Adam,Rouilly

SERVING MEDICAL EDUCATION WORLDWIDE

AR402/AR402-B DIGITAL EAR EXAMINATION TRAINER

Instruction Manual

Thank you for purchasing this AR402 Digital Eye Retinopathy Trainer.

Please read this instruction manual carefully and retain it for future reference.

Skills

Developed in collaboration with **Professor Tony Wright, Emeritus Professor of Otolaryngology,** our new **AR402 DIGITAL EAR EXAMINATION TRAINER** has been designed to facilitate the most realistic training experience in **ear examination.**

Using high resolution digital screen technology, the trainer includes **48 common and less common ear conditions** as well as an anatomically accurate ear structure to offer a comprehensive training solution for ear examination and use of an otoscope.

Features

- Simple to set up and use
- Soft, flexible and realistic pinna and ear canal
- High resolution digital display
- Easy to use, digital control for ear conditions
- Examination cover to hide displays of condition numbers
- Battery or worldwide mains power compatible
- Sleep mode to conserve power

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Safety and Precautions

The digital images of ear conditions are the copyright of Professor Tony Wright, Emeritus Professor of Otolaryngology. They are for sole use with the AR402 Digital Ear Examination Trainer. These images may not be extracted, copied, sold, displayed, projected or reproduced in any format without prior consent.

The trainer contains sensitive electronic parts. Do not store near heat or where it may experience extremes in temperature, humidity or magnetic fields.

Use only the low-voltage power mains adaptor supplied. Use of other adaptors may damage the model, and invalidate your guarantee.

Use only 4x AA batteries (not included) in the battery compartment as indicated. Do not attempt to use any other type or size of battery. Other battery sizes may damage the model, and invalidate your guarantee.

Do not use the adaptor if the low voltage cable is damaged. The cable cannot be repaired, the adaptor must be replaced.

Do not power down and leave or store the trainer with batteries still installed for prolonged periods. Always remove batteries before storage.

The trainer contains no user serviceable parts. Do not attempt to open or disassemble the trainer. Doing so could cause damage and will invalidate your guarantee.

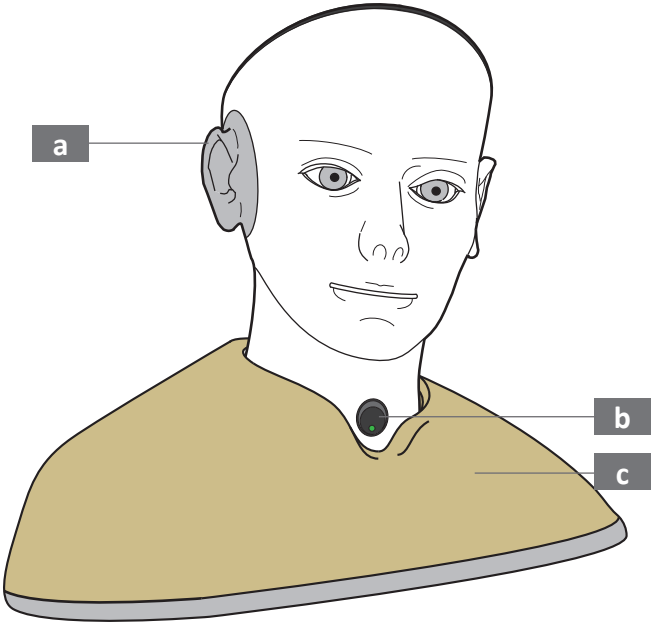
Do not exert excessive force on the buttons or place the trainer upside down. Doing so could cause damage and will invalidate your guarantee.

Re-chargeable batteries may be used to power the trainer. Please note however that the mains adaptor will not re-charge batteries.

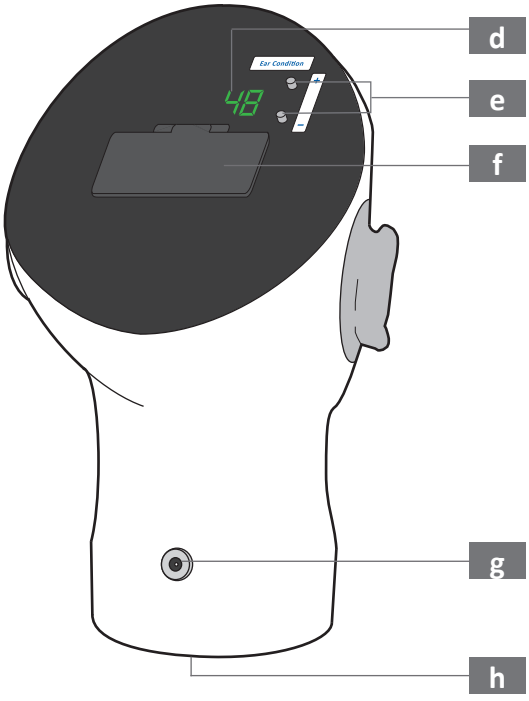
Please treat the trainer with the same care you would a patient.

Parts

Front (Shown inserted into shoulder base)



Rear (Shown removed from shoulder base)



a Flexible right patient ear for examination

b Power switch (with green indicator light)

c Removable shoulder base

d Ear LED condition number indicator

e Ear condition Up (**+**) and Down(**-**) buttons

f Examination cover

g Low voltage power jack

h Battery compartment (on base) for 4x AA batteries (not included)

Supplied With

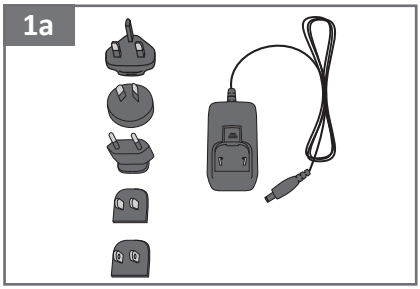
Low voltage power adaptor with world plug fixings

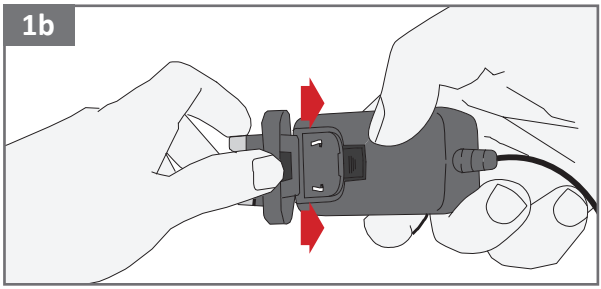
S403/7 Blue battery compartment opening tool

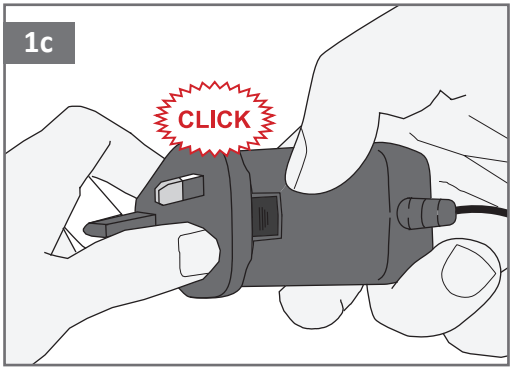
S402/9 Rigid carry case

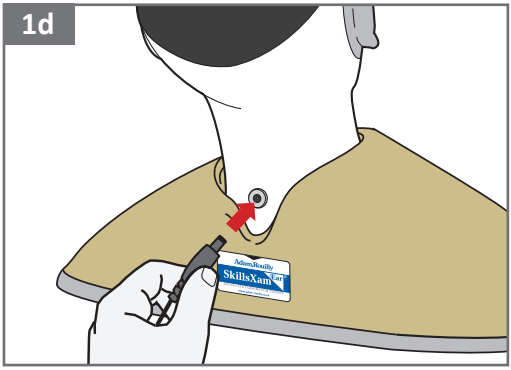
If you require replacement parts please contact our Sales Department, quoting codes where applicable.

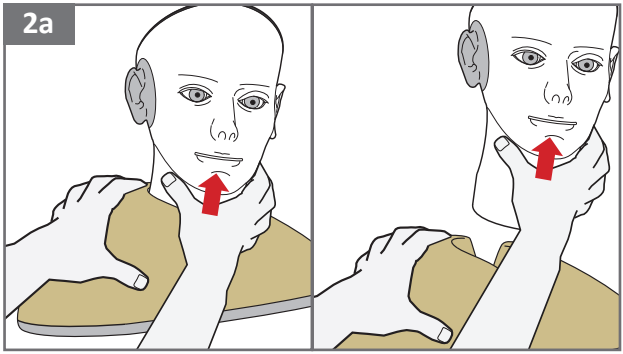
Before Use

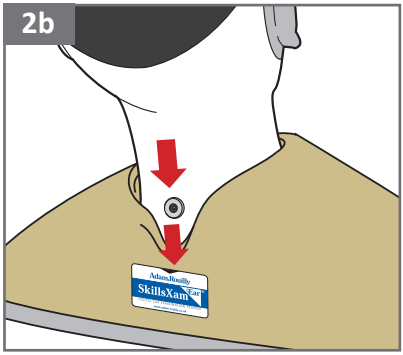


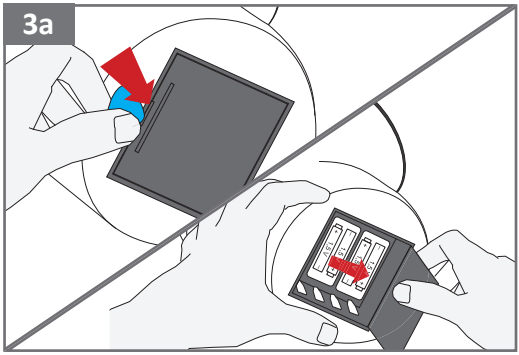


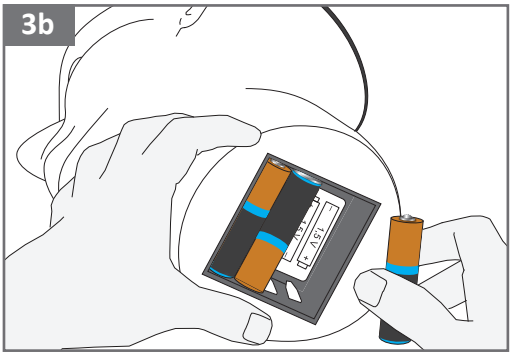












Using the Included Power Adaptor

Ensure the work area is clean and dry.
Place the trainer on a stable, flat surface.

1a Before first use, first select the appropriate plug fixing for your local mains supply from those included.

1b Insert the plug fixing into the adaptor with the large catch at the base of the adaptor first.

1c Align the small rectangular groove on the top of the fixing and press this into the adaptor so that it clicks into the spring lug.

1d Plug the low voltage cable from the adaptor into the power jack at the rear of the model.

Plug the low voltage adaptor into the mains outlet.
The simulator is now ready for use.

Removing the Shoulder Base

The shoulder base angles the head correctly during the examination procedure. The head may be removed from the base to access the battery compartment.

2a To remove the base, place one hand firmly on the shoulder base. Place the other hand firmly under the chin to grasp the head, and pull up.

2b To reinstall the head, reverse the procedure. Ensure that the power jack aligns with the black arrow ▼ on the label at the rear of the shoulder base.

Using Battery Power

Alternatively, the model may be powered by **4x AA batteries (not included).**

Use only 4x AA batteries (not included) in the battery compartment as indicated. Do not attempt to use any other type or size of battery. Other battery sizes may damage the model, and will invalidate your guarantee.

Do not power down and leave or store the trainer with batteries installed for prolonged periods. Always remove batteries before storage.

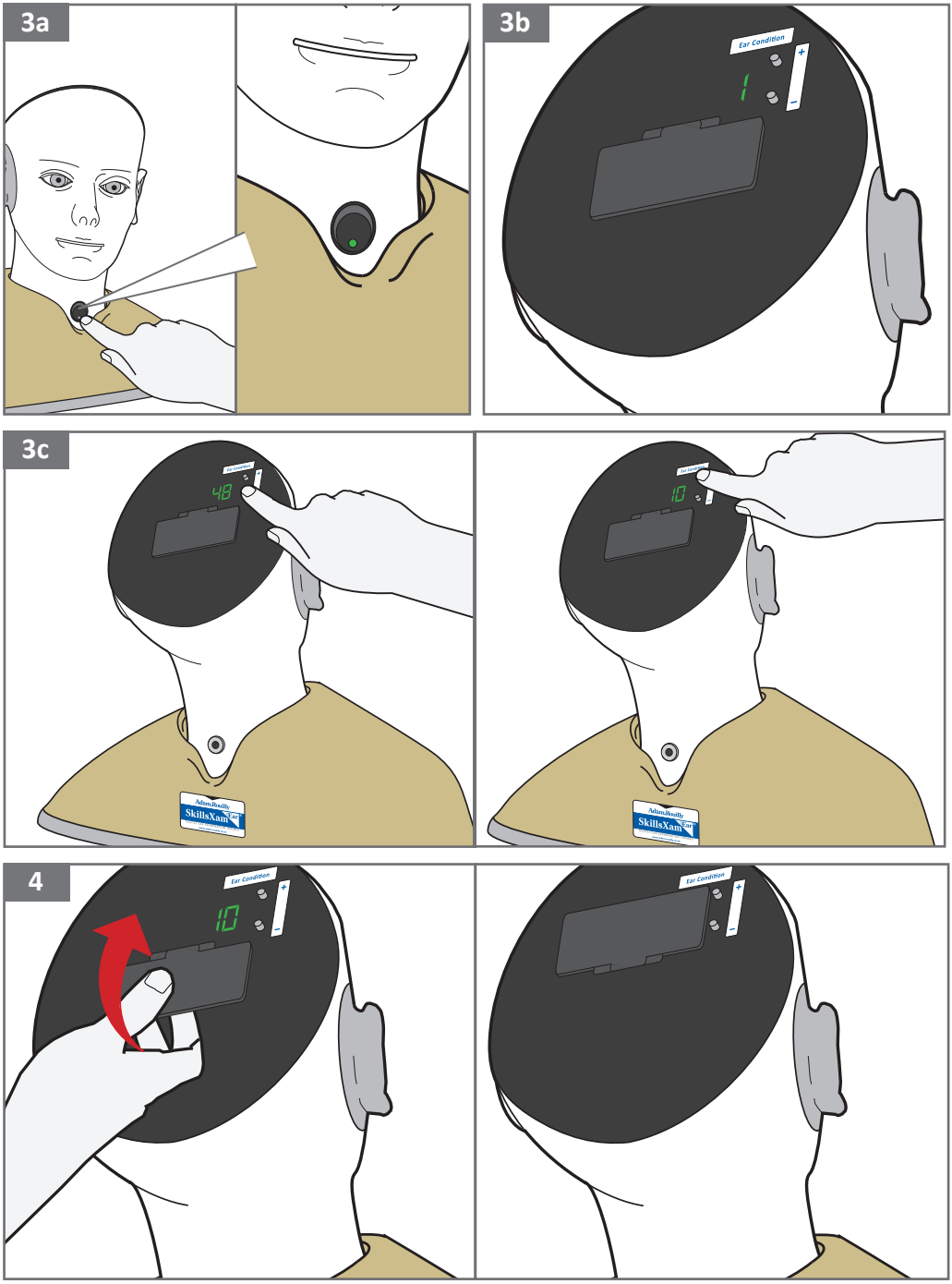
Re-chargeable batteries may be used to power the trainer. Please note however that the mains adaptor <u>will not</u> re-charge batteries.

3a Open the battery compartment at the base of the simulator by inserting the supplied blue tool into the small slot on the side of the compartment door.

3b Install 4x AA batteries (not included) as indicated on the diagram in the battery compartment.

Refit the compartment door.
The simulator is now ready for use.

Before Use



Power on and Select Conditions

3a Power on the model using the power switch.
The green indicator light on the switch will illuminate.

If the model fails to power on, check the batteries are fitted correctly and have sufficient power, or check the low voltage cable is attached correctly and the mains supply is turned on.

3b After a short delay, the ear LED condition number indicator will display a "**1**", indicating that Condition 1 is being displayed in the ear.

Whenever the model is powered off and then on again, the ear condition will automatically default to Condition 1.

3c Any of the 48 conditions may be set at any time.

To set a condition, simply press the Up (**+**) or Down(**-**) buttons until the desired condition number is displayed on the LED condition number indicator.

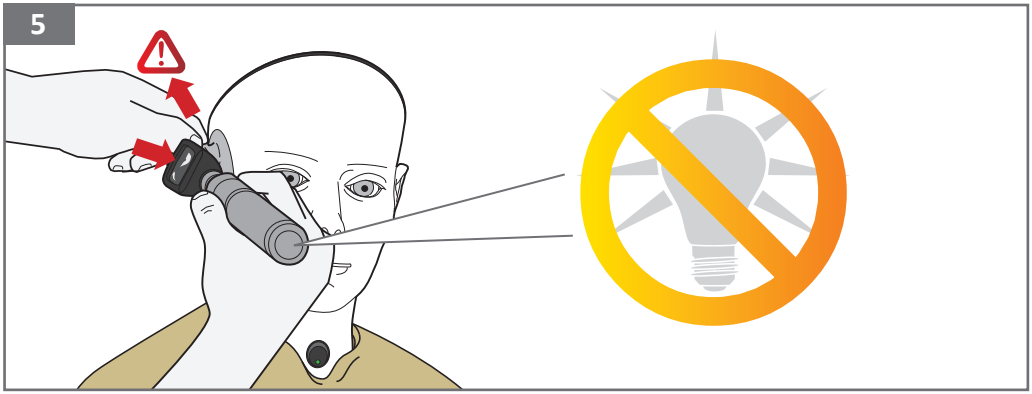
For detailed descriptions of each condition, please refer to page 14.

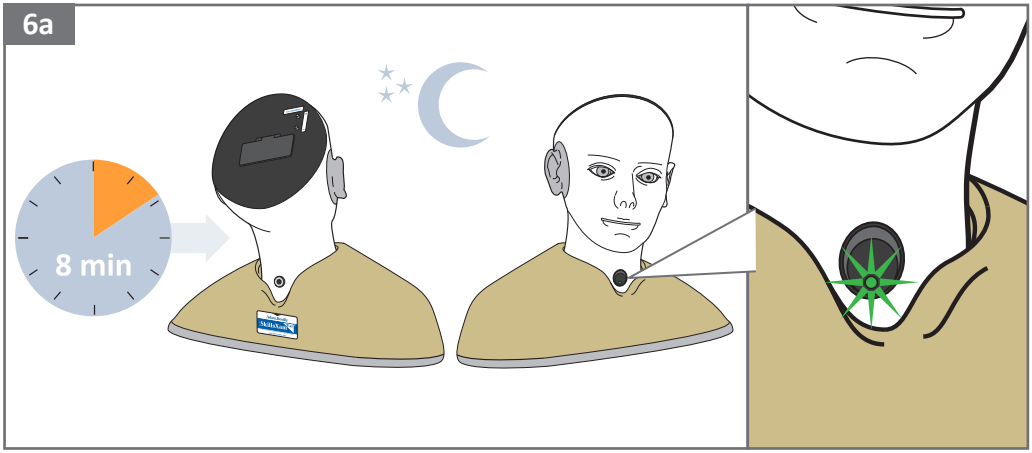
Using the Examination Cover

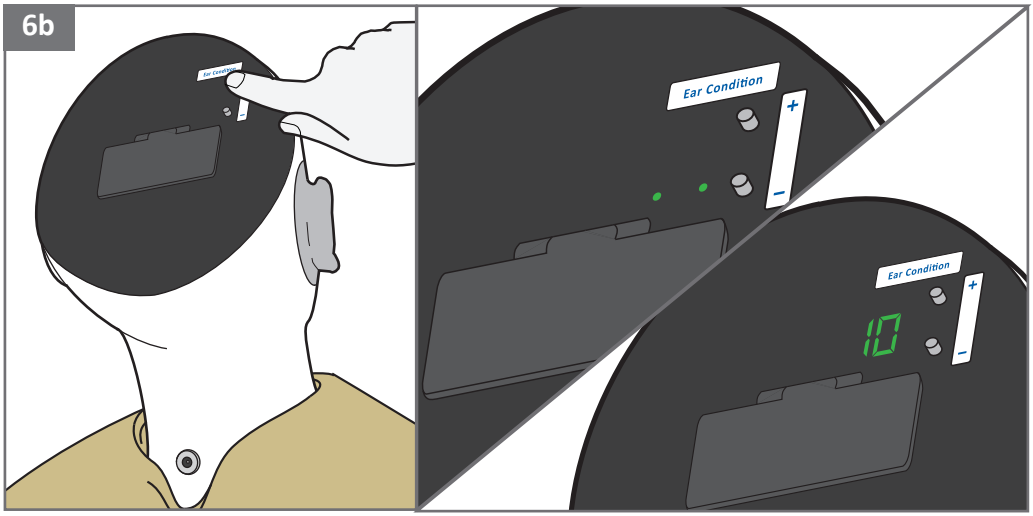
The ear LED condition number indicator may be hidden if required, e.g. under examination conditions.

4 To use, simply lift the hinged examination cover until it rests over the ear LED condition display.

During Use







Otoscope Use and Flexible Pinna

5 An otoscope (not included) may be used to view each condition - insert the speculum into the ear canal with care.

The flexible pinna may be manipulated to straighten the ear canal.

For best clarity of display of the conditions, we recommend setting the otoscope light to "off".

Treat the ear with the same care you would a patient. Excess force may cause damage to the model.

Sleep Mode

The model has an **automatic sleep mode** which turns off all displays to conserve power.

This is **functional** if **either battery power** or **mains power** is used.

During sleep mode, the last conditions selected on the ear are stored.

6a After a period of approximately **8 minutes** of no new conditions being selected, the main internal display and LED condition number indicator will switch off.

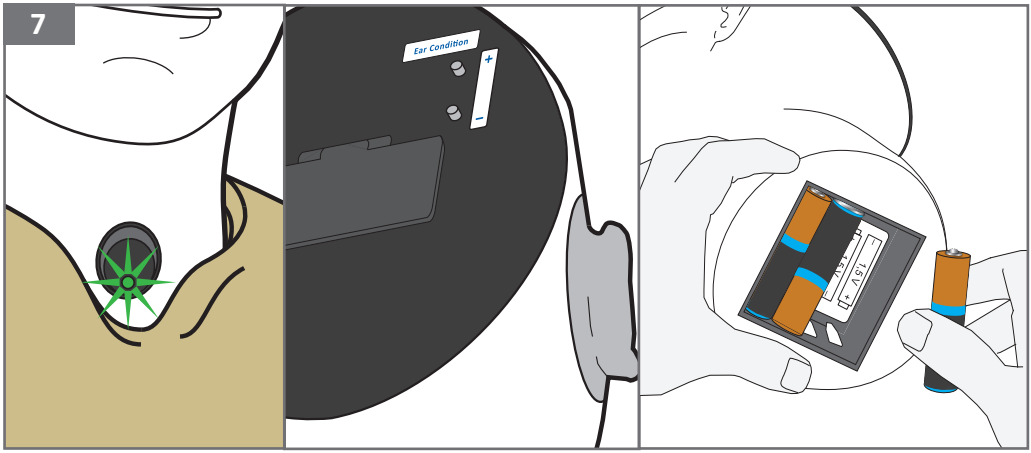
The **green power indicator light** on the power switch will **flash,** indicating that sleep mode is operational.

6b To wake, simply press either the Up (**+**) or Down(**-**) Button **once.**

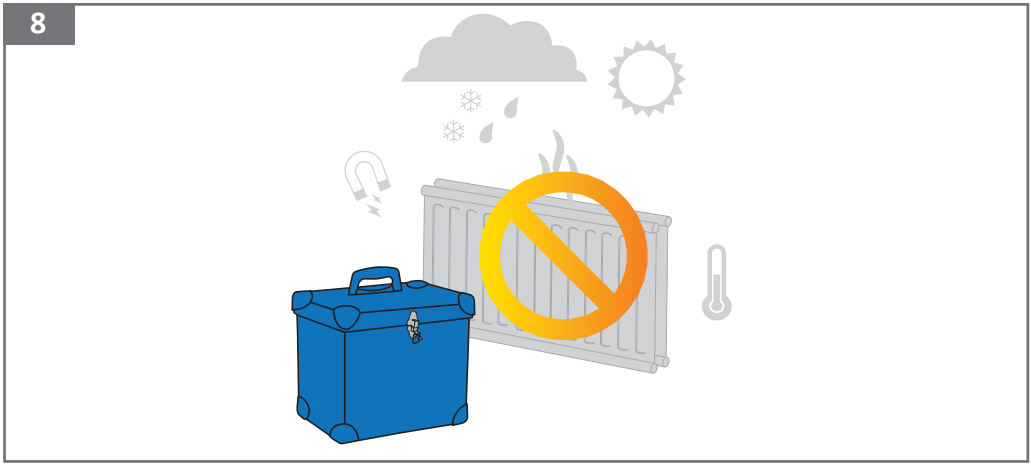
After a short delay, the LED condition number indicator display will show two "●" and then resume at the number of the condition which was last selected.

The model is ready for use again.

During Use



After Use



Low Battery Indication

7 If battery power is insufficient for the model to function correctly, low battery indication may display.

The green power indicator light will illuminate when the model is powered on however the LED condition number indicator display and main condition display will remain off.

Switch the model off and replace the batteries.

Do not power down and leave or store the trainer with batteries installed for prolonged periods. Always remove batteries before storage.

Using the Supplied Rigid Carrying Case

8 After use, or before transportation, the model should be placed with the head installed in the shoulder base and **upright** in the supplied **Rigid Carrying Case.**

The trainer contains sensitive electronic parts. Do not store near heat or where it may experience extremes in temperature, humidity or magnetic fields.

An Introduction to the Anatomy of the Ear

by Professor Tony Wright, Emeritus Professor of Otolaryngology

"Figure 1 is a normal, adult right tympanic membrane viewed with a wide angle telescope. The handle of the malleus (blue arrow) runs from the lateral process at the top to the umbo in the middle of the membrane – the pars tensa. Posterior, i.e. to the left as you look at the image, is the long process of the incus (red arrow). Above the white bump at the top of the malleus handle - the lateral process of the malleus - is the so called attic region of the ear drum - the pars flaccida (green arrow)."

"In Figure 2, I have removed the membrane and drilled away some of the roof of the ear – the outer attic wall or "scutum" (scutum is Latin for shield) to reveal the head of the malleus and part of the body of the incus. Descending from the body of the incus is the long process which connects with the head of the stapes. Just above the arch of the stapes is the facial nerve that runs across the deep wall of the middle ear, then turns downwards to leave the base of the skull by the stylomastoid foramen before it turns forwards to supply the muscles of facial expression e.g. smiling, closing the eyes, lifting the forehead, wrinkling the nose and so on.

Below the stapes is the round window niche protecting the round window membrane which moves in the opposite direction to the stapes with the vibrations of sound.

The chorda tympani nerve carries taste from front two thirds of the tongue and runs through the middle ear to join the facial nerve on its way to the brain. The nerve runs deep to the malleus handle and then across the long process of the incus before passing through the back wall of the ear canal to join the descending portion of the facial nerve."

"In Figure 3, I have now cut through the temporal bone to remove the ear canal along with the malleus and incus to show the inner wall of the middle ear and the honeycomb of air cells in the mastoid. Above is the lining of the inside of the skull the dura mater. You can see how thin is the bone in the roof of the middle ear – the tegmen- and that there is not much between a middle ear infection and meningitis or a brain abscess. The floor of the middle ear has the dome of the jugular bulb which is where the sigmoid sinus, the major venous drainage route of the brain, performs an "S" on the side, turn to leave the skull by the jugular foramen and become the jugular vein in the neck. The vein is usually covered with bone, as in this example, but can be bare of protection and high when it poses a risk during middle ear surgery.

Above the facial nerve is the smooth dome of the lateral semicircular canal."

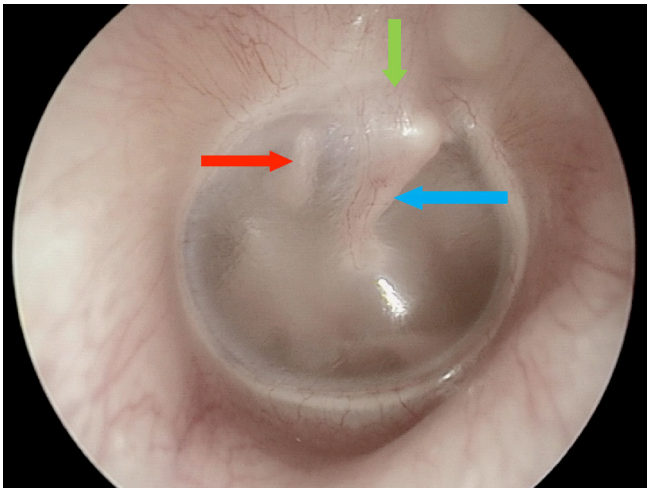


Figure 1

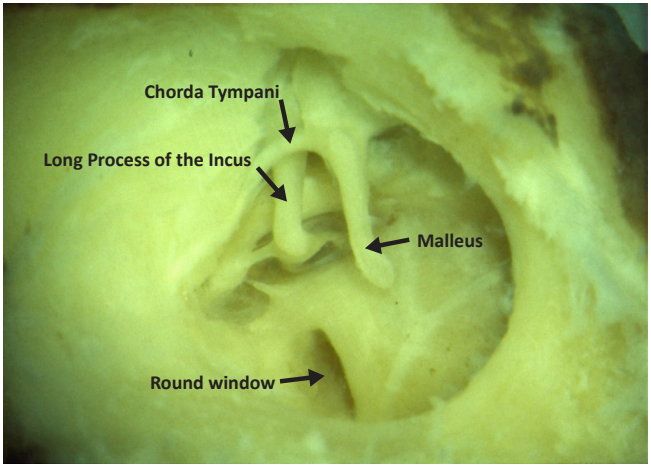


Figure 2

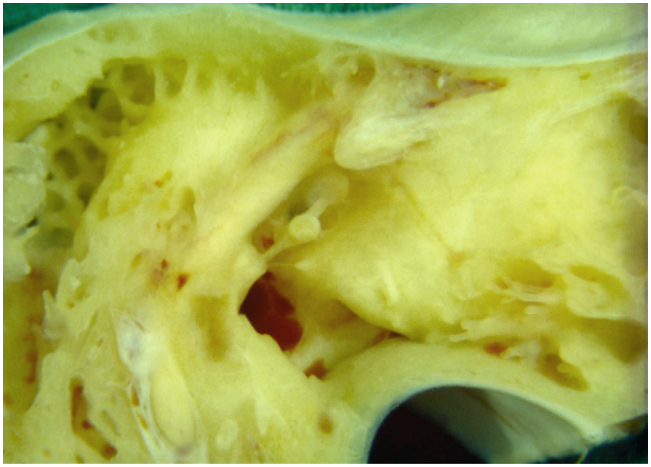


Figure 3

Conditions and Diseases of the Ear

by Professor Tony Wright, Emeritus Professor of Otolaryngology

Condition 1 NORMAL I

The main clinical features are:

- This a normal right tympanic membrane
- The handle of the malleus runs from the lateral process at the top to the umbo in the middle of the membrane – the pars tensa
- Posterior, i.e. to the left as you view the image, is the long process of the incus
- Above the white bump at the top of the malleus handle – the lateral process of the malleus - is the so called attic region of the ear drum - the pars flaccida

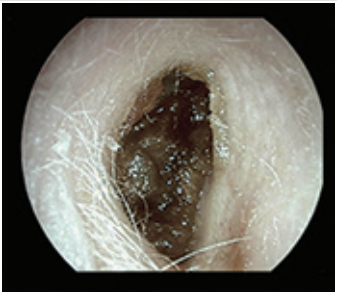
Comment:
The bright spot in front of and below the malleus is a reflection of the light source used to take the picture, and indicates the membrane is in a normal position.

Condition 2 NORMAL II

The main clinical features are:

- A further normal membrane
- The anterior recess cannot be seen as it is obscured by a prominent ear canal wall

Condition 3 EAR WAX (CERUMEN)



The main clinical features are:

- The very thin skin of the deep ear canal grows and migrates outward from the eardrum to the opening of the canal. This normally keeps the ear canal free of debris and maintains the resonance properties of the canal helping clarity and volume of hearing
- Close to the outside of the canal are modified sweat glands that produce a liquid with anti bacterial and anti fungal properties
- Further out are the fine hairs that produce a waterproof oily material

Comment:

The combination of skin, sweat and oil forms a thin film of "wax" which protects the ear canal. Variations of any of these three components alters the quality of the wax and may result in accumulation. Wax formation is a natural protective mechanism defending the ear against infection. Complete removal of the wax by irrigation or use of cotton buds can put the ear at risk of infection as the natural protective mechanism has been lost.

Condition 4 SWIMMER'S OSTEOMA

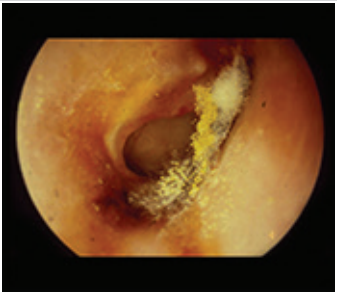
The main clinical features are:

- Often incorrectly called swimmers osteomas, these bony swellings in the ear canal should really be called exostoses but the name has become fixed
- The image also shows some tympanosclerosis of the membrane

Comment:

Swimmers, especially those in colder waters, often develop bony swellings in the ear canal. They are smooth swellings and generally cause few problems as the normal canal skin can migrate out over the smooth surface. Occasionally the swellings become very prominent, especially in the floor of the ear canal, so that the skin builds up and forms a mass of dead skin which may become infected if the ear gets wet.

Condition 5 FUNGAL EAR I



The main clinical features are:

- There is a perforation of the tympanic membrane in the background
- Earlier infections had been treated with antibiotic ear-drops. The consequence of this was a fungal infestation of the external ear canal with white fungal hyphae and yellow spores
- More commonly the spores are black – from Aspergillus niger – but these are not so photogenic

Comment:
Recurrence is common as spores are resistant to treatment – it is the hyphae that are sensitive.

Condition 6 FUNGAL EAR II

The main clinical features are:

- This is a fungal collection -Aspergillus niger -in a mastoid cavity
- Past the collection of white hyphae and black spores is the membrane with an anterior inferior perforation

Comment:
Moisture resulting from the perforation may have encouraged fungal growth.

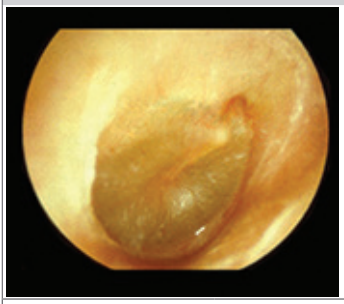
Condition 7 ACUTE VIRAL EAR

The main clinical features are:

- The deep canal is reddened but there is no fluid behind the membrane
- There is a dilation of the blood vessel on the membrane
- The light reflex is in the correct place

Comment:
The patient was a child and complained of a very sore ear and was slightly febrile but there was no discharge from the ear.

Condition 8 ACUTE SECRETORY OTITIS MEDIA I

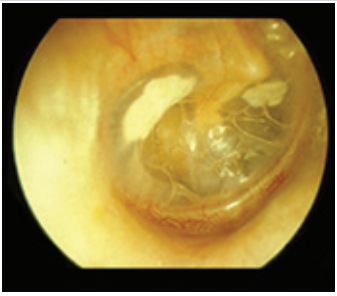


The main clinical features are:

- The tympanic membrane appears dull
- The light reflex is altered and there are a few blood vessels on the surface

Comment:
Following a viral upper respiratory tract infection – a common cold – the lining of the middle ear becomes congested and secretes clear mucus. The small cilia in the middle ear and Eustachian tube stop working and fail to clear the thin mucus in much the same way that the nose becomes runny. The middle ear fills with mucus and the hearing becomes dull, feels full and blocked and there may be discomfort.

Condition 9 RESOLVING SECRETORY OTITIS MEDIA



The main clinical features are:

- The patient had had a cold with a blocked uncomfortable ear
- Through the tympanic membrane can be seen bubbles in the residual fluid in the middle ear as the Eustachian tube has started to function again and air is getting to the middle ear as the mucus is being transported out to the nasopharynx
- There are two patches of tympanosclerosis in the tympanic membrane. These are the two white patches - a small anterior patch and a larger posterior patch

Comment:

The cold had resolved but the ear still felt blocked and then started making cracking and popping noises. The hearing would change from lying down to standing.
Tympanosclerosis is calcification in the fibrous tissue of the middle layer of the tympanic membrane and occurs when the membrane is stretched, the fibres tear and repair occurs. It is common following glue ear, middle ear infections, grommet insertion or any event that stretches the normal membrane sufficiently. Tympanosclerosis of this extent has little, if any, impact on the overall hearing.

Condition 10 ACUTE SECRETORY OTITIS MEDIA II

The main clinical features are:

- There has been active viral involvement of the middle ear cleft
- The membrane is bulging, and reddened with involvement of the attic and deep ear canal skin

Comment:

The condition is painful and the hearing is reduced.

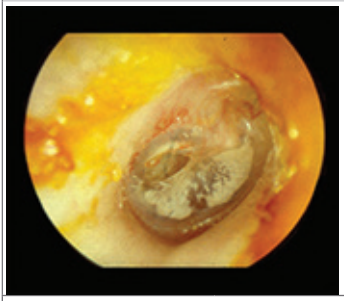
Condition 11 ACUTE SECRETORY OTITIS MEDIA III

The main clinical features are:

- There is a red inflamed membrane with blisters which is about to breakdown and discharge a muco-pus

Comment:
If the discharge from an ear is mucoid and sticky then there must be a defect in the membrane as mucus only comes from a mucosa and this is what lines the middle ear. The skin of the ear canal will produce a watery, serous discharge, not mucus.

Condition 12 PERFORATION FOLLOWING AN ACUTE SUPPURATIVE OTITIS MEDIA (ASOM)

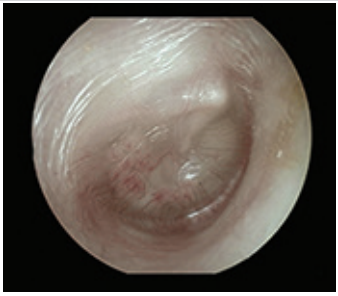


The main clinical features are:

- Posterior perforation of the Typanic Membrane
- Small granulation on scarred rim of perforation
- Patches of tympanosclerosis in the rest of the drum and middle ear mucosa, visible through the perforation is healthy

Comment:
This perforation is unlikely to heal because of the scarring at its rim.

Condition 13 CHILDHOOD GLUE EAR



The main clinical features are:

- Glue ear is defined as the presence of sterile fluid in the middle ear that has been present for three months or more
- The membrane is grey, dull and retracted with the malleus handle looking short because of the retraction
- There are radial blood vessels within the membrane
- There is no active infection

Comment:

There are many causes as to why the fluid is there and include viral infection, bacterial infection, allergy, cleft palate, cystic fibrosis and primary ciliary dyskinesia. Once the mucus is present, moving it along the Eustachian tube becomes a mechanical problem. The cilia of the Eustachian tube have to move the mucus out towards the post nasal space but air has to get into the middle ear to prevent a vacuum forming. If the system is completely full of mucus and the mucosa of the Eustachian tube is congested, then the air cannot get into the middle ear and the system "locks up".

Condition 14 GLUE EAR IN A CHILD WITH A DERMOID CYST IN THE EARDRUM

The main clinical features are:

- This child has glue ear, with a dull, retracted membrane, loss of the light reflex and radial blood vessels
- Coincidentally, there is also a small dermoid cyst in the membrane just posterior to the tip of the malleus handle

Comment:

The features of bilateral glue ear are:

- Hearing loss
- Speech delay
- Discomfort
- Recurrent ear infections
- Behavioural changes

Condition 15 ADULT GLUE EAR

The main clinical features are:

- The membrane is not inflamed but is yellow and dull
- There is an air bubble in the anterior superior quadrant

Comment:

The appearance had been the same for several months and developed following a particularly severe cold. There was an associated hearing loss with a sense of blockage in the ear and the patient's own speech sounding as if he had a "bucket on his head". The other ear was normal.

Condition 16 A STANDARD VENTILATION TUBE IN THE MEMBRANE

The main clinical features are:

- This image shows a standard Shah type ventilation tube, also called a grommet

Comment:

The grommet is in the standard position, namely the anterior inferior quadrant, where there are no important structures that can be damaged during insertion. Grommets do not usually stay in the same place as the migration of the membrane moves the grommet, despite its mass. The usual direction is posterior but sometimes they move superiorly in front of the handle of the malleus before they are ejected.

Condition 17 INFECTED MINI GROMMET WITH OTITIS EXTERNA SECONDARY TO A MUCUS DISCHARGE

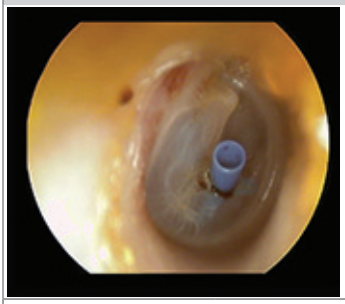
The main clinical features are:

- This ear has a Shah "mini" grommet in the inferior segment
- Clear mucus is filling the lumen of the tube
- Discharge from the ear canal

Comment:

Mucus which is still being produced in the middle ear, flows through the tube into the ear canal. In this patient the skin of the membrane and the deep ear canal has become inflamed and is prone to developing an *infected otitis externa.*

Condition 18 PERMANENT VENTILATION TUBE IN PLACE



The main clinical features are:

- The image shows an example of a Triune tube which contains three flanges at the end of the tube which sit on the inside of the eardrum and anchor the tube in place

Comment:

Whilst most children usually grow out of glue ear, some individuals have a tendency to recurrent glue ear with hearing loss, possible recurrent infections and retractions of the membrane. A standard ventilation tube may last six to nine months on average and if frequent re-ventilation is needed then a more permanent tube may be used.

Condition 19 LARGE PERFORATION OF THE TYMPANIC MEMBRANE

The main clinical features are:

- Large perforation of the membrane showing stapedius tendon and stapes head with a good connection between the incus and the stapes head

Comment:
A perforation of this size is associated with a moderate conductive hearing loss of up to 40 dB.

Condition 20 A POSTERIOR PERFORATION OF THE TYMPANIC MEMBRANE

The main clinical features are:

- A posterior perforation of the membrane
- The incudo stapedial joint has been eroded

Comment:
There is a 60 dB conductive hearing loss because of the ossicular discontinuity.

Condition 21 TWO SMALL TRAUMATIC PERFORATIONS FOLLOWING A BLOW TO THE EAR

The main clinical features are:

- Traumatic perforations from acute pressure changes - slaps, blast injuries, diving injuries - are usually in the anterior half of the membrane
- Perforations from infections are often in the posterior segment
- The light reflex is in the correct location

Comment:
Following a blow to the ear the patient noticed an immediate hearing loss, tinnitus, a feeling of blockage in the ear and pain. The pain settled quickly but the other symptoms took some while to recover as the two small perforations healed.

Condition 22 SUBTOTAL PERFORATION OF THE TYMPANIC MEMBRANE

The main clinical features are:

- There is a large perforation revealing the round window and the opening to the Eustachian tube.
- The handle of the malleus is intact and the head of the stapes is just visible

Comment:
This is associated with a significant conductive hearing loss of around 40 – 50 dB

Condition 23 PERFORATION WITH TYMPANOSCLEROSIS

The main clinical features are:

- A longstanding posterior perforation in a retraction with extensive tympanosclerosis involving the remnants of the membrane but also involving the middle ear
- There is tympanosclerosis on the head of the stapes and also the anterior arch as well as behind the malleus handle
- It appears that there is also tympanosclerosis involving the stapes footplate just below the facial nerve
- The long process of the incus is missing

Comment:
Associated with a 60 dB conductive hearing loss.

Condition 24 GROMMET SCAR HEALED

The main clinical features are:

- There is a triangular thin scar in the anterior inferior quadrant of the membrane
- This membrane is particularly thin and the chorda tympani can be clearly seen as can the long process of the incus
- There is also a small attic erosion that looks as if there is a perforation

Comment:
Close examination with a microscope will show a membrane but it is very thin. To help decide this in a patient with an otoscope, the otoscope should be tilted a little from side to side to see if there is a reflection from an intact membrane that moves and disappears with tilting.

Condition 25 TYMPANOSCLEROSIS OF TYMPANIC MEMBRANE

The main clinical features are:

- The image shows a healthy intact membrane with a small triangular scar in the anterior inferior quadrant typical of earlier grommet insertion
- To each side of this is a plaque of tympanosclerosis. This is a deposition of calcium in the fibrous, middle layer of the membrane. The membrane has three layers (as does the rest of the body: ectoderm, mesoderm and endoderm) an outer layer of squamous epithelium (skin) an inner layer of very thin mucosa, and a middle layer made up of fibrous tissue strands running radially, like the spokes on a wheel, and circumferentially like concentric rings

Comment:
When the fibrous layer is stretched and the links between the strands are broken, they heal by laying down small amounts of calcium hence the white appearance. Grommet insertion by adding mass to the membrane frequently, but not always, causes this appearance. However, any problem that stresses the membrane can cause this change.

Condition 26 POSTERIOR RETRACTION

The main clinical features are:

- A healthy looking, but rather thin membrane, with a posterior retraction which is just touching the long process of the incus and possibly being a thin, healed posterior perforation of the membrane with some retraction secondary to previous or current impaired Eustachian tube function
- The retraction at the posterior margin of the membrane is starting to cause a problem with the normal migration of the membrane skin. There is an irregular edge at the junction of the deep ear canal and the membrane and this altering the migration pattern

Comment:
The patient was virtually symptom free – with bad pain only on descent during aeroplane flight. The attic is also retracted although it is not accumulating keratin.

Condition 27 RETRACTION ONTO LONG PROCESS OF THE INCUS

The main clinical features are:

- There is a significant posterior retraction onto the long process of the incus, the head of the stapes and the tendon of the stapedius muscle
- There is a ribbon of keratin arising from the edge of the retracted membrane

Comment:
It is not obvious that there has been an earlier perforation with loss of the middle layer of the membrane to cause this problem. The retraction pocket has become deep enough to inhibit the migration of the skin of the surface of the membrane which has formed a trail spreading along the posterior wall of the ear canal.

Condition 28 RETRACTION WITH LOSS OF LONG PROCESS OF THE INCUS AND KERATIN TRAIL

The main clinical features are:

- This ear is difficult to evaluate due to the rather narrow deep canal
- There is a posterior retraction of the membrane with a trail of keratin running along the posterior wall of the canal
- There is loss of the long process of the incus so that the membrane is attached to the head of the stapes
- The trail of keratin along the posterior canal wall indicates early failure of migration

Comment:
There is very little hearing loss because the membrane is attached to the head of the stapes.

Condition 29 RETRACTION WITH LOSS OF LONG PROCESS OF THE INCUS

The main clinical features are:

- There is a deep posterior retraction of the membrane onto the head of the stapes and stapedius tendon
- There has been extensive loss of the long process of the incus and the membrane is touching the promontory above the round window niche. It is not possible to tell if the membrane is just touching the promontory or is really stuck to it, a situation that would be called an *adhesive otitis media*
- There is also a small attic retraction with the thin drum forming a dimple just anterior to the head of the malleus

Condition 30 POSTERIOR RETRACTION POCKET ONTO JUGULAR BULB AND WITH MIDDLE EAR FLUID

The main clinical features are:

- Posterior retraction with yellow sterile fluid in the middle ear and early loss of the long process of the incus
- There is a small patch of tympanosclerosis in the anterior inferior quadrant
- The round window niche is outlined just below the head of the stapes and stapedius tendon
- Below the round window and partly obscuring it, is the dome of the jugular bulb which is higher than normal and has lost its bony covering hence the bluish colour

Comment:
The sigmoid sinus inside the skull flows into the jugular vein in the neck, and lies just below the floor of the middle ear. This part of the vein is called the dome of the jugular bulb. It is usually covered with bone but in this case the bone is missing.

Condition 31 RETRACTION WITH EARLY KERATIN BUILD UP

The main clinical features are:

- There is a posterior retraction onto the round window and above this is a ball of keratin overlying and probably eroding the long process of the incus and head of the stapes. This is a *pars tensa cholesteatoma*
- The bony rim of the ear canal has been partly eroded and the normal migration of the skin of the membrane has been impeded as it cannot migrate around the sharp edges that have been created by the retraction and the erosion

Condition 32 CHILDHOOD ATTIC RETRACTION

The main clinical features are:

- An image of a child with recurrent glue ear
- The drum is dull and grey with radial vessels
- It is just possible to see a slight retraction at the site of an earlier grommet insertion
- Above the lateral process of the malleus is the pars flaccida and this has started to retract and get stuck down to the underlying head of the malleus and the various membranes, ligaments and nerves that cross the region

Comment:

When the glue ear resolves the attic region may find itself isolated from the middle ear by adhesions and scars so that ventilation by way of the Eustachian tube is impaired. Oxygen absorption continues from the lining of the mastoid and attic so retraction continues even though the Eustachian tube function has become normal.

Condition 33 DEEP ATTIC RETRACTION

The main clinical features are:

- The image is from a young adult who has grown out of the glue ear phase and the pars tensa looks normal.
- The attic region has become isolated from the middle and retraction of the pars flaccida has continued.
- There is a slight failure of migration of the attic skin which is shown as flakes of keratin at the anterior edge of the retraction.
- There is also some erosion of the outer attic wall

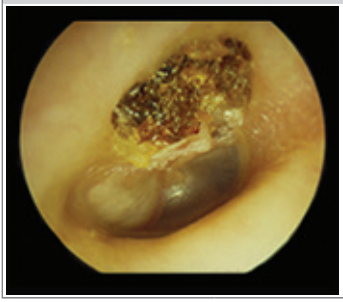
Condition 34 ATTIC RETRACTION ACCUMULATION KERATIN – UNDERLYING CHOLESTEATOMA

The main clinical features are:

- Failure of migration has occurred from this attic retraction pocket
- The dead skin has formed a brown crust with more bone erosion
- Beneath this is a cholesteatoma

Comment:
This is not wax, for wax is not formed in this part of the ear hence the old saying, “Beware of Attic Wax”.

Condition 35 EXTENSIVE ACCUMULATION WITH CHOLESTEATOMA IN MIDDLE EAR



The main clinical features are:

- There is an extensive attic erosion and an accumulation of keratin with a cholesteatoma deep to the dark surface layers
- The cholesteatoma is so extensive that it has expanded into the middle ear behind the pars tensa where it can be seen as a smooth white mass

Condition 36 WET CHOLESTEATOMA

The main clinical features are:

- This image shows the tympanic membrane with some tympanosclerosis
- There is a very large attic perforation with an extensive cholesteatoma, shown as the white mass
- There is a small red polyp arising from the roof of the attic
- The pars tensa is intact with some tympanosclerosis

Comment:
The patient had a long history of cholesteatoma.

Condition 37 CLEAN DRY RECONSTRUCTED MASTOID CAVITY

The main clinical features are:

- After the removal of an extensive cholesteatoma from the attic and mastoid air cells, cartilage from the outer part of the ear canal was used to cover over the open mastoid air cells and a large graft of temporalis fascia was used to cover the bare bone of the attic and roof of the ear
- The skin of the tympanic membrane could then migrate out over the fascia and cartilage to re-epithelise the cavity

Comment:
This image was taken one year after the original operation and the cavity is waterproof, self-cleaning and dry.

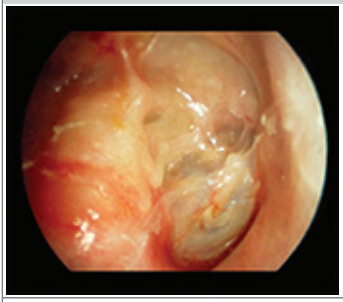
Condition 38 OLD STYLE MASTOID CAVITY WITH RESIDUAL CHOLESTEATOMA

The main clinical features are:

- This is an old style mastoid cavity with two large pearls of residual cholesteatoma overlying the lateral semicircular canal and facial nerve at the geniculate ganglion where the nerve turns inwards towards the brain and enter the internal auditory meatus
- Behind the posterior of the two pearls is a bony ridge with unhealthy mucosa
- There is a web across the anterior of the two pearls

Comment:
The bare mastoid bone has not been grafted and there is moist mucosa present.

Condition 39 MASTOID CAVITY WITH FISTULA INTO LATERAL SEMICIRCULAR CANAL



The main clinical features are:

- In this picture you can see the tympanic membrane remnant and the handle of the malleus
- Slightly above and posterior with a straight blood vessel on its surface is the exposed facial nerve
- Slightly above and posterior to the facial nerve is a greyish ellipse in the dense bone of the lateral semicircular canal

Comment:

This patient initially presented with a dead ear on the left side secondary to a cholesteatoma. This was treated surgically. Subsequently they developed vertigo with an offensive discharge from the right ear also caused by cholesteatoma. At surgery there was a fistula into the lateral semicircular canal and a dehiscent facial nerve. The patient had remarkably good hearing despite the loss of the malleus head and incus.

Condition 40 CONGENITAL CHOLESTEATOMA

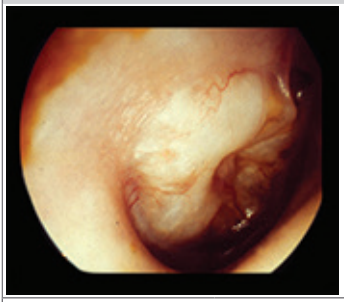
The main clinical features are:

- Image shows a congenital cholesteatoma in an eighteen-month old patient
- A congenital cholesteatoma is defined as a cholesteatoma in the middle ear without a perforation or retraction of the membrane
- There is a smooth rounded pearly white mass behind the membrane

Comment:

These cholesteatomas arise from small, residual embryonic clusters of squamous epithelium that fail to regress and disappear as they normally do. Subsequently they grow slowly and cause no symptoms until they make contact with the ossicles and cause a slowly progressive conductive hearing loss which may well not be noticed as the other ear is normal. Congenital cholesteatomas usually develop in the anterior superior quadrant of the middle ear. This example was cleverly spotted by a health visitor.

Condition 41 LARGE CONGENITAL CHOLESTEATOMA



The main clinical features are:

- The image shows a large congenital cholesteatoma
- There is a pearly white mass bulging the posterior half of the membrane although it can also be seen behind in the anterior superior quadrant

Comment:
This large congenital cholesteatoma was not noted as the other ear was normal, the hearing was effectively normal and speech and language development was unaffected. There was a significant conductive hearing loss in this ear.

Condition 42 EAR CANAL CHOLESTEATOMA I

The main clinical features are:

- This is a rare condition when the skin of the ear canal loses its usual characteristics of being only a few cells deep and of migrating outwards towards the external opening of the canal
- In this condition a small area of canal skin reverts to a primitive skin type that does not migrate and starts to erode the underlying bone

Comment:
The cause is completely unknown. Once the collection of dead skin - keratin - is removed there is usually erosion and bare bone. There are sharp, bony edges to the erosion and the further prevents the normal migration of the deep ear canal skin and more keratin accumulates.

Condition 43 EAR CANAL CHOLESTEATOMA II

The main clinical features are:

- The accumulation of keratin has been removed
- Erosion of the bone of the floor of the canal, with sharp edges and bare bone

Condition 44 KERATOSIS OBTURANS

The main clinical features are:

- The skin of the tympanic membrane and deep ear canal usually migrates outwards to keep the deep ear canal clean and free of debris
- In keratosis obturans this migration fails in the deep canal and the dead skin – keratin - accumulates and forms a mass which gradually expands the bony ear canal because of the constant pressure
- The floor of the canal has been eroded and the tympanic annulus is clearly visible with a thin layer of skin below it being all that separates the ear canal from the middle ear
- The bone covering the attic region is also missing

Comment:
The patient presents with hearing loss and a plug of skin in the canal, which can become infected with a foul discharge.

Condition 45 GLOMUS TYMPANICUM TUMOURS

The main clinical features are:

- The classic description is of the appearance of a rising sun and if you observe closely they can usually be seen to pulsate
- This is a glomus tympanicum arising from the middle ear and the lower limit of the tumour can be seen

Comment:
Vascular growths in the middle ear can arise from chemo receptor tissues that lie in the middle ear on the promontory - glomus tympanicum tumours - or on the dome of the jugular bulb in the floor of the middle ear - glomus jugulare tumours. They often present with a pulsatile tinnitus and a slight conductive loss. Whilst they are very slow growing and not malignant they can eventually erode nearby structures such as the inner ear, facial nerve and the lower cranial nerves. They are very vascular and cause torrential bleeding if cut.

Condition 46 GLOMUS JUGULARE TUMOUR

The main clinical features are:

- A very vascular tumour which arises from the dome of the jugular bulb in the floor of the middle ear and gradually grows up into the middle ear with the so called "rising sun" appearance
- It is very important to distinguish between the more benign g*lomus tympanicum* and the more extensive *glomus jugulare*

Comment:
They often presents with a pulsatile tinnitus and a slight conductive loss.

Condition 47 FOREIGN BODIES

The main clinical features are:

- Many foreign bodies can end up in the ear canal
- With new technology hearing aids that have the loud-speaker in the ear canal, the dome that covers the loud-speaker sometimes disconnects from the speaker unit when the aid is removed from the ear
- Nowadays, this is probably the most common foreign body

Comment:
Spherical or rounded foreign bodies such as ball bearings, miniature chess men and the like, need specialist referral and removal because of the risk of them slipping deeper into the canal and damaging the membrane.

Condition 48 AURAL POLYP

The main clinical features are:

- A soft, vascular swelling completely blocking off the ear canal in this case so that it is not possible to see its origin

Comment:
Aural polyps can arise from the lining of the middle ear by way of a perforation of the pars tensa. They can also arise from exposed bone or from attic erosions from cholesteatoma.

This manual has been produced solely as a guide to the conditions on this trainer. This manual is not a diagnostic tool for treatment planning. This manual supersedes all previous versions of the Adam,Rouilly Digital Ear Examination Manual.

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