EXPERIENCES WITH A MOBILE BURIED IMPLANT AFTER ENUCLEATION*

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Artificial eyes were used in statues and embalmed bodies several thousands of years ago. An eye painted on ivory was found in a statue excavated near the Oracle at Delphi. Numerous examples occur of artificial eyes fitted to ancient Egyptian mummy-cases.

The earliest reference to an artificial eye being used on human beings is in the Babylonian version of the Talmud, Nedarim, pages 66a and 66b, which was compiled over 1,600 years ago. The text suggests that a golden eye was used in a person's orbit.

In the 5th century B.C. an eye was painted on pottery stuck on a piece of cloth, which was then fastened over the socket of the patient.

In the 16th century the great French surgeon, Ambroise Paré, described artificial eyes made of silver or gold and enamelled to look like an eye. These were used in patients' sockets. In the 17th century glass was used for the first time in the manufacture of artificial eyes. In 1934 plastic material was used and several years later alloys, usually in conjunction with plastic material, were employed.

The surgical removal of an eye, or enucleation, has been practised as a surgical manoeuvre probably for hundreds of years. Until 1841 the operation was very crude. A stout thread was put through the eyeball, and the eyeball pulled forward. A knife was then pushed through the conjunctiva, swept around until the tissues were divided, and in this way the eye was 'delivered'. This operation left a socket that very seldom allowed an

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artificial eye to be fitted. In 1841 Ferral described the anatomical relations of Tenon's capsule to the muscles and the orbital fat, and showed how an eyeball could easily be removed by working inside Tenon's capsule. In 1826 Cleoburey had described how he performed an enucleation by working inside Tenon's capsule, but did not describe the anatomical relationships.

Since 1841 a tremendous number of modifications of enucleation have been described, an obvious indication of how unsatisfactory from the cosmetic and psychological point of view the 'straightforward' operation of enucleation has been.

Grimsdale and Brewerton, in discussing the bad cosmetic result of a simple enucleation, state that many patients prefer the frank deformity of an empty socket to the vacant staring look of a sunken prosthesis that has no movement. The main modifications of the simple enucleation were devised to provide a moving stump.

Mules (1884), dissatisfied with the cosmetic results of previous operations, performed an evisceration and removed an elliptical piece of sclera. He then inserted a glass ball into the sclera, and closed the opening with sutures. There were several modifications of this operation, some of which are in use today.

Adams Frost (1885) suggested that a glass globe be put into Tenon's capsule after enucleation. The cosmetic results were not as good as in Mules's operation, but complications were fewer. Chibret (1885) implanted a rabbit's eye into Tenon's capsule. According to his description the eye lived for some time and even developed corneal sensitivity. After 2 weeks, however, the rabbit's cornea dissolved in pus.

Greenwood (1914) stitched the superior to the inferior rectus and the lateral to the medial rectus and tied them over a glass ball.

Ramsay (1903) injected paraffin into Tenon's capsule, and Spratt (1905) used lard paraffin balls.

Rollet (1904) implanted a mass of skin and subcutaneous fat, which he took from the deltoid region, into Tenon's capsule.

Sattler (1912) suggested the use of costal cartilage in Tenon's capsule.

In the British Army ophthalmic issue in 1940, Mules's balls were replaced by the Duke-Elder sphere.

No new developements in the attempt to improve the cosmetic result of enucleation occurred until 1945, when Cutler described his famous ball-and-peg type of implant and prosthesis.

In 1946 J. H. Allen, discussing an article by himself, C. S. O'Brien and L. Allen, described a modification of the Cutler implant. This modification, however, was also not completely buried.

The sad history of the almost perfect mechanical implants which were not competely buried is too well known to bear reiteration. It was, however, from their modification of the Cutler implant that J. H. and L. Allen developed a buried implant which has none of the disadvantages of the Cutler type of implant, but still imparts very good movement to the prosthesis and gives enough 'body' to the socket to prevent the sunken appearance associated with ordinary enucleations. A full description of their implant and their technique of using it after enucleation appeared in the Archives of Ophthalmology of 5 May 1950. We should like to pay tribute to the lucidity of the text and the very fine drawings which make it easy to follow the descriptions step by step. In fact the simplicity of the drawings to some extent belies the technical difficulties presented during the operation.

THE ALLEN OPERATION

The implant used is almost hemispherical. It is 21 mm. in diameter, the size approximating to that of the posrerior half of the globe. A smaller size is used for very young children. It contains 4 tunnels; after enucleation the vertical recti are each brought through the superior and inferior tunnels and stitched together in the opening on the face of the implant, and the lateral and medial recti are brought through the lateral and medial tunnels and stitched together. The vertically and horizontally-acting muscles are stitched together, and the implant is covered with Tenon's capsule and conjunctiva, which is stitched.

A month afterwards the prosthesis is fitted. It approximates in size to the anterior half of the globe, and has a flat, not concave, posterior surface. This lies on the flat rim of the face of the implant, and it is this contact which imparts movement to the prosthesis.

Some Comments

In their technique the Allens use one stitch to each edge of the muscle, making in all 8 stitches, which means there are 16 ends. In our experience, if only one double-armed suture is used for each muscle, it simplifies the operation a great deal, cuts down the time appreciably and obviates a lot of muttered imprecations while sutures are sorted out.

Perhaps the most difficult aspect of the operation is stitching the muscles together in the opening of the face of the implant, because there is very little room to work in, and the edge of the opening in the face allows of little manoeuvring. This becomes most apparent when the opposing muscles are being stitched together. It is difficult at this step to keep the muscles sufficiently taut. To overcome this we have modified the technique as follows:

Whilst the implant is held firmly with forceps by the assistant, a vertical muscle and a horizontal muscle are pulled firmly through their respective tunnels until they cross each other. They are then clamped together with an artery forceps just beyond the crossing, and stitched together at the crossing. The other pair of muscles is then treated in the same way. The two lots are finally stitched together so that the combined junction lies in the centre of the face of the implant. The muscles should, however, not be pulled too tight, because movements of the implant become limited.

A complication arising from the Allen technique is that the nasal edge of the implant may push forward so that it is very difficult to fit the prosthesis properly. In fact, in extreme cases the prosthesis will not stay behind the lids. To overcome this, after the muscles have been stitched together, the central junction of the muscles is gripped with a forceps whilst the implant is rotated with another forceps so as to tilt the temporal

edge of the implant forwards. White silk is then stitched through the lateral rectus and around the bridge of its tunnel several times so as to anchor the implant in this position. This procedure improves the cosmetic and the functional result.

RESULTS AND COMPLICATIONS

Twenty-five of these operations are reported in the present series. The first was performed 4½ years ago and the last in this series a year ago. More than 60% were done at least 2 years ago. Figs. 1, 2 and 3 illustrate the result in 3 cases.

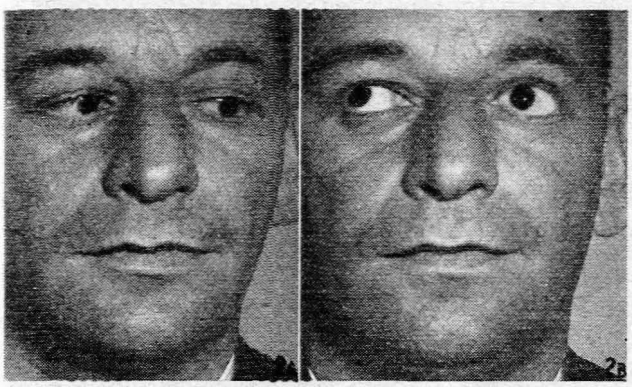

Fig. 1

Fig. 2

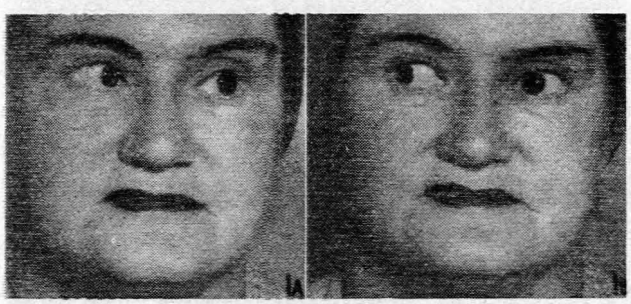

Fig. 3

Two cases have been failures; a fistula developed in both, infection supervened, the external rectus sloughed and the implant had to be removed. It is difficult to determine whether the primary cause of the failure was imperfect closing of the conjunctiva at operation, or pressure on the conjunctiva from the implant or from the prosthesis, or infection from buried stitches, or some other cause.

One of the failures was a man whose orbit had been riddled with quartz from a blast accident. When the implant was removed, exudate was found around particles of buried quartz and he was probably an unsuitable case for the operation, but he had retained the implant and worn a prosthesis for a year. Another complication arose in his case. The lower fornix was shallow and when he looked up or sneezed, the prosthesis fell out. This was overcome by doing a fine tarsorrhaphy at the inner end of the lids, which was successful in retaining the prosthesis and was scarcely noticeable.

The other failure was a boy whose conjunctival edges did not heal despite the absence of infection. He was readmitted after a month but, despite freeing and freshening the edges of the wound, the hole would not close. After 4 months a prosthesis was fitted, which was worn without discomfort or discharge for a further 8 months. After this the socket became infected and, although this was cured with local antibiotics, the external rectus had sloughed and the implant had to be removed.

There are 2 other cases in which the conjunctiva did not heal. One is an old woman on whom 3 attempts have been made to join the edges of the hole but all have failed. She uses an antibiotic ointment daily and has worn her prosthesis for 18 months. The other patient was operated on overseas and came complaining of profuse discharge from the socket. After antibiotic therapy it was possible to resuture the conjunctival wound. The operation was successful and there has been no discharge for a year.

One complication that we have met is tilting of the implant so that the prosthesis leaves a gap on the nasal side, or even falls out when the patient looks to the side. An attempt was made to correct this in one case by carrying out a squint operation on the implant. This was partly successful and although a gap can be noted, the prosthesis no longer falls out.

Another complication, found in one case, was a lax lower lid which would not allow the retention of the prosthesis. The Dimmer modification of Kuhnt's operation for ectropion gave a very satisfactory result.

CONCLUSIONS

The use of the Allen type of buried implant is, in the large majority of cases, a very satisfactory operation. The cosmetic results are very good.

The most important difficulty is that of securing permanent closure of the conjunctiva, for which careful suturing without tension is the best answer.

Another difficulty is the nasal tilting of the implant, which is easy to rectify either by stitching it with a temporal tilt, or by tightening the muscles to make the implant lie deeper.

The final difficulty, perhaps better called a disappointment, is the fact that the vertical movements are not as good as the lateral ones. The answer to this problem is

probably the use of magnets in the implant and the prosthesis.

SUMMARY

1. Twenty-five cases of the buried Allen implant are reported at intervals of between 1 and 4½ years after operation.

2. Two failures and other complications are described.

3. Modifications in technique are suggested.

All the implants and prostheses were made by Mr. A. Schulmeister, without whose cooperation these cases could not have been done.

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