THE ARRUGA STRING PROCEDURE

A HISTORICAL LANDMARK IN RETINAL DETACHMENT SURGERY

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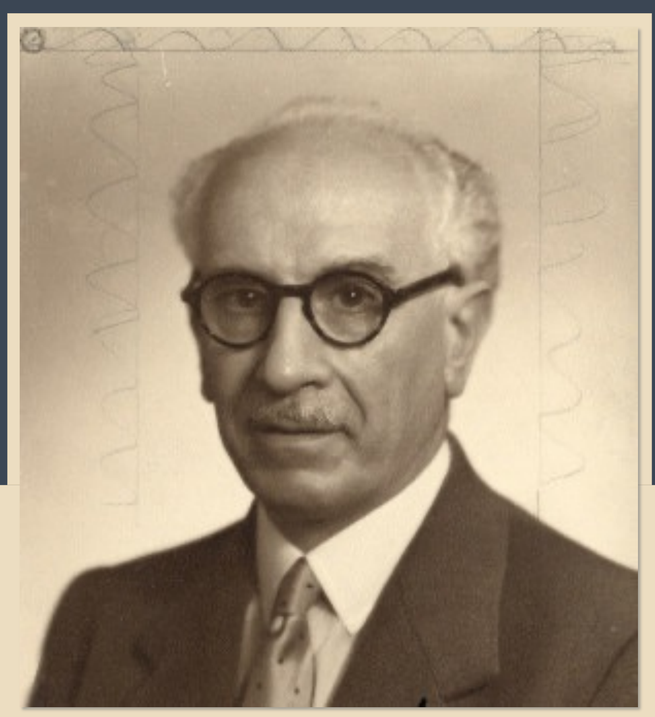


HERMENEGILDO ARRUGA (1886-1972)

Highly influential Spanish ophthalmologist based in Barcelona.
He significantly advanced retinal detachment surgery, building on the work of Jules Gonin.
His major contribution was simplifying the circumferential scleral shortening procedure, leading to the **Equatorial Cerclage** in the 1950s.
He was awarded the prestigious Gonin Medal in 1950.
Author of influential works: *Retinal Detachment (1936)* & *Ocular Surgery (1946)*

THE EQUATORIAL CERCLAGE PROCEDURE

(modification of a technique used by Schepens, Okamura, and Brockhurst)

Key Features:

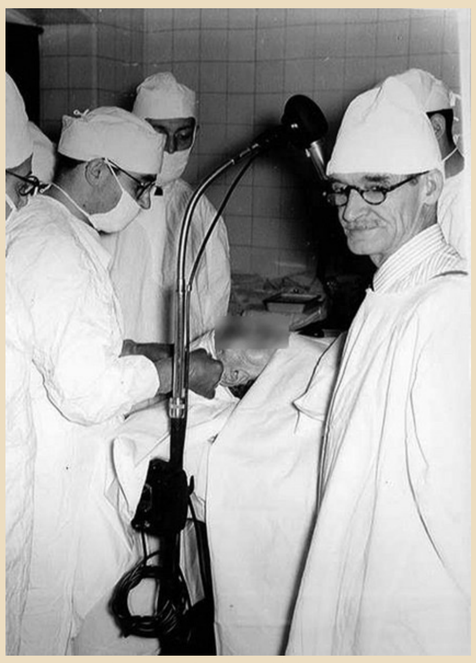
1. **Localisation & Diathermy:** Localise the retinal tear(s) and apply full-thickness scleral diathermy to create an inflammatory chorioretinal adhesion.

2. **Suture Placement:** A continuous, non-absorbable suture (**Supramid***) is passed around the circumference of the globe, beneath the rectus muscles at the equator, encircling the globe.

3. **Tightening & Drainage:** Subretinal fluid may be drained with a needle anterior to the string. The suture is gradually tightened (cerclage) to produce a circumferential scleral indentation, reducing the globe circumference and approximating the retina to the choroid.

4. **Indentation:** The resulting pressure creates a low, circumferential fold, bringing the treated area of retina and tears onto the indented scleral wall.

**Arruga Supramid suture:*
- *a non-absorbable pseudomonofilament with a polyamide core*
- *narrower than silicone sutures*
- *poor elasticity*



Ascaso & Grzybowski. (2014)

TIMELINE: ADOPTION AND EVOLUTION

1930s-1940s — Foundation for scleral shortening laid by Gonin and others.

1950s — Arruga introduces the equatorial cerclage (the 'string' procedure) as a simpler, faster alternative to full-thickness scleral resection.

1950s-1960s — Technique is widely adopted across Europe due to its simplicity and high initial success rate (reported around 50-66% in some series).

1964 — Introduction of the **"String Syndrome"** complication (Manson).

1960s-1970s — Gradual replacement of the simple Arruga suture by **Silicone Elements** (e.g., bands and sponges) which offered controlled, broader indentation with less risk of scleral erosion.

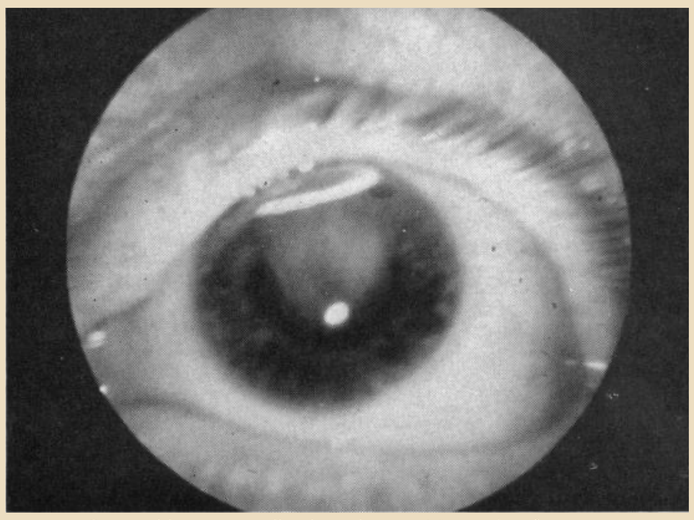
Late 1970s — **Pars Plana Vitrectomy (PPV)** gains prominence, eventually replacing most external buckling procedures for complex detachments.

LEGACY, BENEFITS, AND COMPLICATIONS

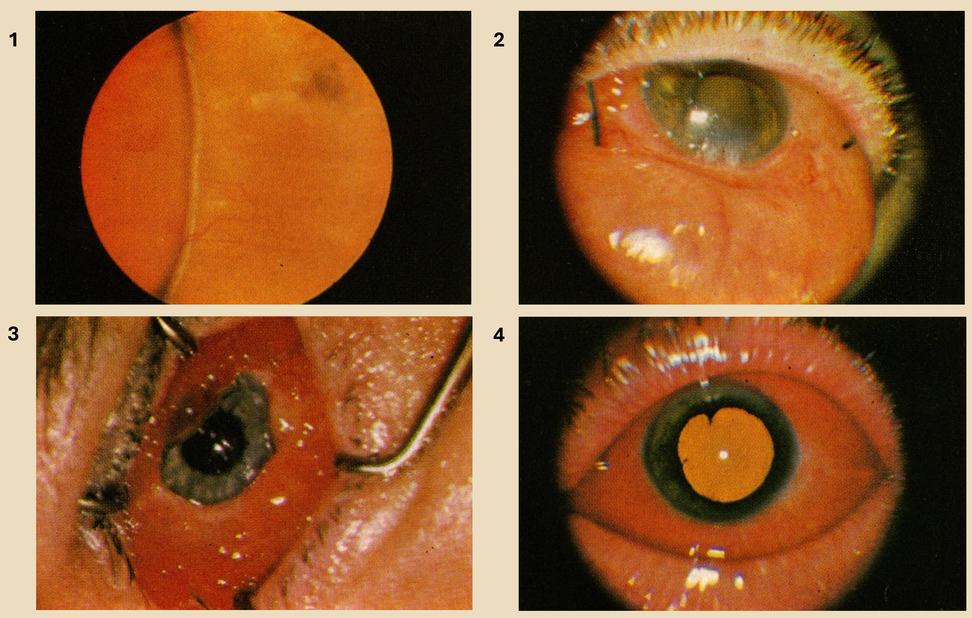
Legacy:
The Arruga cerclage fundamentally established the concept of **circumferential scleral indentation** as a pillar of modern retinal detachment surgery. It directly **paved the way** for modern silicone-based scleral buckling (e.g. Custodis sponge, Schepens band).
- Emphasised the **importance of scleral indentation** and **support of the vitreous base**.
- Represented an era of **extraocular approaches** before intraocular vitrectomy techniques evolved.

Benefits:
Simplicity of operation, relatively short operating time, and a high rate of anatomical reattachment for suitable cases.

Major Complications:
- **Anterior Segment Ischemia:** Over-tightening could occlude the long posterior ciliary arteries, leading to vision-threatening ischemia. Once recognised this necessitated the removal of the string.
- **Scleral Erosion/Intrusion:** The thin suture, under tension, could erode through the sclera and choroid, entering the vitreous cavity (sometimes called the "clothesline phenomenon").
- **"The String Syndrome" (1964):** A severe, inflammatory reaction characterised by low intraocular pressure, conjunctival chemosis, uveitis, and secondary cataract, often resulting in complete, non-resolving detachment.
  - **Narrowing of palpebral fissure**



Supramid suture eroding into vitreous 14 months after surgery
Dark & Rizk. (1965)

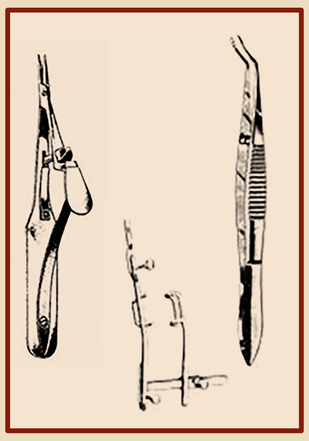


1. *Fundus appearance in the line of the cerclage suture, showing pigmentation*
2. *Severe conjunctival reaction prolapsing through palpebral aperture*
3. *Mild form of conjunctival reaction*
4. *String syndrome showing posterior synechiae*

Manson. (1964)

ARRUGA'S TOOLS FOR THE OCULAR SURGEON

Arruga designed a number of influential surgical tools. For the cerclage, the key components were the *non-absorbable suture* (e.g., Supramid) and a reliable **Needle Holder** for precise placement and tensioning. He also developed the **Arruga Capsule Forceps** for intracapsular cataract extraction, a procedure he advocated, and an eye **speculum**.



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