GRAFTLESS STAPEDECTOMY

By Dr. B. GARAYCOCHEA (Lima-Perú)

THERE is no doubt that removal of the stapes and its replacement by a polythene tube or by the stapes itself with the interposition of an organic graft (vein, fat or perichondrium) has definitely replaced direct or indirect mobilization of the stapes or fenestration of the external semicircular canal, which are attended by such uncertain results.

Stapedectomy is, therefore, the best surgical technique for the treatment of conductive deafness due to otosclerosis. How far, however, can stapedectomy accompanied by a graft be considered the perfect technique? We are all aware that all cases of otosclerosis do not respond to surgical treatment, even though the operation has been carried out with all possible skill and that no logical explanation can be given for the occurrence of these failures.

Excluding destruction of the labyrinth which fortunately is not a common complication, there may be other rare causes as yet unknown. The object of this paper is to explain some biological and mechanical causes why these failures may occur and at the same time introduce a new technique which I call graftless stapedectomy.

Recently I published a case in which there had been involvement of the facial nerve and in which I had performed a fenestration of the promontory fixing in a polythene tube of the Shea modified type without the use of any graft. The result was amazing. The patient did not suffer any vertigo and there was permanent improvement in the hearing. This was my first case of graftless stapedectomy which opened up a new approach to stapedectomy technique and has resolved many of the problems caused by the use of grafts.

In animal experiments it has been possible to establish the behaviour of grafts applied to the oval window after the removal of the stapes. Today we know vein-grafts encourage fibrosis in the middle ear, and however the vein graft is applied it soon disappears in a mass of fibrous tissue, and the fibrosis may not affect the middle ear alone but may also invade the cochlea destroying the sensory nerve endings to a greater or less extent. The same objection applies to the use of gel-foam though to a less degree. Perichondrium, though more manageable at the time of operation and so easier to use reacts in the same way as vein grafts. Recently six cases of granulomata following the use of fat-grafts with stapedectomy have been reported.

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On the other hand it has been proved that removal of the footplate of the Stapes from the oval window is quickly followed by the formation of an endosteal and periosteal membrane over the oval window in all but the most exceptional cases. It is fortunate that nature provides this protection for the inner ear.

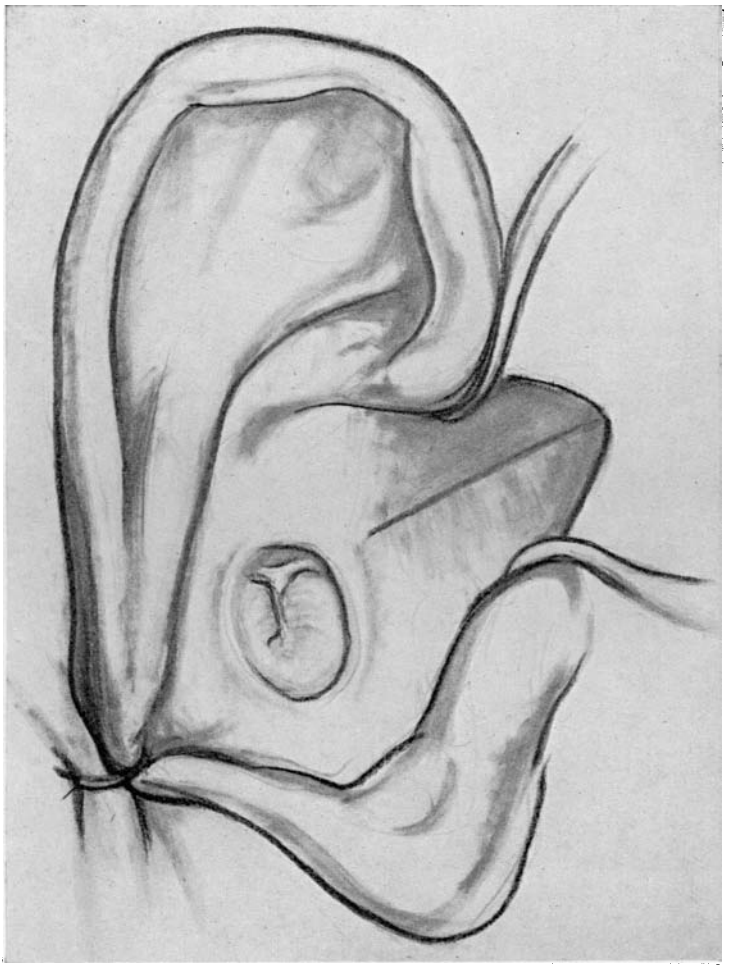


FIG. 1.

There are ten steps in performing a graftless stapedectomy:

1. An incision is made in the external ear between the Tragus and Helix as shown in Fig. 1 and a holding suture is used as done by Mr. Kersley of Preston Royal Infirmary, which leaves the meatus wide open and in my opinion gives the best field of vision throughout the operation.

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It also leaves both hands free without using a self-retaining speculum which is expensive and does not provide as good a field of vision. The incision is easy to make and usually results in an invisible scar.

2. The tympanotomy is carried out by the method used by Rosen for mobilization of the stapes, care being taken to produce a tympano-

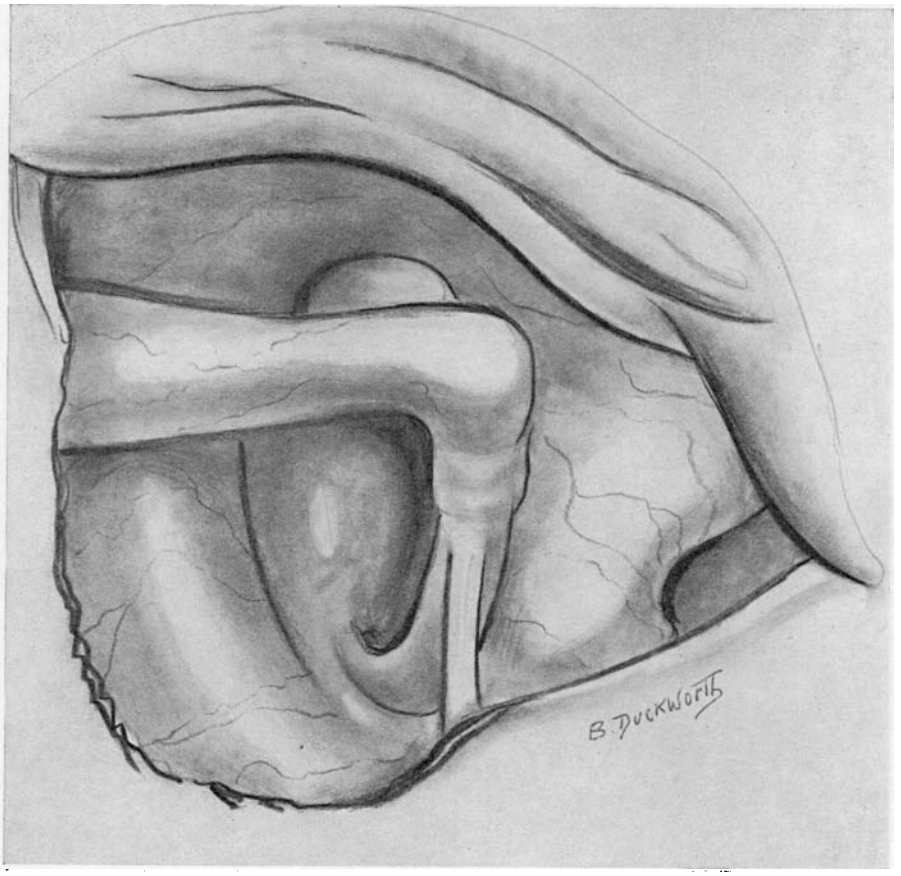


Fig. 2.

meatal flap sufficiently large to come correctly in contact with the meatal wall at the end of the operation.

3. Whenever necessary, and it usually is necessary, I drill the postero-superior meatal wall which is quite a safe thing to do and is quickly done as it can be done under visual control throughout. Nor will it produce any damage to the facial nerve either directly or through the heat produced. (Fig. 2).
4. Once the mucosa over the footplate and promontory has been re-

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tracted, the stapedial tendon and crura are severed (Fig. 3). This is usually easy to do as the otosclerotic bone holds the footplate firmly (Fig. 4). It is important not to remove the footplate, so opening the labyrinth, before trying the polythene tube for size.

5. Using a polythene modified tube of the columella type (Fig. 5*b*) it is

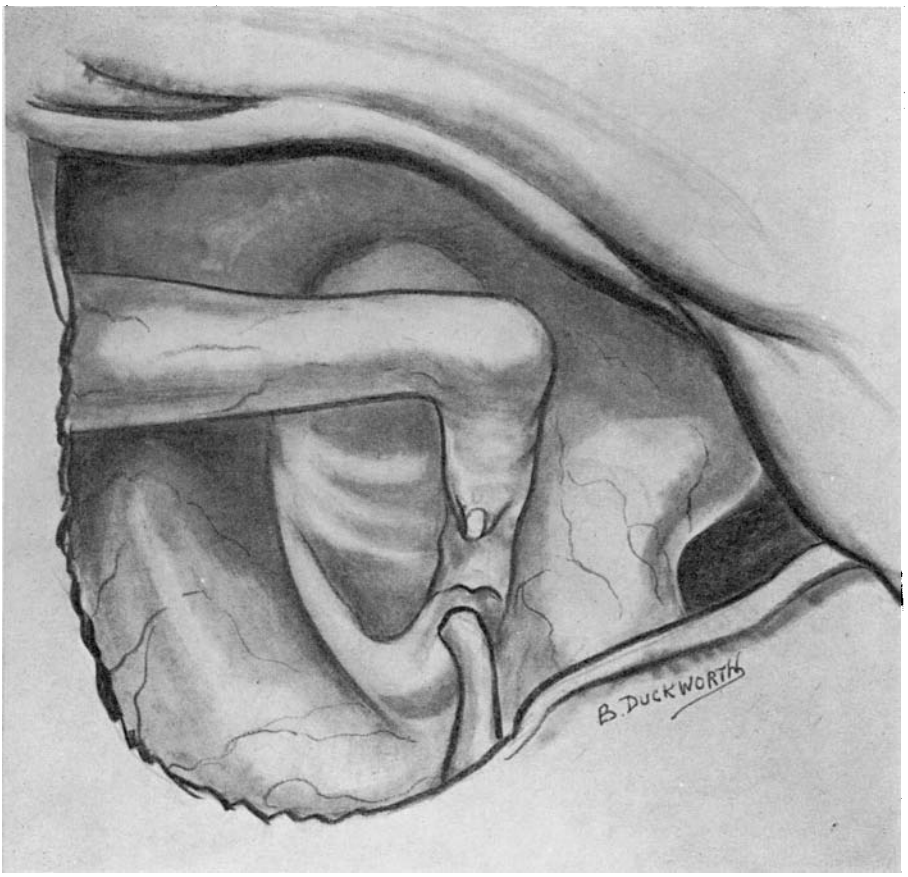


FIG. 3.

inverted over the footplate and trimmed with a pair of sharp scissors (Fig. 6) until it will fit in the oval window. It is important that it should be made to fit as accurately as possible as this will be the only thing covering the oval window; if it is too large it will not fit into the oval window at all and so not be in contact with the labyrinth. If too small part of the oval window will remain uncovered. It is better, however, that it should be too small than too large because I am convinced that a sheet of mucosa will soon be formed

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and will cover over the uncovered portion of the oval window. This development of a membrane in the oval window has been seen to occur in man as well as having been proved to occur in animals, so that to leave the oval window uncovered does not appear to be a risky thing to do, as it was formerly thought to be.

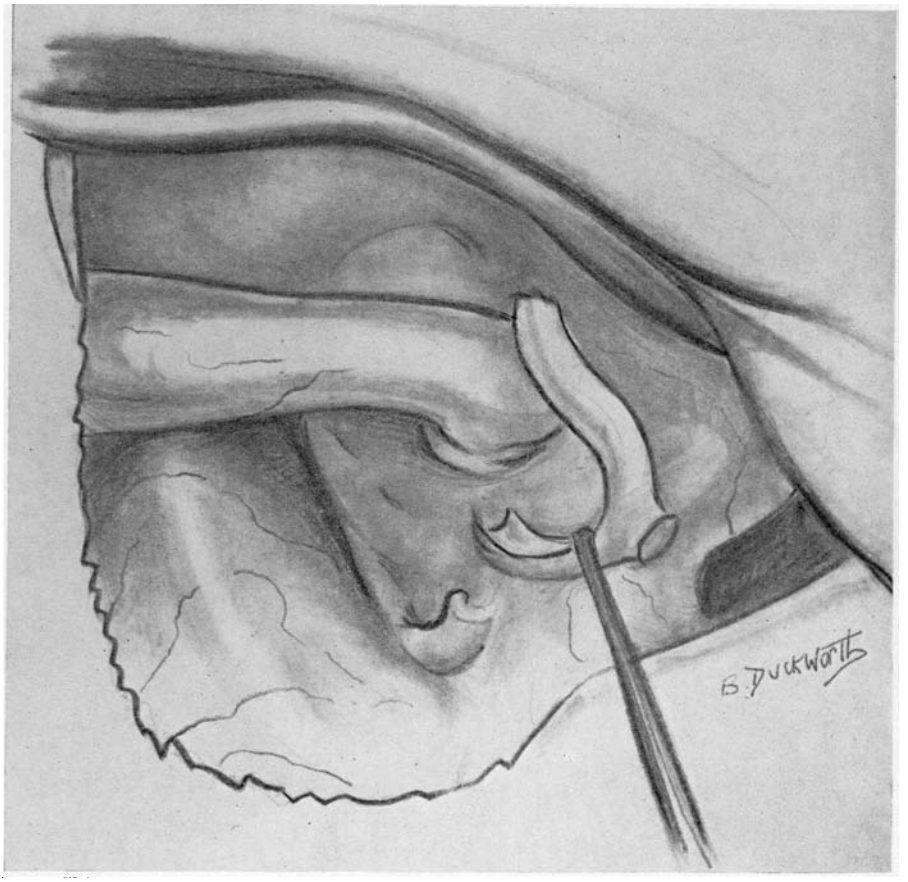


FIG. 4.

It has been shown experimentally that polythene is well tolerated. In two of the cases, here reported, an accidental perforation of the drum remained open for 4 weeks and I was able to see in both cases that the oval window became, at the end of the first week, completely covered by mucosa which surrounded the tube.

In the first five cases I used the ordinary Shea type of polythene tube with a modification (Fig. 5*a*). The labyrinth was uncovered on three of those five cases. On the remaining two the polythene

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tube was surrounded with balls of gel-foam in order to close the labyrinth. This is no longer necessary because, as I have pointed out, the inverted columella tube, modified, shaped to fit the oval window almost entirely covers its surface.

6. The footplate of the stapes is removed with a micro-perforator

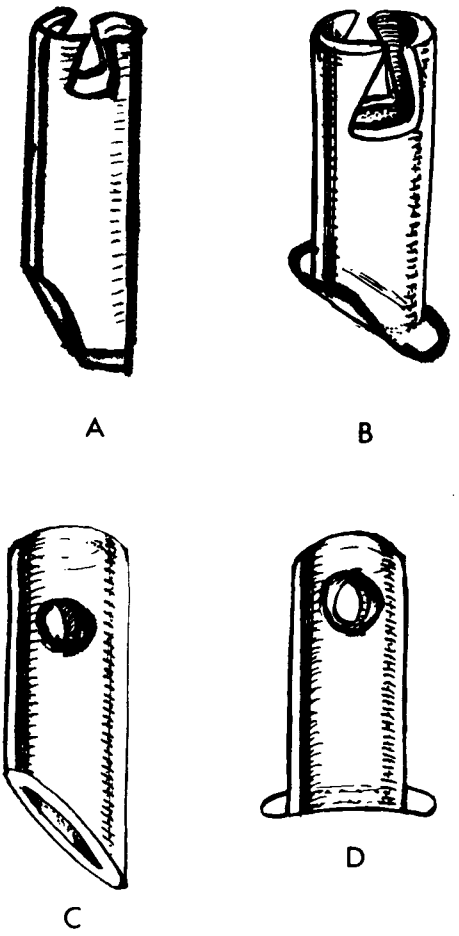


FIG. 5.

(Stride's model), which is an efficient substitute for a micro drill, the removal being completed with a micro hook. I try to remove the whole of the footplate and so far I have experienced no difficulty in doing this (Fig. 7).

7. Once the footplate has been removed and the labyrinth exposed it is very important to obtain complete hæmostasis, by the use of hypo-

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tensive drugs, if necessary. For this reason I think it is preferable that the operation should be performed under general anæsthesia. Hearing tests carried out during an operation done under local anæsthesia appear to me to be useless, as the patient, being under the influence of drugs, cannot be expected to answer questions

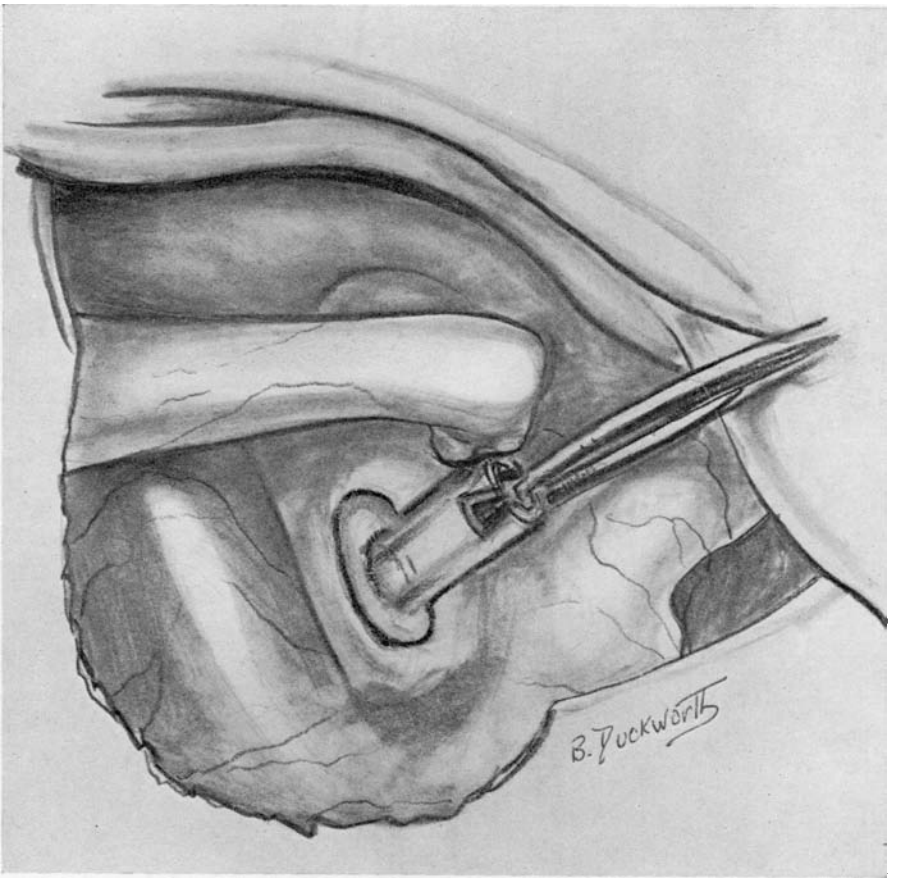


Fig. 6.

rationally. I also believe that the vertigo often accompanied by vomiting which so often occurs on removal of the footplate is prevented so that the patient is saved much discomfort. The operative field should be kept quite dry, not merely to prevent the entrance of blood into the labyrinth but also to maintain visual control of the strut manœuvres. When blood does gain entry into the labyrinth it may be removed with the sucker without labyrinthine damage provided that the end of the sucker does not enter the labyrinth and

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that the suction is not too powerful. In four of these cases such meticulous aspiration was carried out without in any way interfering with the hearing improvement.

8. At this stage of the operation the polythene tube should be placed first in contact with the incus and the other end of the tube should

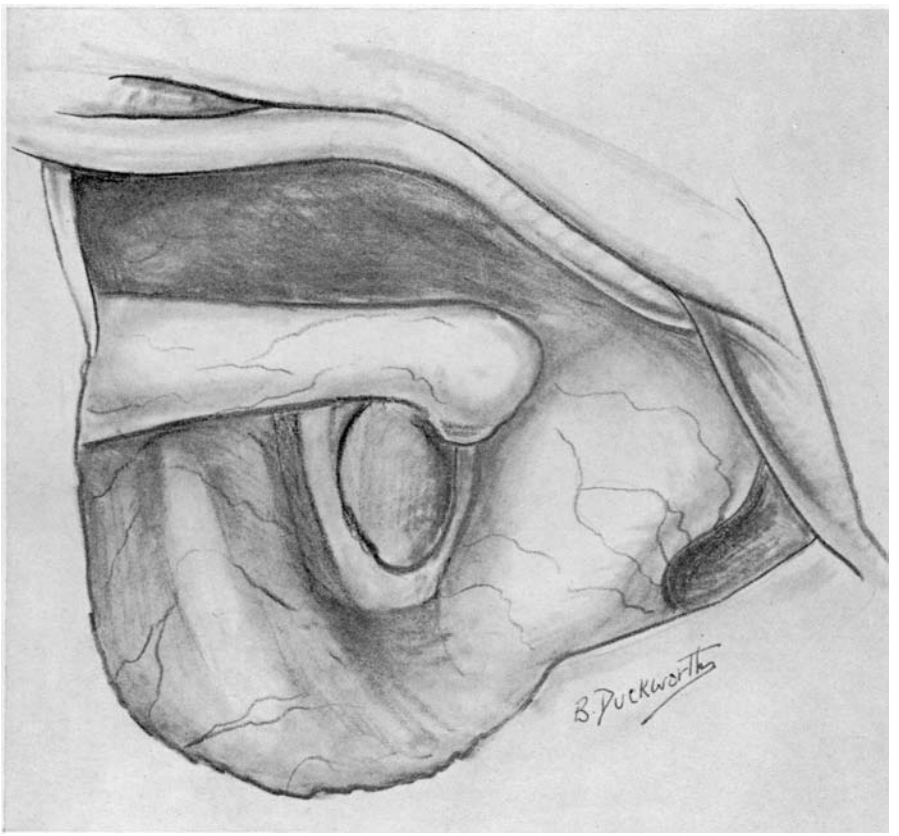


Fig. 7.

then be slid into place against the oval window. Getting the strut in place in contact with the incus may prove difficult, if so then the oval window should be covered with a piece of gel-foam and when the strut is in place the gel-foam may be removed with the sucker in order that the strut may be seen to be in proper position in the oval window.

9. Both the incus-strut and the strut labyrinth points of contact should be carefully examined with a × 40 magnifications to make sure that

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the strut is in proper position in the oval window (Fig. 8). The tympano-meatal flap is then replaced.

10. I consider it most important that the meatus be filled with gel-foam soaked in a solution containing Adcortyl-A with graneodin in order that the drum be covered with a liquid medium containing a

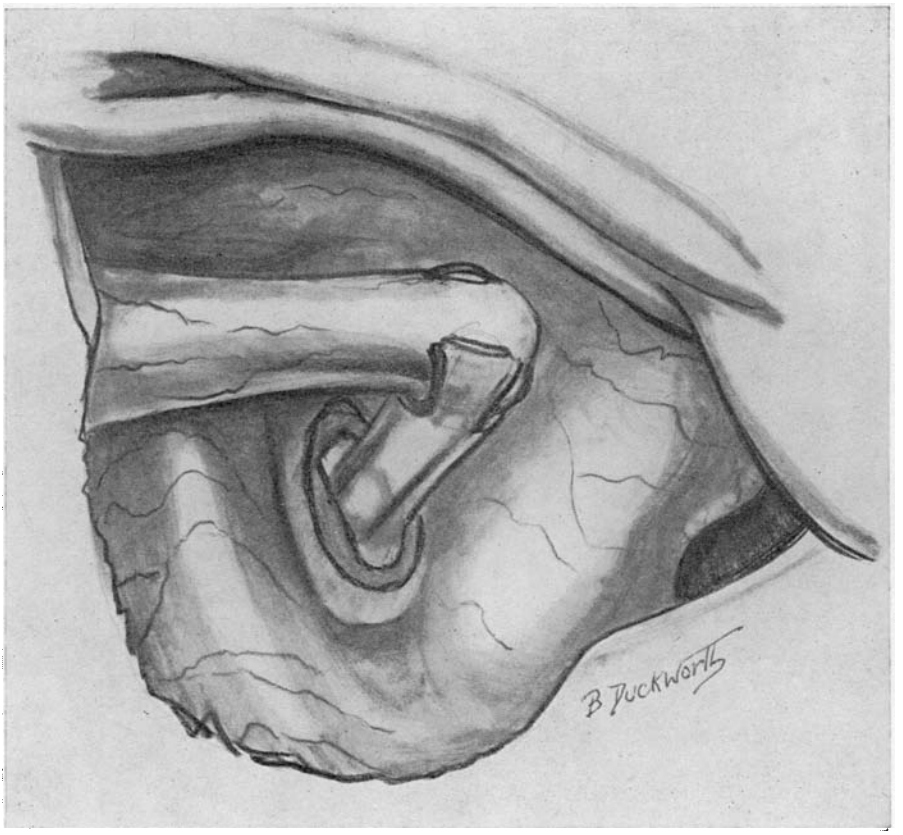


Fig. 8.

powerful antibiotic which will prevent infection and damp down the sounds during the first week after the operation. It is well known that a fluid is the best medium to absorb sound. The incision is closed in the usual way and the ear is then sprayed with an antibiotic powder (polybactrin spray). Dressings are then applied and the ear bandaged until the first dressing is done the following week.

Reviewing the techniques in common use so far I conclude that the mechanical transmission of the sound wave is best achieved by the use of a polythene tube of the columella type put in in the inverted position

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and trimmed to fit the oval window in such a way as to cover the maximum area of the labyrinth in the same way as the footplate of the stapes does. Fig. 9 shows in graphic form the mechanics of the vein graft in which

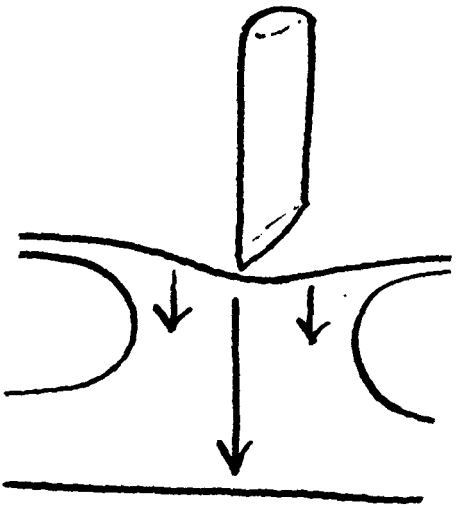


FIG. 9.

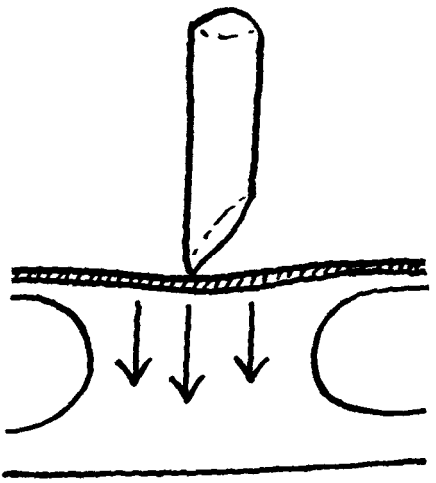


FIG. 10.

the maximum pressure is only exerted in the centre where the strut is in contact with it and becoming progressively less towards the periphery. When fat or perichondrium are used, the tissue being thicker the dis-

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tribution of the pressure is better but the amount of pressure is less (Fig. 10). By using a strut without any intervening graft I get both, the maximum pressure effect and the best distribution of that pressure (Fig. 11) although the strut is hollow. In this connection we have been considering the purchase of struts with solid bases to see whether they would prove even more efficient.

It can be seen in Fig. 5*b* that I have used a polythene tube, columella type inverted and in which a special cut has been made, not only in the "labyrinth part" of the strut but also in the "incus part", in such a way that it holds the incus without any risk of losing contact. This modification

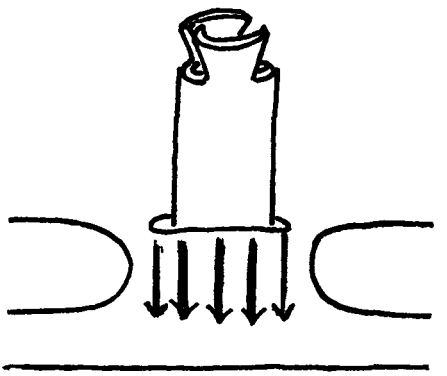


FIG. 11.

has been done in all cases with scissors and help of the microscope. It has been proved to be a difficult stage of the technique, due to the very small piece that has to be cut. Fig. 5*c* shows a variation of strut which contains a hole for the incus. This variation has been provided by Mr. Lawson in a very simple way. Fig. 5*d* shows my last type of strut which is of the columella type with a hole for the incus. This strut can be made very easily, it only takes a few seconds to be perforated and it has proved to be ideal for this type of technique.

The advantages of graftless stapedectomy are clear:

(*a*) It is the avoidance of the use of material which has been shown to cause tissue reaction both in animals and in human beings.

(*b*) All possibility of the strut not being properly in place in the oval window is avoided because the interposition of graft prevents visual control of the positioning of the strut. Moreover when grafts are used the strut may not be long enough to reach the labyrinthine compartment and so fail to transmit the sound wave. I believe that most failures to improve the hearing when grafts are used are due to this cause even though instruments are used to measure the distance from the

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incus to the oval window. Graftless stapedectomy, therefore, not only avoids the use of organic grafts but also guarantees in the most logical way the correct apposition of the strut in the oval window because this is checked by direct vision.

Included in this report of the first 12 cases of graftless stapedectomy are two cases which must be considered as experimental and really not suitable for surgery but were done at the patients' special request. In both these cases there was such extensive cochlear damage that they could have been regarded as cases of perceptive deafness.

In Case II (J.M.) it was only obtained an improvement of 20 db. at 125 frequency, 15 db. at 250 frequency, 5 db. at 500 frequency and at 1,000 frequency the sound was gained. At operation this patient was found to have an enormous invasion of otosclerotic bone not merely involving the oval window but involving the round window as well. Unfortunately the otosclerotic bone in the round window could not be completely removed owing to the fact that the perforator was unsuitable for work in this area, and this was, I believe, the cause of the poor result in this case.

In Case III (A.H.) the otosclerotic process was only affecting the oval window and it is appreciated that the improvement in the hearing was the maximum which the cochlear damage already present would allow us.

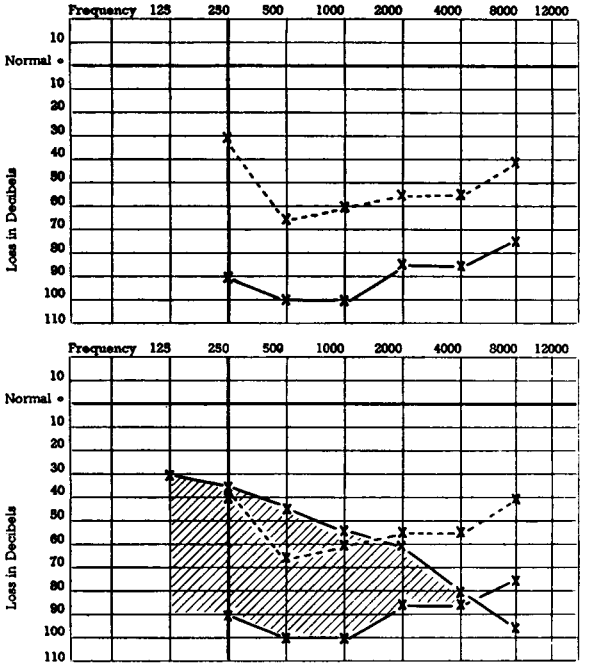
The same applies to Case I (E.H.) in which the hearing by bone conduction was so poor that most surgeons would have considered it unsuitable for surgery. In this case not only was the maximum improvement obtained which the pre-existing cochlear damage allowed but it was gained hearing of 40 db. at 125 frequency which was not present before operation. The lesson to be learnt from these cases would appear to be that we should seriously consider performing tympanotomies in more cases where the hearing by bone conduction is so poor that they may be considered unsuitable for surgery, as many of these cases might well benefit from graftless stapedectomy.

So far I have had no failures except in the Case II (J.M.) where the improvement was poor for the reasons stated. All the other cases recovered their hearing to the maximum that pre-existing cochlear damage allowed. Post-operative vertigo varied from one patient to another, most complaining of slight vertigo during the first 3 days. In one or two cases the vertigo lasted for a week but in no case was the vertigo greater than it would have been had a graft been used. In every case the vertigo had disappeared within 10 days, with the help of drugs.

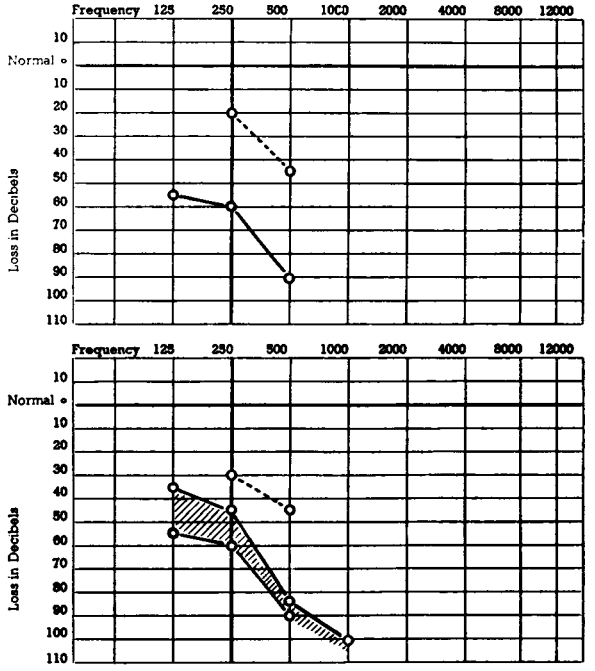
I consider this technique harmless and easy to carry out in experienced hands and without greater risk of labyrinthitis than any other technique.

I wish to express my thanks to Mr. H. P. Lawson and Mr. B. P. Robinson for affording me the opportunity to treat these patients, and

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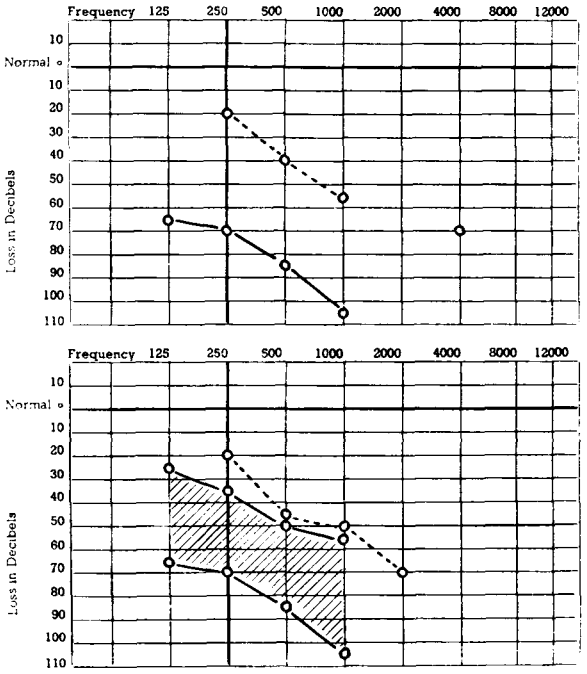


CASE: I (E.H.)
Left Graftless Stapedectomy: September 4th, 1962. Hearing test: November 16th, 1962.

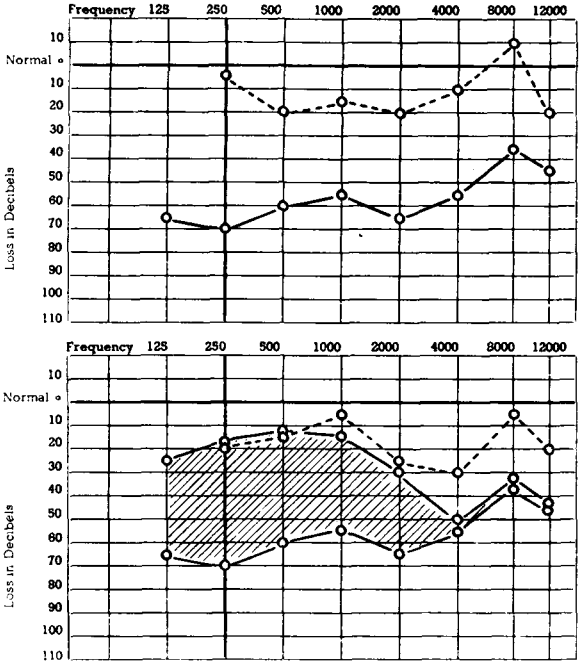


CASE: II (J.M.)
Right Graftless Stapedectomy: August 21st, 1962. Hearing test: November 9th, 1962.

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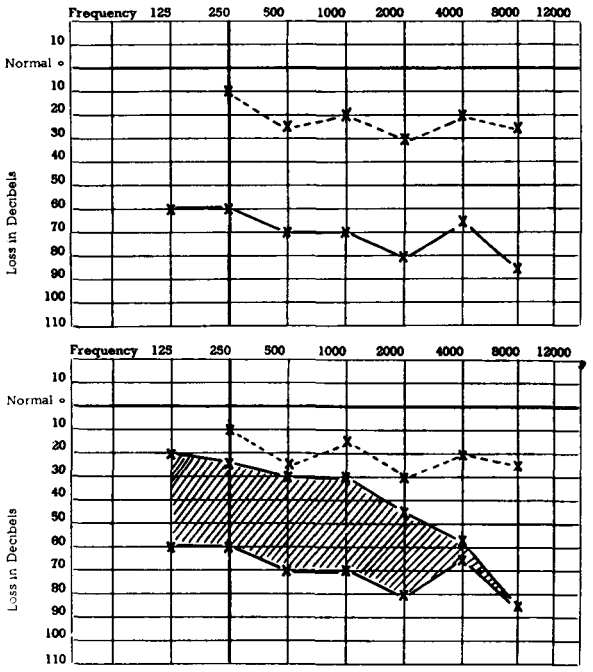


CASE: III (A.H.)
Right Graftless Stapedectomy: September 11th, 1962. Hearing test: October 30th, 1962.

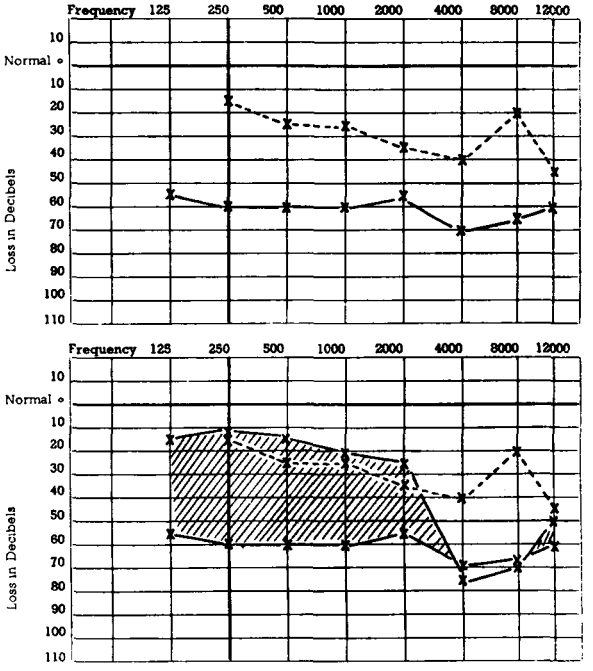


CASE: IV (A.P.)
Right Graftless Stapedectomy: September 18th, 1962. Hearing test: October 11th, 1962.

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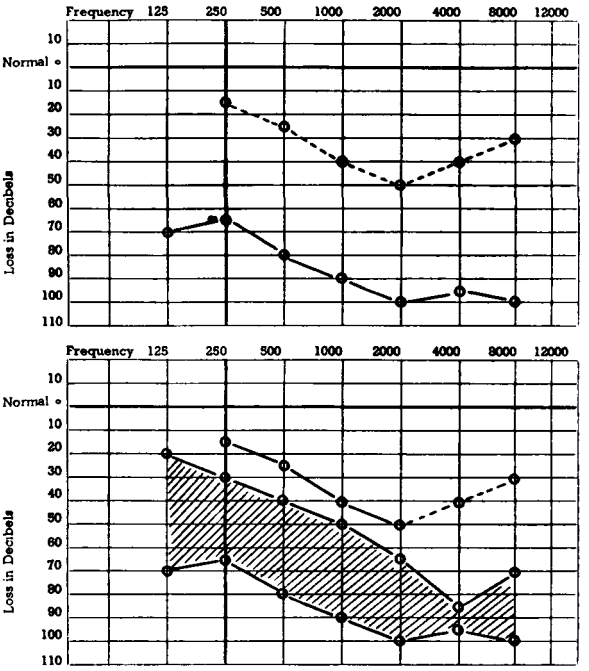


CASE: V (N.W.)
Left Graftless Stapedectomy: September 20th, 1962. Hearing test: October 23rd, 1962.

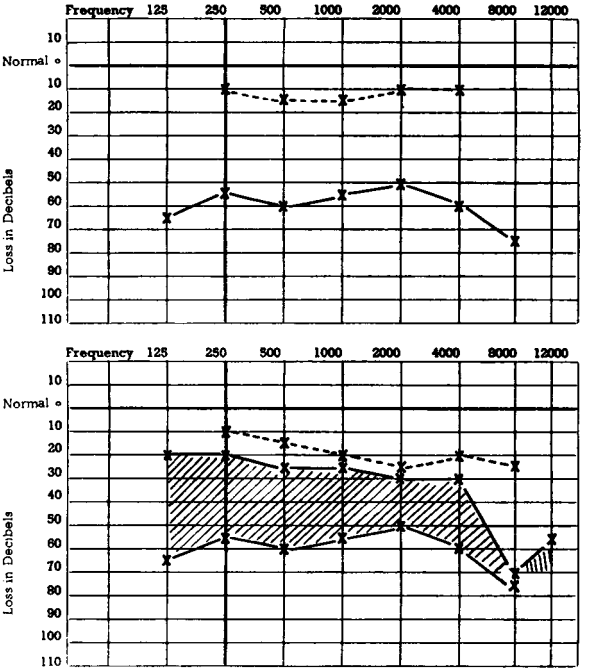


CASE: VI (J.H.)
Left Graftless Stapedectomy: September 27th, 1962. Hearing test: November 7th, 1962.

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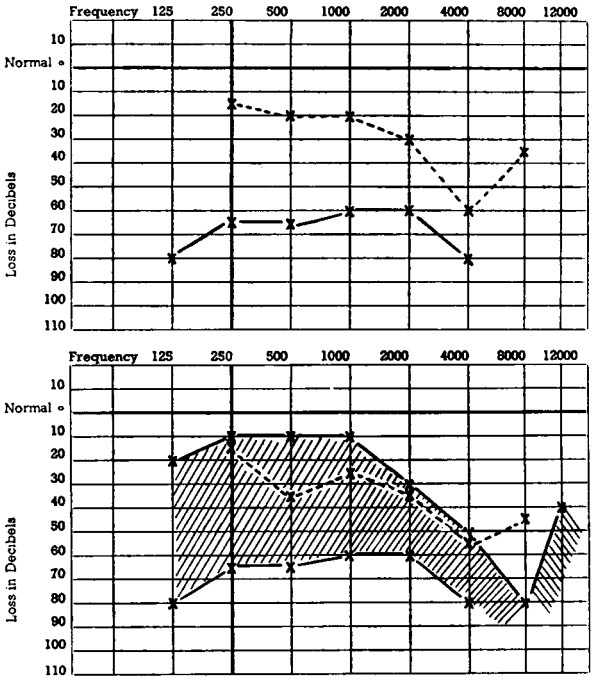


CASE: VII (D.M.)
Right Graftless Stapedectomy: October 9th, 1962. Hearing test: November 23rd, 1962.

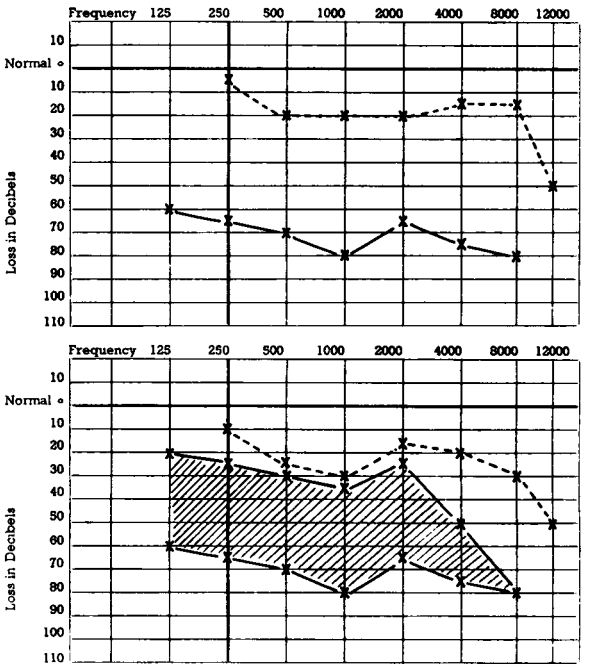


CASE VIII (K.L.)
Left Graftless Stapedectomy: October 10th, 1962. Hearing test: November 19th, 1962.

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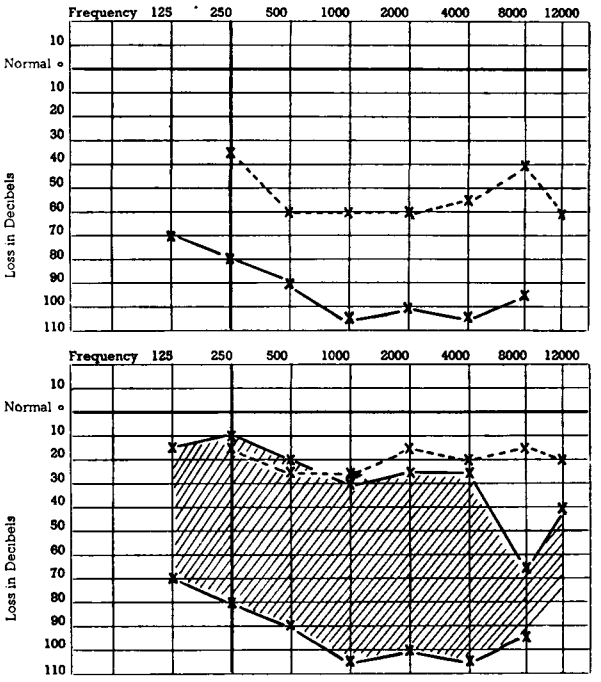


CASE: IX (M.A.)
Left Graftless Stapedectomy: October 11th, 1962. Hearing test: November 29th, 1962.

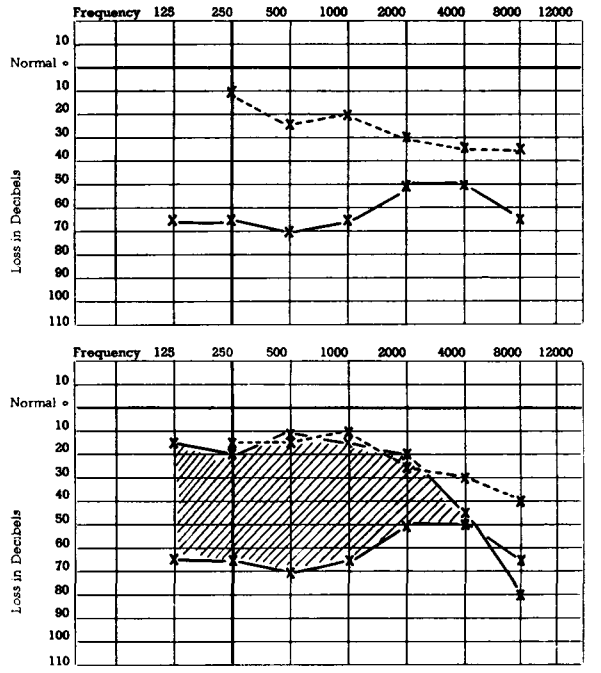


CASE: X (H.M.)
Left Graftless Stapedectomy: October 25th, 1962. Hearing test: November 27th, 1962.

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CASE: XI (C.R.)
Left Graftless Stapedectomy: November 6th, 1962. Hearing test: December 6th, 1962.



CASE: XII (L.B.)
Left Graftless Stapedectomy: November 8th. 1962. Hearing test: December 9th, 1962.

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for their confidence and help; also to the nursing staff of the Hospital, in which it has been such a great pleasure to work.

The drawings illustrating the operation described in this article were made by Miss Barbara Duckworth, Medical Artist to the University of Liverpool, and I wish to thank her for her skill and patience.

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ADDENDUM

Since my recent visit to Memphis, U.S.A. (January, 1963), where I saw Dr. Shea operate on more than ten ears, using his Teflon Piston and peri-veinous tissue graft, I have been trying in some cases, the same type of strut in the technique which is the subject of this paper.

According to my experience I consider that the type of strut I recommend in the present paper, Fig. No. 5 D, seems to me more easy to work with and offers a firmer contact with any type of incus.

I have noticed that the fact that the strut is hollow has no bad effect on the mechanism of the hearing, as I have proved a sheet of mucosa will close the hole of the strut which goes into the vestibule.

I must express, however, how pleased I was to hear Dr. Shea at the First British Academy Conference in Otolaryngology (London, June, 1963), say that he has adopted the same attitude of avoiding the use of organic graft and that the reasons he gave were the same biological ones I mention here.

It is very reassuring to see such a magnificent operator adopting a measure which should be considered by more ear surgeons.

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