course of about 1.5 mm. to pass into a dilated capillary plexus which is draining into the unobstructed vein. This intra-mural vessel is evidently facilitating drainage from the narrowed portion of the obstructed vein. Loewenstein in his histological studies notes that intra-mural vessels may run in the direction of the parent vessel and that they may leave it to pass into the general capillary system.

Summary and Conclusions

(1). A clinical description is given of intra-mural new formed vessels in an obstructed vein.

(2). One of the purposes of such vessels is drainage from obstructed circulation into capillary plexuses situated favourably for the establishment of collateral circulation.

I am indebted to Mr. Gabriel Donald for his care with the illustration.

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AN IMPLANT WITH BRIDGES FOR ATTACHMENT OF MUSCLES*

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THE new developments in plastic prostheses have so well solved the problems of colour and form matching as to emphasize the lack of movement which remains the chief defect in the present solution of this age-old problem. Movement of the prostheses in use or suggested is dependent upon the movement of the stump. The purpose of this article is to suggest a new surgical approach which utilizes the physiological and anatomical characteristics of the normal eye as far as possible.

The use of plastic substances particularly the methacrylic resins is not exactly a new venture in socket implantation for it has been considered by several authorities.¹ The substance is cheap, readily accessible and extremely adaptable. It is well tolerated within the orbit and can be prepared to conform with any desired shape. It can be finished smoothly or roughly as desired, both finishes being considered of benefit by certain sources. We are

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cognizant of the great many materials which have been considered and used in artificial implantation and also how these materials have been discarded one by one. Our aim is to introduce a new surgical approach to implantation.

Since we propose herein only to introduce a new type of implant we shall not go into the evolution of our model with its many discarded suggestions but shall simply submit and describe our present model in the form of a preliminary report. The implant consists of a plastic truncated cone with a convex base. Its exact size is variable, the antero-posterior diameter being 18 to 24 mm. and the diameter of the convex base being 16 to 18 mm. Six bridges, which have been so situated on the basis of anatomical study, have been built upon the anterior convex surface around each of which the recti and oblique muscles are tied and sutured back upon themselves. Upon severing the tendons of all the extra-ocular muscles, double armed 0000 catgut sutures are placed in each muscle and put aside with a clamp. After enucleation and complete stoppage of haemorrhage, the implant is placed in the socket and each muscle is drawn under its corresponding bridge to be sutured back upon itself and around the bridge thus producing a tunnel of muscle tissue. A definite attempt at muscle balance is made. When all recti muscles have been sutured back upon themselves Tenon's capsule comes back into proper anatomical position. The conjunctiva is then carefully sutured in a horizontal line with very close approximation of interrupted sutures. We realize that leaving Tenon's capsule open is a radical departure from any enucleation with implantation but muscle suturing to the bridges of the stump will retain the implant much better than overlaying the implant by suturing Tenon's capsule. The implant cannot be expelled and its mobility is unquestioned. We have endeavoured so to attach the muscle tendons that Tenon's capsule will resume its original anatomical position and the same feature is aimed at when suturing the conjunctiva.

The purpose of our implant is to secure the best possible movement attainable in restoration of a movable stump. Such a movable stump can be mechanically adapted for accurate fixation of a plastic prosthesis which feature has already been completely and adequately achieved. Side issues upon our implantation include the use of the alginate stencils in the socket so as to direct the method of reformation of the cul-de-sac and produce haemostasis thus preventing the frequent complication of chemosis; and a course in orthoptics to keep the muscle tonus adequate. We are at present also considering and experimenting with various methods of fixation of the stump to the inner surface

of the prosthetic whereby the anterior end of the stump can be built up so that no element of exophthalmos will exist. In a later model we have replaced the plastic bridges with metallic bridges not so much to secure added strength as to have a method

FIG. 1.

FIG. 2.

Figs. 1 and 2 show lateral and frontal view of the plastic implant with its bridges. The frontal view shows some perforations upon the surface of the implant.

of X-ray localization to observe any orbital shift of the implant. Having made a careful analysis of many sockets reformed by many of our leading ophthalmologists we wish to introduce this procedure as worth while and simple, realizing the great improvement of movement even at so early a date.

CASE 1.—J.G., aged 26 years, had a complicated cataract of eight years duration secondary to an old iritis. The intra-ocular pressure measured 60 (Schiötz). He complained of headaches in the region of the right eye, pain in the eyeball and redness of his eye. Light projection was faulty. His was the first case in which the bridged implant was employed following enucleation, the operation being performed in November, 1944. In this first model no provision had been made for the oblique muscles and the tendons of the four recti only were attached to their respective posts. At the end of five days the eye was dressed at which time no chemosis whatsoever was observed of the conjunctival tissues. At the end of two weeks the conjunctiva had completely healed. There was no oedema or secretion. Motion, up, down, left and right were highly satisfactory. There was no suggestion of retraction of the conjunctiva upon the temporal side when looking nasally and vice versa. After two months the conjunctiva appeared quite normal and the movement could be considered very good.

CASE 2.—This patient, M., aged 24 years, sustained a penetrating injury to his right eyeball three years ago.² There was a "through and through" penetration of the eyeball. During enucleation a specific complication was observed in the external rectus muscle which had become quite fibrous and inelastic. This loss of elasticity led to a good deal of difficulty in securing the attachment of the external rectus to its respective bridge. Here again only the four recti muscles were attached to the bridges before closing the conjunctiva. Although much more oedema was present in the conjunctiva than was seen in the first case, this subsided almost completely at the end of two weeks. At the end of five weeks the conjunctiva was quite normal in appearance and the movement could be considered quite good except in the lateral direction. The implant seemed to lodge slightly upward and nasally but was not actually displaced. Movement parallels the remaining eye in all directions except in looking to the right temporal field.

CASE 3.—A.D., aged 22 years, had a shrunken globe resulting from a perforating glass injury some twelve years earlier. There were multiple staphylomata and X-ray indication of choroidal calcification. The cataractous lens was visible within a rather deep anterior chamber. Enucleation was technically difficult because of the rapid collapse of the globe in which hypotension had existed preoperatively. At any event, only the four recti muscles could be adequately secured to the bridged implant. The oblique attachments were unused. Oedema and chemosis were minimal and upon the ninth day the results were considered very

good from the standpoint of movement and from the general appearance of the conjunctival sac. At the end of two weeks the conjunctiva was competely healed with the "collar button" stud projecting through this structure and moving to all extremes of up, down, medial and lateral movement.

CASE 4.—J.T., aged 26 years, lost the sight of his left eye following a penetrating knife injury in childhood. The eye rapidly became shrunken, with deformed irregular cornea and multiple scleral staphylomata. X-ray report disclosed a calcification of the choroid of rather symmetrical appearance. There was ptosis of the left upper lid and retraction of the globe. The eye was enucleated in the usual manner. All six extra-ocular muscles were attached to their respective bridges and the conjunctiva was sutured about the "collar button stud" with two sutures running through the neck of the collar button stud to keep the conjunctiva snugly secured and thus prevent its riding upward. A negacoll mould was placed in the socket and retained for five days. At this time very little oedema was present and the implant appeared to be in good position. At the end of ten days the oedema had subsided; the conjunctiva was well united and the movement was excellent.

CASE 5.—J.S., aged 24 years, suffered a penetrating "through and through" corneal wound following an explosion of a bottle when he was fourteen years old. There had been recurrent attacks of pain and redness in his left eye for the past two years. The intra-ocular pressure was 42 (Schiötz). The iris was completely incarcerated in the vertical corneal wound being so drawn that no pupil and no anterior chamber was visible. The eye was enucleated and the extra-ocular muscles were attached to their respective bridges with the "collar button stud" being handled as in Case 4. Both Case 4 and Case 5 were operated upon the same day and results appear to be running parallel. At the end of two weeks the conjunctiva whitened; there was no oedema; the collar button stud was in good position and movement appeared to be unusually good.

Observation of our five cases over a six months period has tended to confirm our expectations. While only time can finally resolve the ultimate value of any new approach we feel that the well established physiological basis for what at first glance may appear to be radical, justifies our venture.

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