How to buy microscopes

The purpose of this guide is to provide background information which will allow you to make an informed choice when selecting your operating microscope. We also wish to eliminate some of the “jargon” relating to surgical microscopes.

Surgical Operating Microscopes (SOM)

Surgical operating microscopes use a series of glass lenses to produce an enlarged image of an object that is too small to be seen by the naked or unaided eye.

The most obvious benefit of SOM is the magnification and improved lighting which provides the surgeon the view to accurately perform his surgery with precision. At higher magnifications (>5X), there is no doubt that operating microscopes offer superior magnification than loupes, as well as other benefits. These include a better working posture and reduced musculoskeletal strain, and the ability to display and record still or video images which is helpful for training, medico-legal purposes and patient information and involvement.

The role of surgical operating microscopes (SOM) in Dentistry and Surgery

In dentistry, the introduction of SOM to endodontics (root canal therapy) has dramatically changed the practice of the specialty. It allows access into the pulp chamber, ability to locate the canals and the presence of fractures as well assess marginal integrity of restorations. With the SOM the surgical site can be visualized and treated with exacting precision.

In surgery, it has provided surgeons with a way to perform microsurgery - surgery that is performed on very small structures, such as blood vessels and nerves, with specialised instruments under an operating microscope.

Numerous surgical specialties use microsurgical techniques. For example, ear nose and throat (ENT) surgeons perform microsurgery on the small, delicate structures of the inner ear or the vocal cords. In opthalmology, removal of cataracts, corneal transplants and treatment of glaucoma all depend on the use of an operating microscope. Plastic surgeons use microsurgery to repair minute blood vessels, nerves and tendons with the aid of a SOM. Neurosurgeons can treat vascular abnormalities found in the brain, and cancerous tumours can be removed.

The basic components of a microscope are:

1. The eyepiece

This consists of a cylinder containing two or more lenses to bring the image into focus for the eye and is located at the observer end of the microscope tube.

2. Objective lens

This is the cylinder containing one or more lenses to collect light from the operative field and is located at the end closest to the operation site.

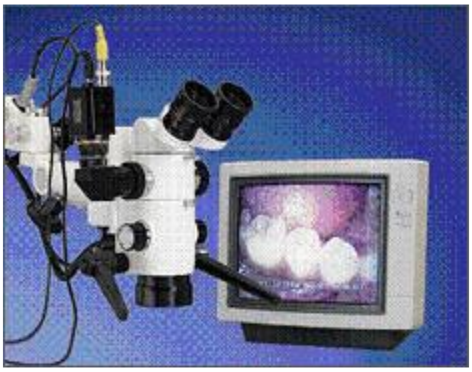
3. The illumination source

This is usually connected to a 100 to 150 watt halogen or Xenon light source via a fiber optic cable and is adjustable. In most operating microscopes, this is achieved by coaxial illumination which means that the light is transmitted through optical system rather than shone onto the operating site externally. ***Coaxial illumination*** is superior since it reduces shadows and provides more homogenous and intense illumination of the object.

Surgical Operating Microscopes are stereo-microscopes. This means that there are two separate optical paths for the left and right eyes which view the operative field at slightly different angles. This gives excellent three dimensional vision (stereoscopic vision) and is ideal for work that involves fine dissection and movements such as microsurgery.

As with loupes, working distance and depth of field here are important qualities. Both are inversely related to the resolution, which is the ability to distinguish two objects close together.

The **magnification** of an optical microscope is the product of the powers of the eyepiece - usually about 10X, and the objective lens being used. Most microscopes come with three to fives steps of magnification ranging from approximately 3X to 27X.



Other options may be added to the microscope such as an assistant's viewing tube which may be monocular or binocular, digital video or still cameras. Recently, various video CCD cameras have been integrated inside SOMs, allowing the images to be displayed on a monitor. These options provide a very powerful tool that can be used for teaching, patient education, and medical legal purposes.

This is achieved by a **beam splitter** which is an optical device that splits a beam of light in two. The beam can be split 50:50 or 20:80. One portion of the beam is diverted to the eyepiece and the other to a camera or the assistant viewing eyepiece.

Anatomy of the SOM
Head
This is the part with the optics (see above) and illumination. The magnification can be changed either manually by adjusting a knob on the head or in some models via a foot pedal. The head can be inclined at an angle, straight or adjustable. This depends on the type of surgery it is used for. In ENT surgery, a straight head is preferred whilst in dentistry an inclined head is preferable. The head also contains the handles to manoeuvre it into the correct position.
Arm
SOMs heads are attached to an arm of variable length which allows it to be manoeuvered into the correct position. There is usually a short and a long arm joined by a hinge.
Base or mounting
SOMs are usually mounted on a sturdy base with castors which makes it portable. However other options include floor or wall mounting and even a table clamp which allows it to be mounted on a table top.

Commonly used Jargon
Chromatic aberration is the tendency of a lens to bend light of different colours by unequal amounts (dispersion of a lens). Chromatic aberration of a lens is seen as "fringes" of colour around the image. This can be reduced by combining more than two lenses of different composition. This is known as apochromatic lenses which are used in some microscopes or can be added as an optional extra.
Focal length usual refers to the focal length of the objective. In most SOM the default focal length will be 250mm, which means that the object will come into focus 250mm from the object which governs the working area between the microscope and the object. Different focal length options are available depending on the type of surgery being undertaken. For example, in deep cavity surgery such as laryngeal surgery or neurosurgery, a longer focal length will be required to allow space for both hands to work under the microscope and also have additional focal length to reach down into the surgical cavity. For neurosurgery, a focal length of 400mm may be required and for laryngeal surgery 300mm may be required.
Diopter adjustment refers to correction of vision for users with near and far vision. Most microscopes have an adjustable diopteric correction from -7 to +7.
Lux is the unit which refers to the intensity of the light. For example:
• 10 lux is equivalent to a candle 30cm away
• 80 lux is equivalent to the light intensity in a hallway or toilet
• 400 lux is equivalent to a brightly lit room or office

• 32,000 lux is equivalent to the minimum intensity on an average day
• 100,000 lux is equivalent to a bright day

Most microscopes achieve a 30-50,000 lux light intensity using a halogen or Xenon light source.

Conclusion

Both for endodontic work and for microsurgical procedures an operating microscope is an essential piece of equipment that will provide unparalleled magnification and illumination of the operative site. When purchasing an operating microscope you need a high quality, high performance system that offers you value for money. We supply superior products and most importantly we provide a high level of backup service.

These are just a few of the facts and product features of operating microscopes. We retail a full range of microscopes. Please go to the microscope product page for full details of our product range and to purchase products. Alternatively, if you would like to speak to someone about our microscopes, please contact us directly on Tel: 0844 272 1918.