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Microscope Basics

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The modern operating microscope allows surgeons to perform true microsurgery with excellent clarity and precision (Figure 1-1). The principles of microscopy are often underemphasized in most ophthalmology residency programs. It is important for surgeons to understand the basics of the operating microscope before embarking on intraocular surgery. Your comfort level with the various capabilities of your particular scope will translate into better visibility and increase surgeon comfort during surgery. Additionally, it requires hours of practice and experience working underneath the operating microscope before becoming comfortable with the spatial relationships that are affected by using the operating microscope. This is similar to one's comfort level using operating loupes for the first time (see Chapter 13).

This chapter serves as an introduction to the basics of an operating microscope. There are multiple scopes available on the market, each of which has particular features that may be important depending on the type of surgery. The various microscope features specific to an individual manufacturer are beyond the scope of this chapter. This chapter focuses primarily on anterior segment surgery.

Basic Concepts

An ophthalmic surgical microscope is an instrument that combines lenses and allows a surgeon a stereoscopic, magnified, high-quality image of the small structures around and within the eye. An operating microscope is essentially a binocular with a close-up lens consisting of binocular viewing system (oculars), an image inverter, beam splitter, magnification system, light source, and an objective lens. Operating microscopes can be floor or ceiling mounted. Illumination of the surgical field is generally from a coaxial light source. The controls for various functions of the microscope are present on a foot pedal as well as on the microscope itself. A well-designed microscope should provide an excellent image that is comfortable to focus on and allows for a surgeon's hands to be free to operate with.

Optics

An easy way to think about the optics of a microscope is to imagine two telescopes that are mounted together. Traditionally, telescopes are composed of an eyepiece and an objective lens. Telescopes are focused for distance, so additional elements are needed to allow close focusing. In an operating microscope, these additional elements are prisms and a magnification changer.

The eyepiece works as an astronomical telescope and provides the majority of the magnification. An astronomical telescope is made of two concave (positive) lenses that result in an inverted image. The inverting prism compensates for the inverted image produced by the eyepiece. The magnification changer is typically a Galilean telescope system in which different lenses allow for varied magnification. A Galilean telescope is composed of a concave (positive) and a convex (negative) lens that allow for magnification in a compact fashion. In modern operating microscopes, the magnification system is composed of computerized controlled lenses that allow continuous control of magnification via foot pedal control. The final aspect of the optical system is the objective lens. Choice of objective lens is dependent on the type of surgery and working distance required. The working distance (the distance from the objective lens to the patient's eye) is equal to the

Garg S, Steinert RF.
Ophthalmic Microsurgery: Principles, Techniques, and Applications (pp 3-13).