A GREAT IDEA
Gerd Meyer-Schwickerath (1920-1992) and his role in the history of retinal photocoagulation

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Laser photocoagulation is a crucial therapy for numerous retinal diseases. Photocoagulation involves protein denaturation and is the result of tissue absorption of radiant energy with conversion to heat.

The effect of solar light on the retina has been known for centuries. Thus, the history of retinal photocoagulation dates to 400 BC, when Plato described the dangers of viewing the sun directly during an eclipse. The first description of a central scotoma following solar burn of the macula dates back to Theophilus Bonetus, who practised in Geneva during the 17th century. It was the observation of this phenomenon that inspired the earliest experimental research on fundus photocoagulation. Both Czerny and Deutschmann, in 1867 and 1882, respectively, used a concave mirror and a convex lens to focus sunlight through dilated pupils of rabbits, creating thermal burns in the animals’ retinas.

In 1927, Maggiore performed the first experimental photocoagulation of the human retina focusing sunlight for 10 minutes into an eye that was to be enucleated because of a malignant tumour. In 1945, the Spanish ophthalmologist José Morón had the idea to close retinal tears using a light source through the pupil to produce a retinal burn similar to that of diathermy. However, although this first known experience of retinal therapeutic photocoagulation appeared in his doctoral dissertation (Madrid 1946), the results were not published until 1949.

In the meantime, the German ophthalmologist Gerd Meyer-Schwickerath (1920-1992) conceived the idea of using photocoagulation to make burns in the retina to seal holes and prevent retinal detachment. He was developing a diathermy machine to treat retinal detachment while he was supervising a medical student who had received a macular burn from the 1945 solar eclipse. These circumstances inspired him to develop, in 1947, a sunlight photocoagulator, an instrument of mirrors and lenses that used sunlight. He later included a heliostat so the sun would remain within the optical axis of the tool despite the earth’s movement. He had to bring the patient on the roof of the Hamburg Hospital, where the sun shines early. In 1949 he presented his essays about the resolution of three cases of retinal detachment successfully treated with photocoagulation. Because the system was so weather-dependent, Meyer-Schwickerath began working with other light sources such as a high-intensity carbon arc. This carbon arc photocoagulator was used clinically on several hundred patients between 1950 and 1956. That system was far from perfect, and Meyer-Schwickerath and Littman in conjunction with Zeiss, assembled the first xenon-arc coagulator in 1956. This was used to treat anterior and posterior segment tumours, retinal tears and macular holes, as well as retinal vascular diseases. Since then, Meyer-Schwickerath is considered the father of modern photocoagulation.

Although incandescent light utilised by the first photocoagulators was effective and came into widespread use, it lacked precision, required long duration of exposure, was painful and resulted in multiple complications. Therefore, this light source would later be replaced by the invention of the first ophthalmic lasers, which instigated the widespread use of photocoagulation for treatment of retinal diseases.

As the first photocoagulators produced light comprised of various wavelengths within the visible and infrared spectrum, full-thickness retinal burns were achieved rather than tissue-specific burns that were later made possible by laser (single wavelength) photocoagulators. The first functioning laser, whose active laser material was a ruby, was invented by Maiman in 1960. It became clear that the laser could be an excellent source for photocoagulation. The first clinical ophthalmic use of a laser in humans was reported by Campbell in 1963 and Zweng in 1964.

The ruby laser they employed operated in a pulsed mode because the thermal characteristics of the ruby crystal prohibited continuous operation at the power levels required for retinal photocoagulation. Use of the pulsed laser often led to the formation of retinal haemorrhages and was poorly absorbed by hemoglobin. The argon laser, developed in 1964, provided an emission spectrum that is absorbed well by hemoglobin when it is used in a continuous mode. Later, in 1968, L’Esperance introduced the argon laser which led to the worldwide use of ophthalmic laser photocoagulation.