Resident’s Corner: Lasers and Ocular Tissue
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Since 1961, when the ruby laser was first used to photocoagulate rabbit eyes,\(^1\) lasers have been used to alter ocular tissue from the cornea to the retina. It’s very likely that you know the variety of different applications of lasers, but just how exactly do they work on ocular tissue?

In the simplest of explanations, a laser is produced by exciting an active medium such as a gas (ex: argon) or solid encased in crystal (ex: neodymium: yttrium aluminum garnet). The excited photons then create a cascade of energy transfers known as stimulated emissions using a series of reflective mirrors to control the light amplification.\(^2,4\)

Within tissue, incident light can either be absorbed or scattered.\(^5\) Although it’s dependent on the properties of both the laser and the ocular tissue, there are three main laser-tissue interactions that commonly occur in ophthalmic procedures.

1. **Thermal**: Absorption of light by a tissue results in an increase in temperature, leading to denaturation or necrosis. Pigments such as melanin or proteins like hemoglobin are particularly susceptible.\(^3,4\)
   - **Clinical applications**: panretinal photocoagulation, argon laser trabeculoplasty.

2. **Photodisruption**: Short pulses (<30 nanoseconds) of infrared energy ionizes molecules, which produce shock and acoustic waves that mechanically disrupt tissues.\(^3,4\)
   - **Clinical applications**: peripheral iridotomy, posterior capsulotomy, femtosecond laser (ex: creation of LASIK flap with IntraLase).

3. **Photoablative**: Ultraviolet radiation (<300 nanometers) in short intervals (<20 nanoseconds) can break chemical bonds with high precision.\(^3,4\)
   - **Clinical applications**: Reshaping of corneal stroma during refractive surgery using an excimer laser.

Reference:

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