http://www.vision-and-eye-health.com/cataract-surgery-techniques.html

Intracapsular Surgery of Cataract

Cryo-Extraction

Work of Krawicz & Kelman

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Monash Health
Intern

5th century BC – 18th century
Couching

Figure 1. Couching
http://www.vision-and-eye-health.com/cataract-surgery-techniques.html

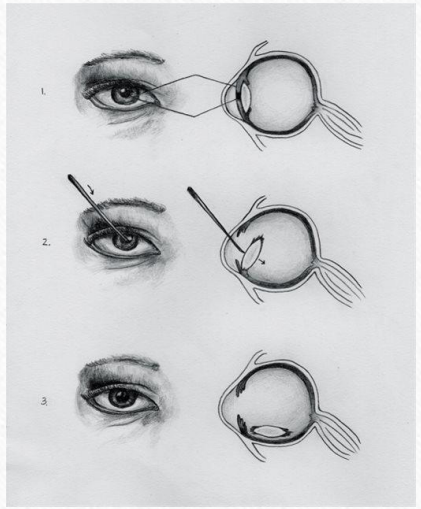


Figure 2: Couching technique
http://www.uniteforsight.org/traditional-eye-practices/module3

18th century

Intracapsular cataract extraction (ICCE)

1753: Samuel Sharp first documented ICCE

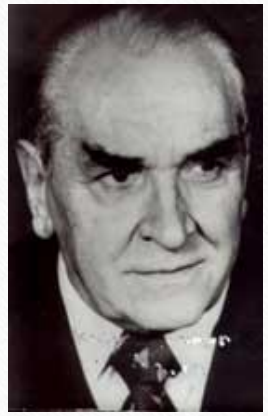
1957: Joaquin Barraquer, first surgeon to utilise the enzyme alpha-chymotrypsin to dissolve the lens zonules – zonulolysis

1961-1962: Introduction of cryoextraction independently by T.Krawicz and C.Kelman

Extracapsular cataract extraction

1747: French surgeon Jacques Daviel

'More effective than couching with an overall success rate of 50%' (Rucker 1965)



Tadeusz Krawicz
1910-1988
http://www.pan-ol.lublin.pl/biul_1/krwawicz.htm

Charles Kelman
1930-2004
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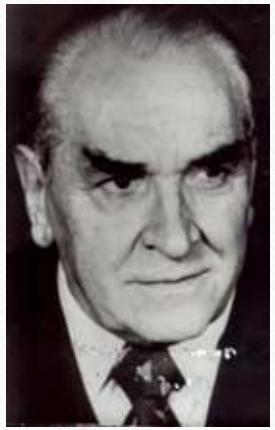
1961



http://www.pan-ol.lublin.pl/biul_1/krwawicz.htm

Krawicz's first reports in 1961 British Journal of ophthalmology
Intracapsular extraction of intumescent cataract by application of low temperature

Previous issue with ICCE was the tension of zonules on lens capsules, making it difficult to deliver the cataract as a while with capsules intact
Then, zonulolysis was introduced, still failures were reported such as rupture of lens capsule

Krawicz: 'This is due to imperfect capsule grasping methods'
Introduction of cryoextractor:

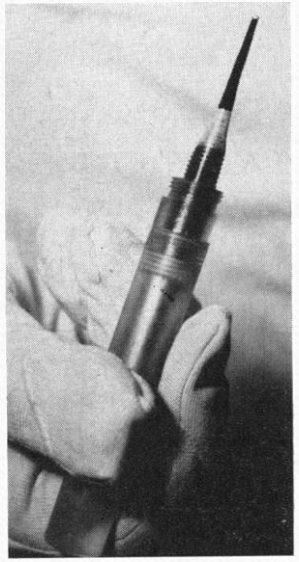
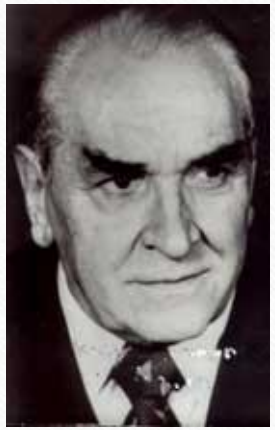


Figure 3: Cryoextractor 1961 (Krawicz 1961)

"Pencil-shaped, ball tipped metal instrument which was ***refrigerated in a mixture of dry ice and methyl alcohol*** so that when the ice-coated tip is ap plied to the exposed lens, the ***capsule and the underlying cataractous ma sses adhere firmly to its ball-shaped end*** and an ***easy intracapsular extrac tion is ensured"***
Krawicz 1961

1961



http://www.pan-ol.lublin.pl/biul_1/krwawicz.htm

Krawicz's reports in 1961 British Journal of ophthalmology
Intracapsular extraction of intumescent cataract by application of low temperature

First fifty operations by this method are given:

- Only experimented on intumescent cataract
- Fourty-eight cases: cataract was extracted intracapsularly
- Two cases: Capsule rupture near the lower part of the equator during the final stage of the operation but the capsule was removed completely
- One case: Some lens debris under the iris
- One Case: Some vitreous loss, related to corneo-scleral suture
- Two Cases: choroidal detachment at a later stage

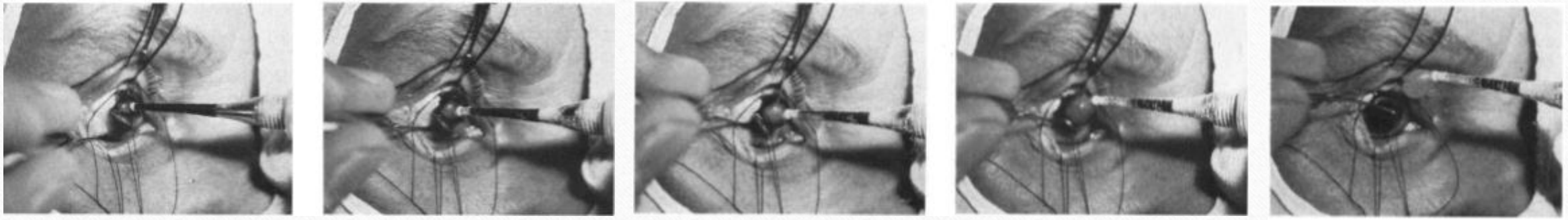
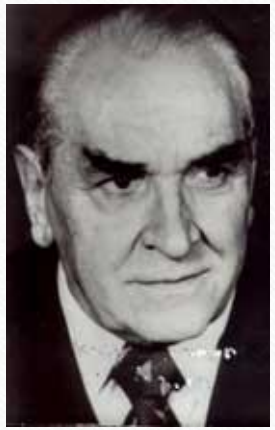


Figure 4: Cryoextraction by Krawicz in 1961: Corneo-scleral suture, iris incised at 11 and 1 o'clock and pulled upwards with a r etractor, cryoextractor applied to lens at 12o'clock, zonule fibres broken by rotating movements (Krawica 1961)

1963



http://www.pan-ol.lublin.pl/biul_1/krwawicz.htm

Krawicz's reports in 1963 British Journal of ophthalmology
Further experience with intracapsular extraction of intumescent cataract by application of low temperature

Six hundred sixty (660) extractions performed:

- Four-hundred fifty-two (452) intumescent cataracts and 208 other types
- Fifteen (2.28%) ruptured capsules
- Thirty six cases: enzymatic zonulolysis used in patients aged between 30 – 60 years, where increased resistance of zonule fibres expected, without capsular complications

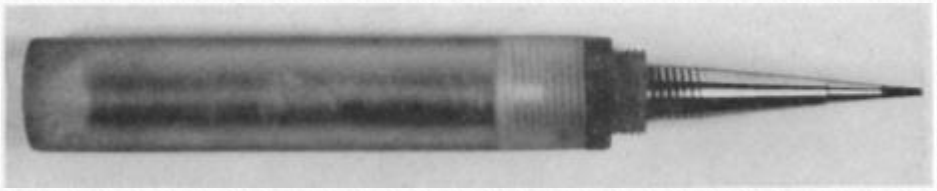


Figure 5: Modified Cryoextractor 1963 (Krawicz 1963)

"We now use a slightly modified instrument, in which the conical end is divided into one or two steps, and we feel that this adds to the handiness of the cryoextractor." Krawicz 1963

1967

Charles Kelman
1930-2004

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Kelman's reports in 1967 International ophthalmology clinical
Cryoextraction of cataract

Advantages of cryoextraction over the standard erisophake or forceps technique:

- Easier delivery of cataract as the capsules remain intact as ice mass penetrates into the interior of the lens

Figure 6: Two erisophakes
https://www.hkmj.org/abstracts/v22n6/628.htm

Instrumental factors

- Temperature between -20 to -40, adequate freezing capacity and importance of insulation
- Defrosting mechanisms to release the accidental adhesion of the iris and cornea

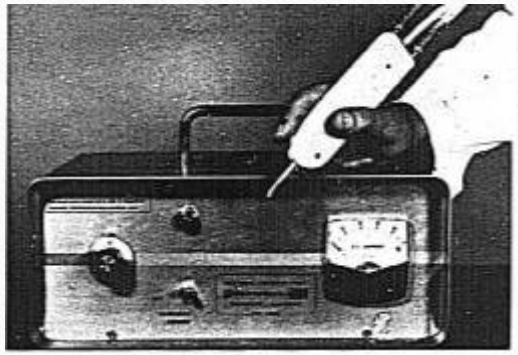

Figure 7: Cryostylet with power supply (Kelman 1965)

1965

Charles Kelman
1930-2004

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Kelman's reports in 1965 International ophthalmology clinical Complications of cryosurgical cataract extraction:

Complications:

- Iridodialysis: Inadequate temperature of the instrument tip
- Freezing of the corneal endothelium: usually due to the assistant inadvertently releasing the cornea on a poorly insulated instrument
- Capsule rupture: When extraction is performed too quickly before the ice mass is formed or if the cryosurgical instrument does not achieve a temperature of at least -20 degrees

Major differences from Krawicz's technique:

- Use of Cryostylet
- Zonule stripper – eyeliner brush

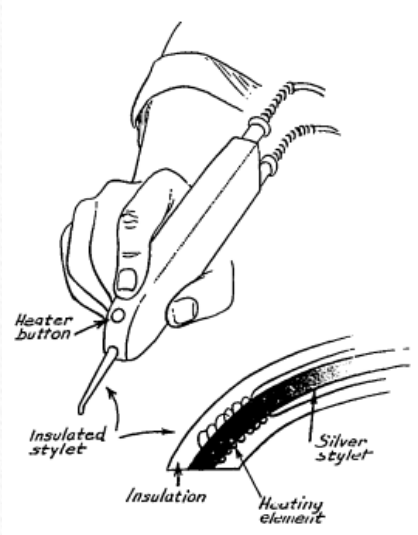

Figure 8: Defrost mechanism of cryostylet allowing quick defrost followed by quick freezing when desired (Kelman 1965)

Unfortunately, ICCE's popularity rapidly declined due to rapid improvements in ECCE techniques.

Disadvantages of ICCE

- Related to removing the lens and lens capsule in its entirety
- The lens capsule serves as a wall between the anterior and posterior structures of the eye.
- Retinal detachment, macular edema, and corneal decompensation, are more likely to occur when this wall is not in place to prevent the vitreous from prolapsing forward.
- Larger incisions to remove a cataract, leading to slow healing and a greater amount of surgically induced astigmatism

"Despite the drawbacks of ICCE, it remained the primary approach for cataract extraction in the United States, well into the 1970s, and modern ICCE is still in practice in developing countries" (Davis 2016)