EVOLUTION OF THE SLIT-LAMP BIOMICROSCOPE (1820-1960)

Dr Rahul Chakrabarti, FRANZCO
RANZCO Congress, Sydney, 2019
PRE-EMERGENCE OF THE SLIT-LAMP

- Johannes Purkinje (1823)
  - Attempts to develop a type of slit lamp using a hand-held lens to focus strong illumination

- Louis De Wecker (1863)
  - Portable ophthalmomicroscope
  - Combines small monocular microscope
  - Rests against patient face with attached condenser lens
BINOCULAR OPHTHALMOSCOPE

Felix Giraud-Teulon (Paris, 1861)
- Illumination from gas or oil lamp
- Difficult to use, not popular

John Laurence and Charles Heisch (London, 1862)
- Binocular ophthalmoscope
- Adjustable inter-pupillary distance

Walter Thorner (Emil Busch Company, Rathenow Germany)
- Eliminates reflexes from the cornea

Allvar Gullstrand (Jena, 1910)
- Aimed to employ binocular eye piece to view the fundus in 3-Dimensions
- Table mounted, free of annoying reflexes

Images: Keeler, Dua (2014) The Eye in History
SIEGFRIED CZAPSKI (1897)

- Siegfried Czapiski (1861-1907), of Carl Zeiss (Jena, Germany)
- Table mounted, binocular microscope
- High, interchangeable magnification
- First time allowed the stereoscopic examination of the cornea under magnification
- Illumination (projected obliquely) via a weak, diffuse beam of light

ALLVAR GULLSTRAND (1911)

- Allvar Gullstrand (1862-1930)
- Nobel Prize for Medicine and Physiology 1911 (for the optical schematic system of the eye)
- Nerst Slit Lamp (Carl Zeiss) – First instrument to feature slit illumination
  - Nerst glower (Walther Nerst 1897, University of Gottingen)
  - Early form of incandescent lamp, heated ceramic rod
  - Glowing light focussed onto a mechanical slit aperture
  - Beam projected through a double convex lens

Images: Zeiss.com, and Richard Keeler (RCOphth Museum)
Otto Henker (1874-1926)
Combined Czapski’s binocular microscope with Gullstrand’s slit-lamp

Leonard Koeppe (1915) - Idea to combine Gullstrand’s slit lamp with binocular microscope of Czapski

Resulting in the first Slit Lamp Microscope
Devised an arm to support the focusing loupe
Allows “hands free” corneal inspection

Images: Google 2019
NERST SLIT LAMP
AFTER KOEPPE

- Microscope mounted on a base and placed on glass table for smooth positioning
- Nerst lamp unit mounted on double arm
- Allowed one to swing the lamp around the microscope from one eye to another
- Condensing lens positioned at end of the arm holding the lamp

Image: Richard Keeler (2017)
Challenge was to eliminate/reduce reflexes when examining the fundus

- Walter Thorner (1874-1948)
- Allvar Gullstrand

Principle – path illuminating the fundus should not overlap the visual path

- Small, narrow, short slit of illumination 1.5mm at an angle in margin of patient’s pupil
- Fundus observed monocular or binocularly through central 2.4mm of dilated pupil

Image: Richard Keeler, RCOphth museum collection (2017)
LARGE SIMPLIFIED OPHTHALMOSCOPE (1919)

- Based on Gullstrand’s earlier models
- Reflex-free ophthalmoscope
BIRTH OF THE HAAG-STREIT SLIT LAMP

- Alfred Streit
  - In effort to improve the ophthalmometer, designs the arc light focal lamp (1918)
  - Brighter, bluish colour, increases light yield
- Wilhelm Haag
  - 1929, writes to Hans Goldmann (Bern University)
  - Produces first model for the ophthalmology congress (1933)
Joystick controlled mechanism
- Hans Goldmann (1899-1991)
- Joystick controlled mechanism
- Coupling the focusing of the illumination system and corneal microscope

Vertically mounted illumination system, swivel axis
- Comberg (1933)

Image: Zeiss.com
HANS LITTMANN (1950)

• Hans Littmann (1908-1991), physicist
• Combines Goldmann and Comberg systems
• Rotatory magnification changer (Galilean telescope)
• Swing the illumination system around (useful for contact lens examinations)
• Fully manouvreable joy-stick
• Mobile stand on wheels
HAAG-STREIT
SLIT LAMP 360
MODEL (1933)

- Simple construction
- Single lever on the side of the slit lamp
- Allows instrument to move horizontally in all directions with one hand
- Other hand free to use vertical adjustment screw

Image: Haag-Streit (2008) 150 Years of Haag-Streit
Prof Goldmann and Dr Theodor Schmidt - Vertical adjustment of illumination (inclined to 15 degrees), completely pivotable in front of the microscope

- Lamp placed uppermost portion
- Allows slit to be made narrow, sharp
- No cooling device needed to protect lamp house from overheating
- Direction of slit can rotate horizontal
- Important accessories – Goldmann tonometer

Image: Haag-Streit (2008) 150 Years of Haag-Streit
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REFERENCES

• Wernly, S. 2008. 150 Years of Haag-Streit 1858-2008, Stampfli Publikationen, Bern, Switzerland.


• Keeler, R; Dua HS. 2018. The Eye in History, Royal College of Ophthalmologists, London, United Kingdom.