had probably been shifted a little, after Fig. IV was taken, by a slight accidental knock against the stand, as evidenced by the distance between the lead strip and the root of the nose; but the position of the longish foreign body itself shows almost a turning of 90°, thereby establishing beyond the possibility of a doubt the presence of the foreign body within the eye. Fig. VI and Fig. VII are two skiagrams of the same eye, the one looking temporalwards, the other nasalwards. Here also the shadow of the foreign body has kept its locality, but has turned round its centre.

Lastly Figs. VIII and IX show the skiagrams of the shape and position of the foreign body in the enucleated eyeball of Figs. IV, V, VI and VII. The eyeball after enucleation had been subjected to strong shrinkage from formalin, and afterwards to re-expansion in diluted alcohol; this may probably have modified the original position of the foreign body in the vitreous to some extent. In Fig. VIII the eyeball rests on its lower, in Fig. IX on its outer side, in both the cornea looks towards the letters "Fig. VIII" and "Fig. IX" resp.

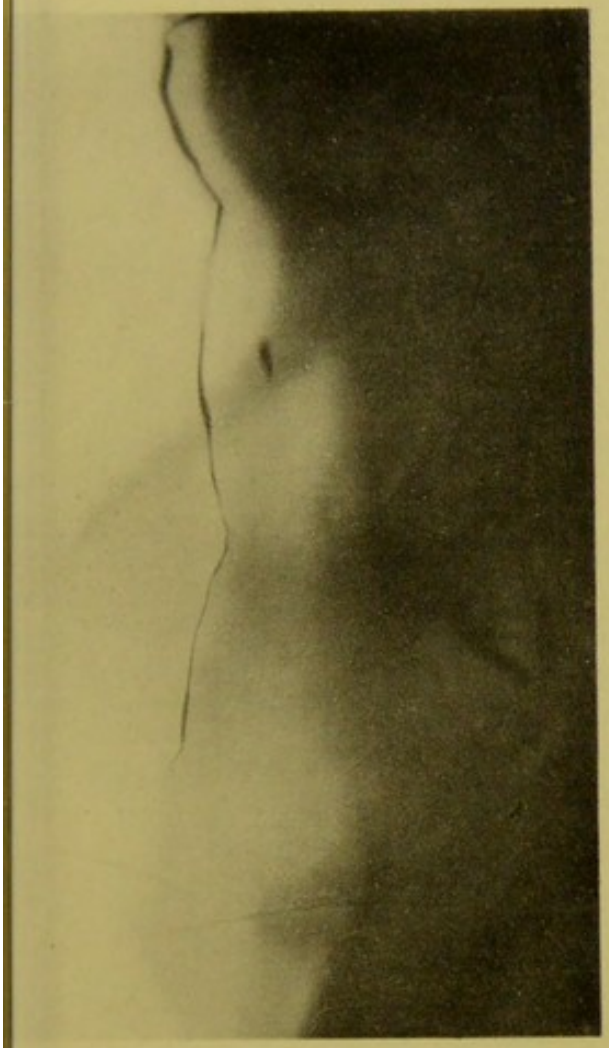


Fig. IV. Eye looking upwards.

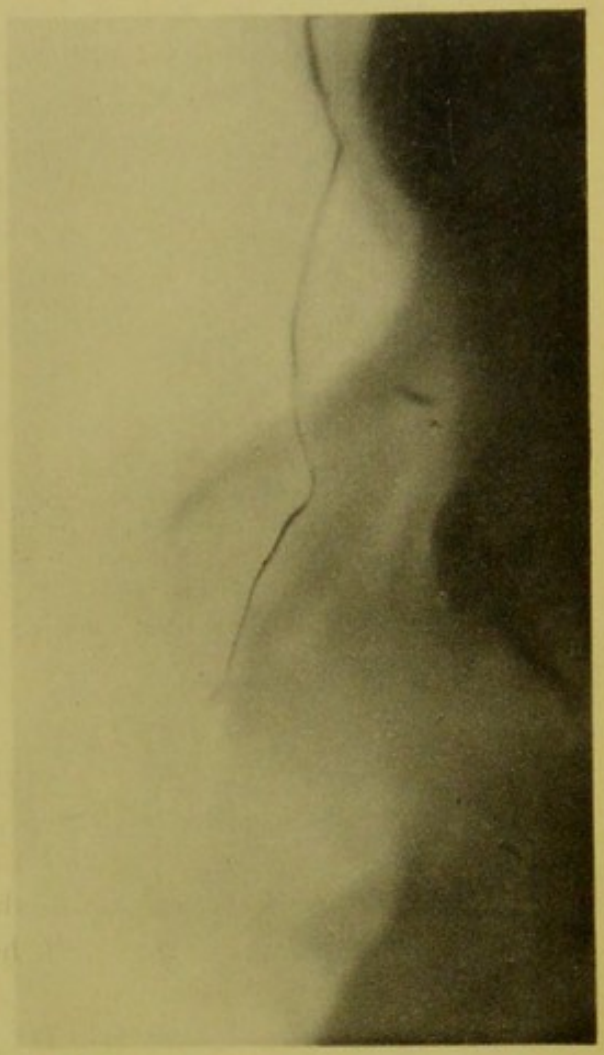
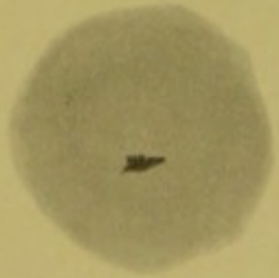


Fig. V. Eye looking downwards.

In Fig IV and V the position of head, tube and plate the same.



Cornea.

Fig. VIII. Eyeball removed; eye resting on its lower side.

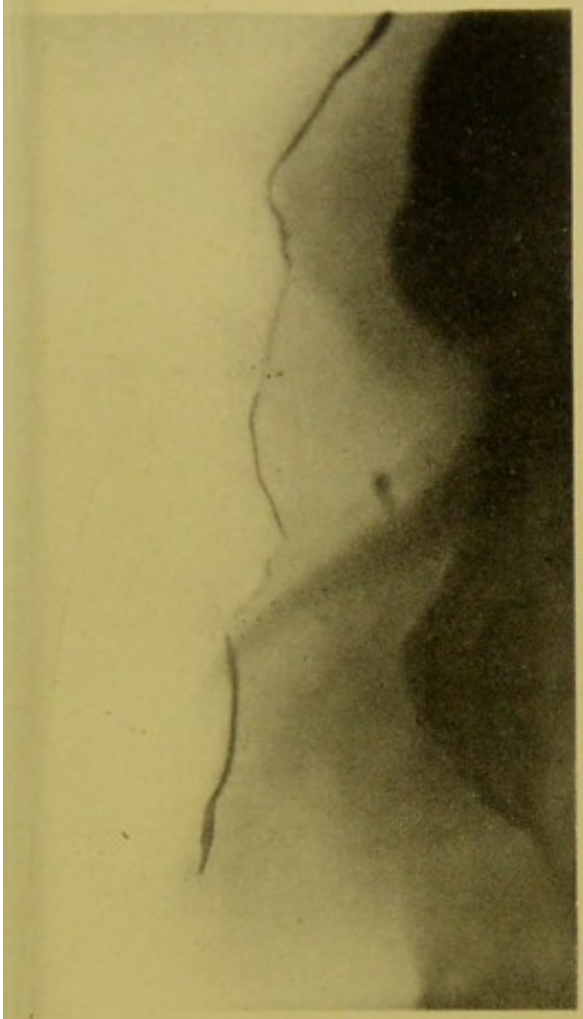


Fig. VI. Eye looking towards nose.

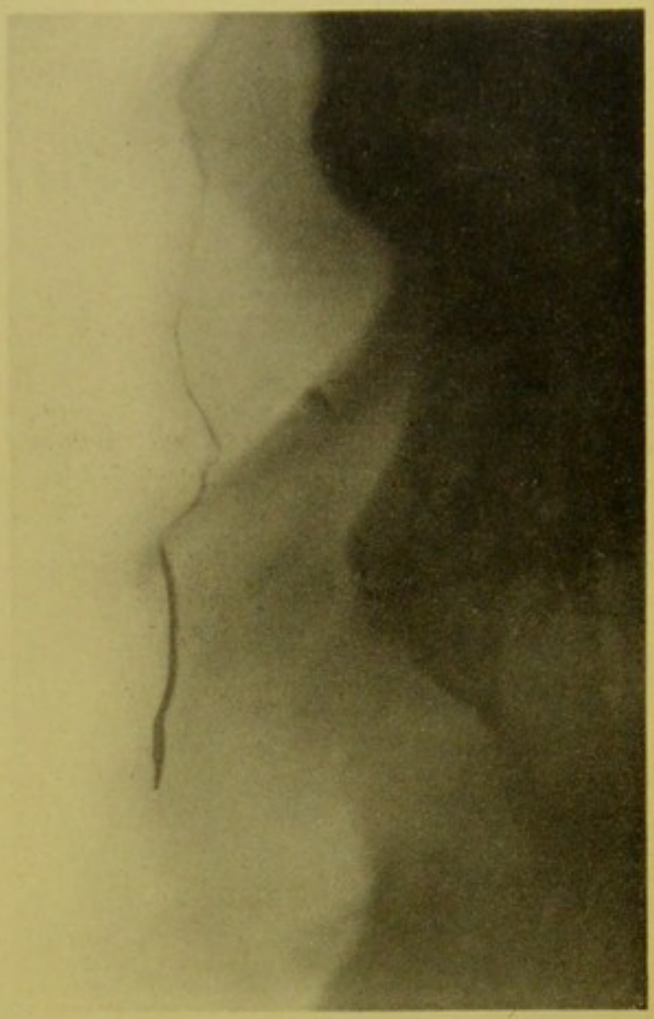
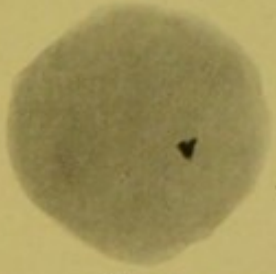


Fig. VII. Eye looking towards temple.

In Figs. VI and VII the position of head, tube and plate the same.



Cornea.

Fig. IX. Eye resting on its outer side.