BASIC ARTHROSCOPIC INSTRUMENTATION

HISTORY OF ARTHROSCOPY

Greatest advantage ??

Q. Who is called the Father of Sports Medicine

Q. Who is credited with performing the first successful Arthroscopy procedure?

TIMELINE

Danish physician Severin Nordentoft reported performing arthroscopy of the knee joint in 1912 at the Proceedings of the 41st Congress of the German Society of Surgeons at Berlin. He called the procedure (in Latin) *arthroscopia genu*, and used boric acid solution as optic media.

?? Living or Cadavers

Professor Kenji Takagi in Tokyo has traditionally been credited with performing the first successful arthroscopic examination of knee joint, in 1919, for TB knee. He used a 7.3 mm *cystoscope*!!

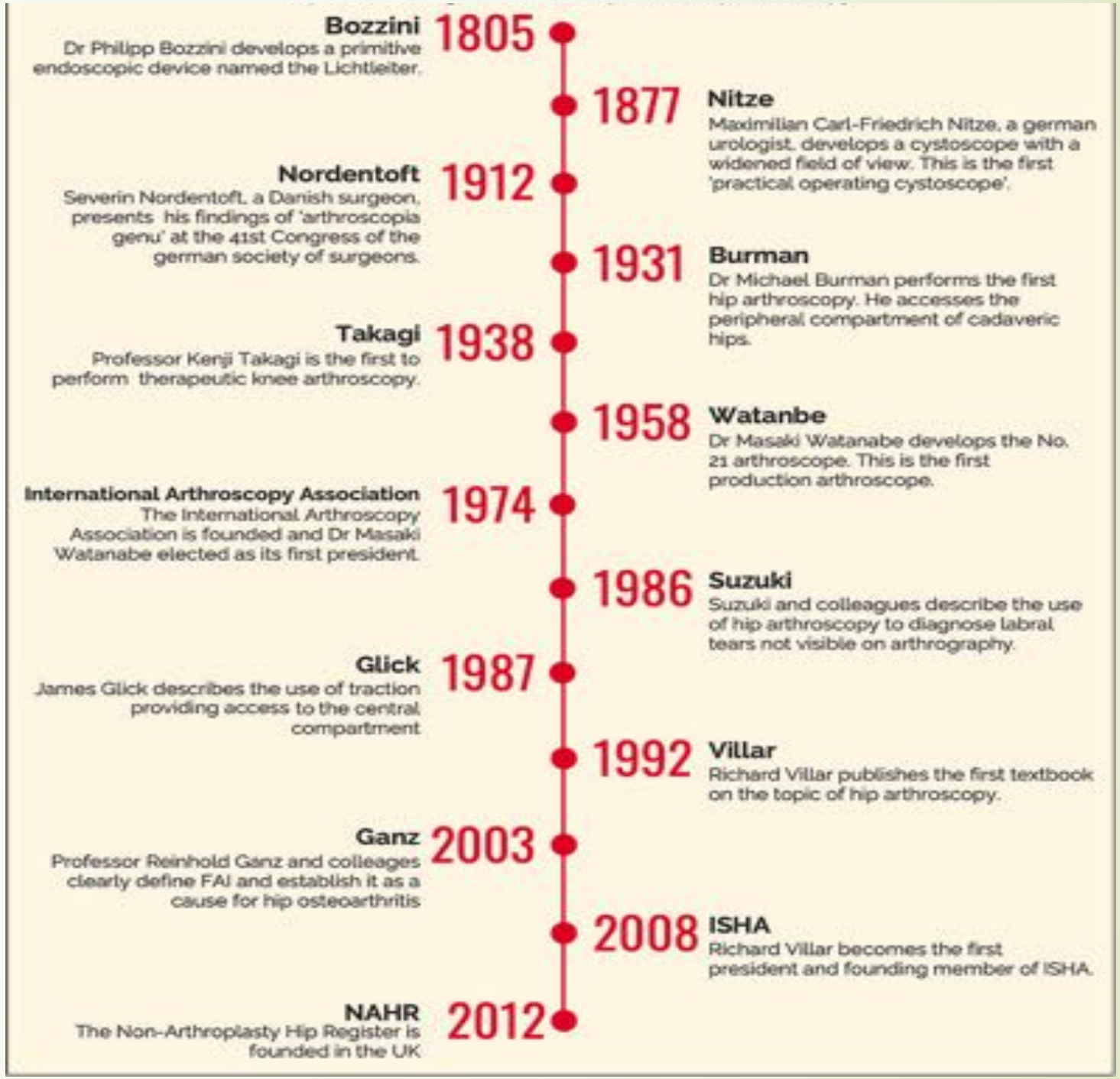
1800s

1950s

The Japanese surgeon Masaki Watanabe, receives primary credit for using arthroscopy for interventional surgery (SHOULDER specifically) as on modern lines. Introduced the concept of *Triangulation*!

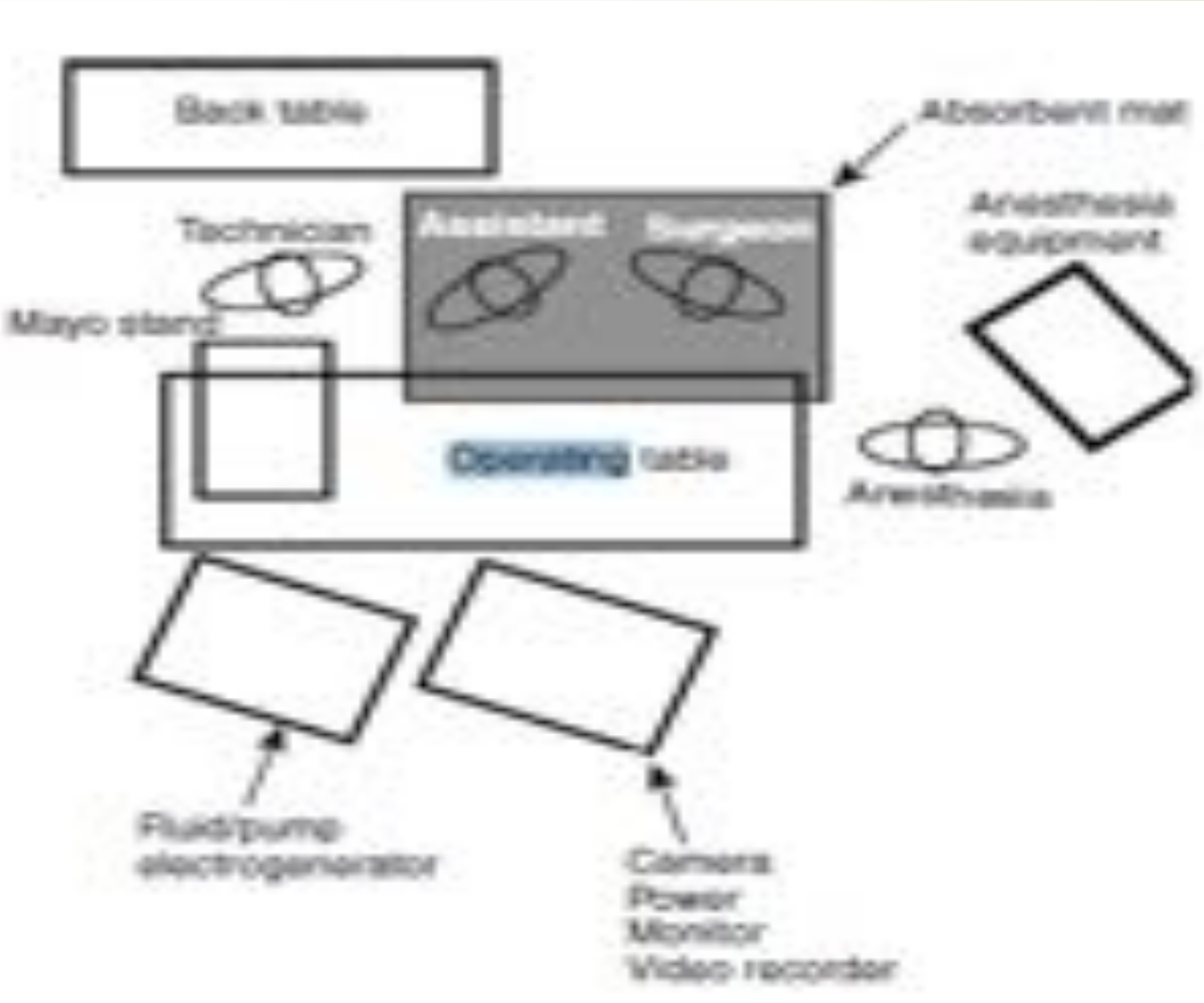
1965 Canadian doctor Robert Jackson is credited with bringing the procedure to the Western world !

HISTORY



Operating Room Setup

Arthroscopic Tower



JOINT DISTENSION PRESSURES

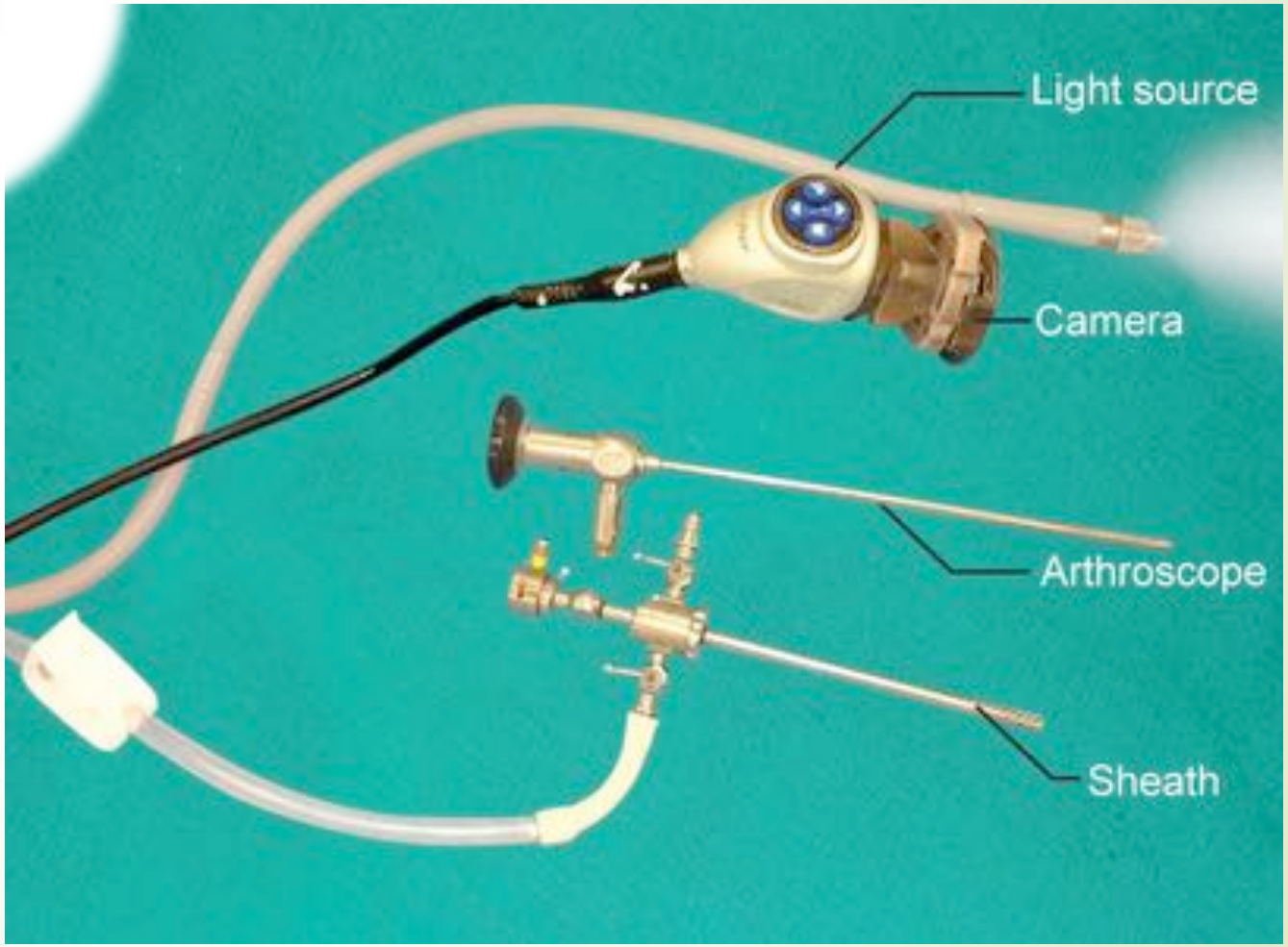
Knee: 60-80 mm-Hg

Shoulder: 30 mm-Hg

Elbow/ Ankle: 40-60 mm-Hg

1 foot raise of 5 L fluid above the joint level, raises pressure by 22 mm-Hg !

- Glycine 1.5%
- Glucose 5%
- Normal saline 0.9%
- Ringer lactate
- Demineralized water



	Approximate PH	Approximate MOSM/L	Compatibility with Electrosurgery	Tissue Toxicity
Synovisol	5.0	282	Nonconductive	Minimal
Ringer lactate	6.5	273	Conductive	Moderate
0.9% Saline	5.5	308	Conductive	Moderate
Glycine	6.0	200	Nonconductive	Minimal
Water	6.8	2	Nonconductive	Severe

From Esch JC, Baker CL Jr. Arthroscopic surgery: the shoulder and elbow. Philadelphia, PA: JB Lippincott, 1993:38.

ARTHROSCOPE

Hip: 4 mm D; 180 mm L

Knee, Shoulder: 4 mm D; 135 mm L

Elbow, Wrist, Ankle: 2.7 mm D, 67 mm L

Small joints: 1.9 mm D, 67 mm L

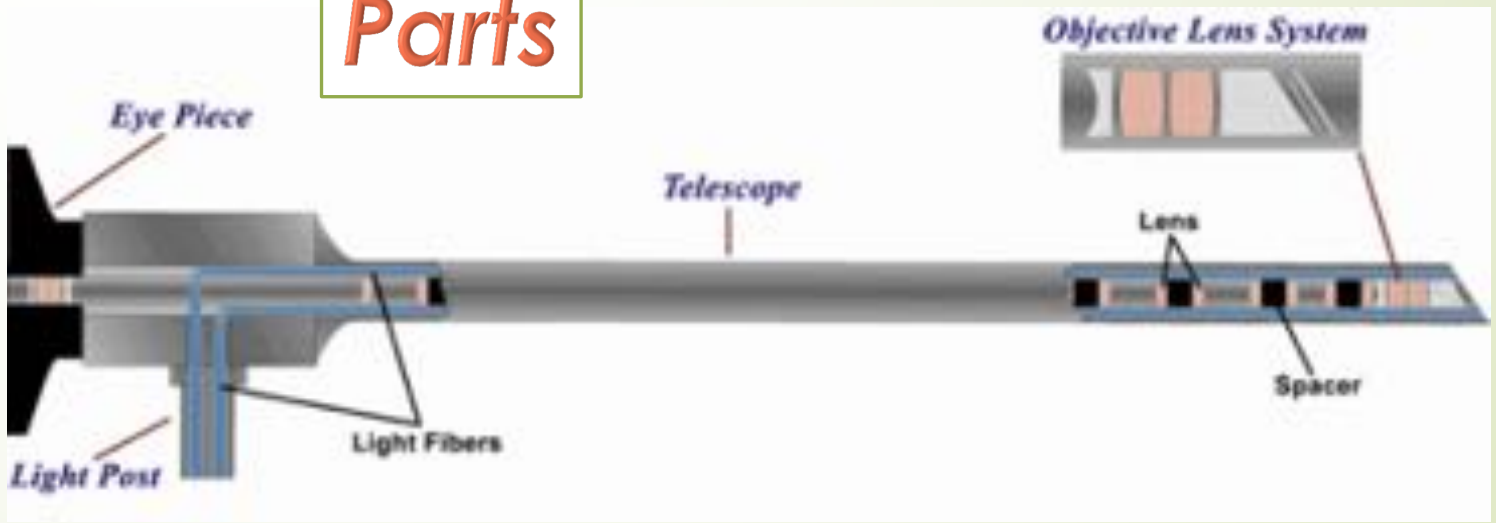
Optical Systems

- Classic thin lens
- Rod-lens system

  (Prof Hopkins, England)
- Graded index lens system (GRIN)

TELESCOPE

Parts



Arthroscopic Movements

Pitoning

The forward and backward movement of the arthroscope is called “pistoning.”

Pitoning allows the surgeon to move closer or further away to visualize one particular area or to obtain a panorama of a larger field.

Angulation

Angulation is a sweeping motion that moves the arthroscope in a horizontal or vertical plane.

Rotation

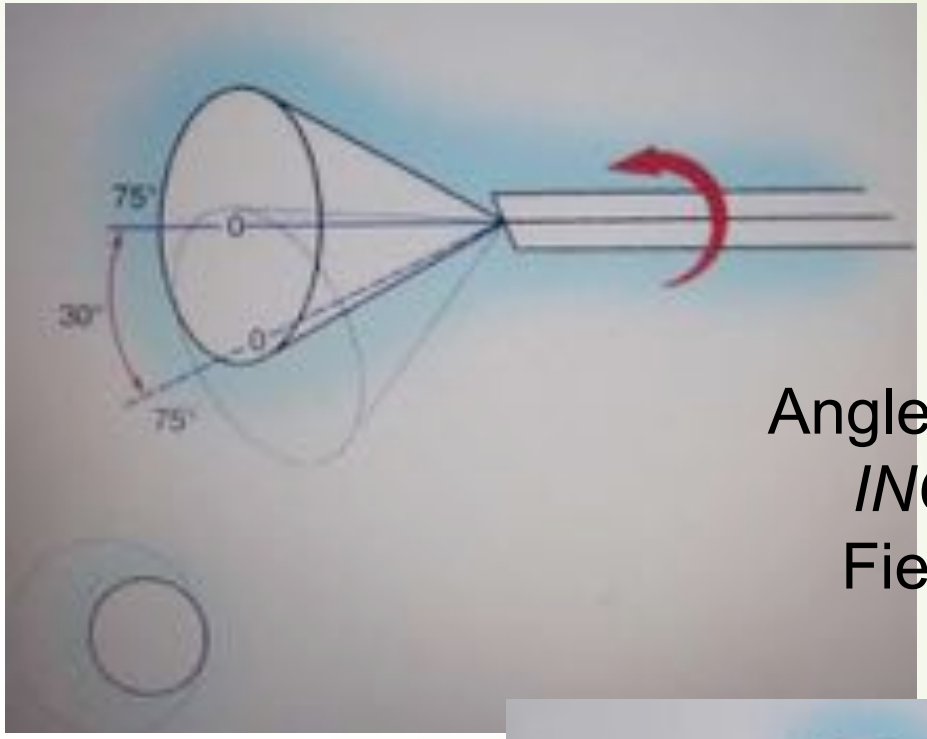
Rotation is the most valuable movement in arthroscopy.

- Using a 30° instead of a 0° arthroscope permits a wider view of joint.
- With the 70° arthroscope, rotation occurs around a central blind.

Field of view

The *actual* field of view is the measured angle of view the arthroscope produces

The *apparent* field of view is the diameter seen at the ocular end of the arthroscope



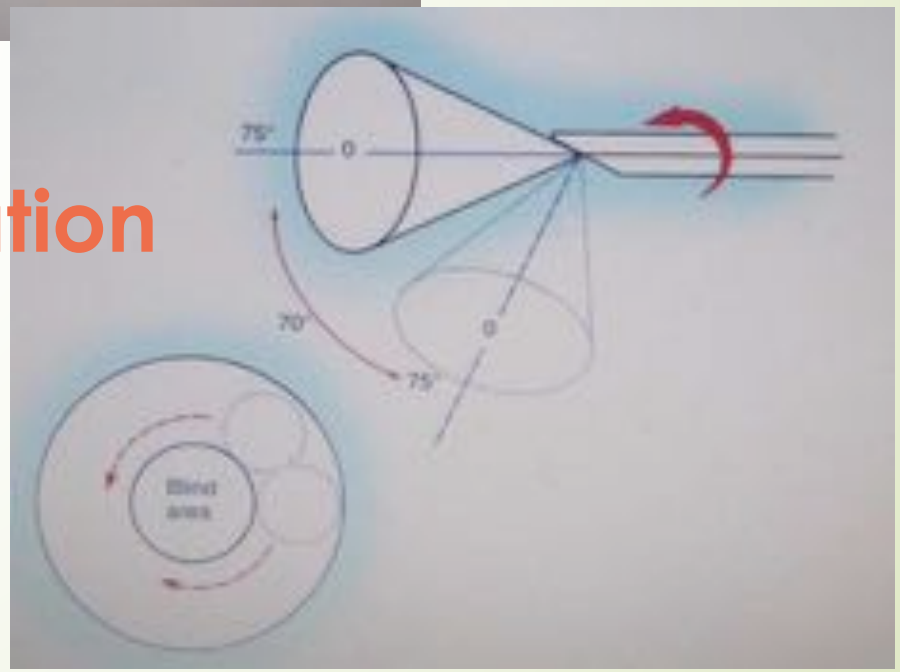
Angle of inclination
INCREASES
Field of view!!

Diameter *and* Angle of Inclination

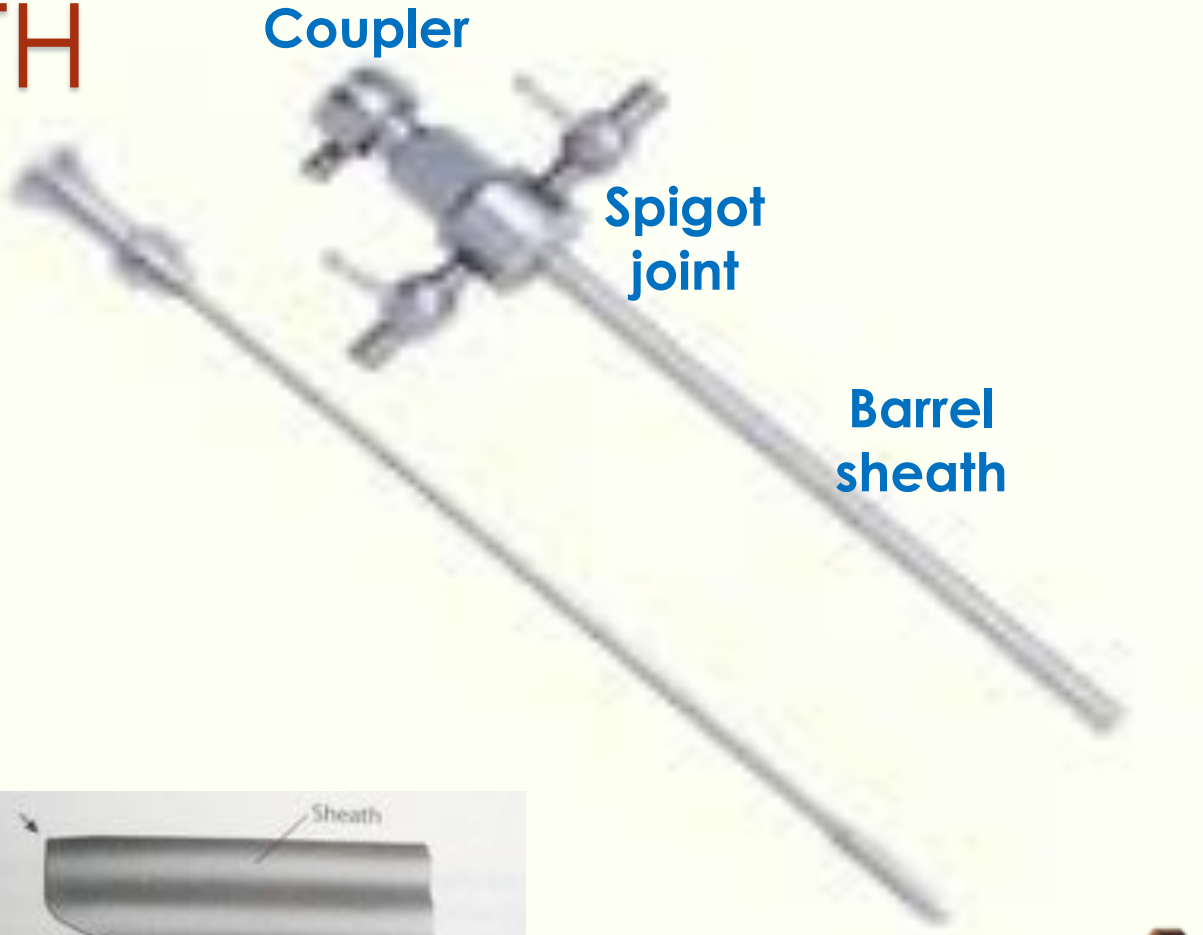
4 mm diameter: 115°

2.7 mm diameter: 90°

1.9 mm diameter: 75°



ARTHROSCOPE SHEATH AND OBTURATOR

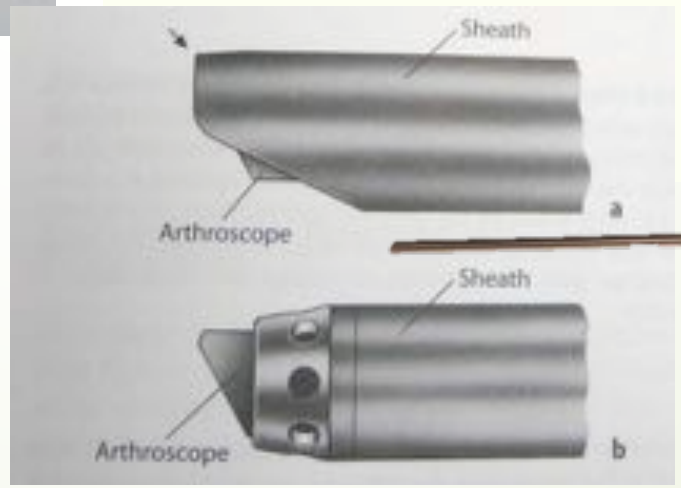


SHEATH Diameters

4 mm scope: 5.5-6 mm

2.7 mm scope: 2.9 mm

1.9 mm scope: 2.2 mm

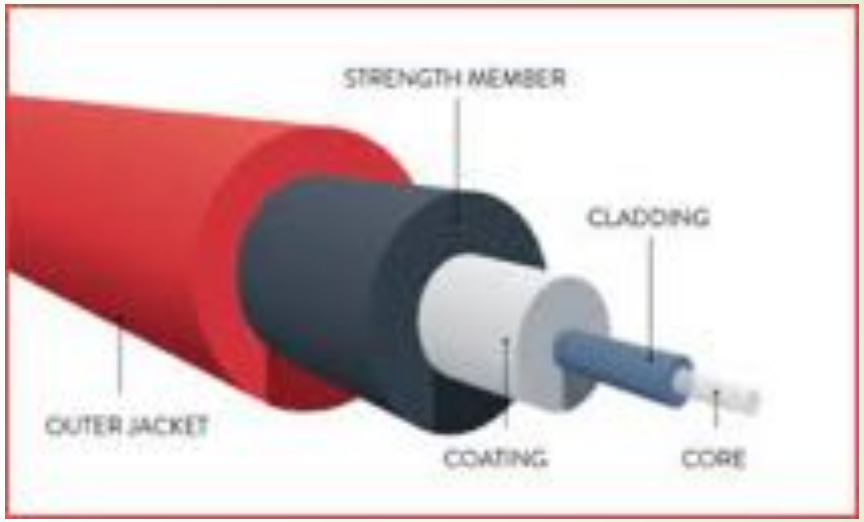


Light source and Fiberoptic Cable

Power: 300-350 Watts

Sources: Tungsten, Halogen, Xenon, **most recently LEDs**

Temperature !!!



300 cm L and 4.8 mm D

Camera

Camera system was invented by McGinty and Johnson

1 chip/ 3 chip

INSTRUMENTATION

Mechanical Instruments

Probes, Punches, Grasping forceps, Suture passers, Knot pushers, Wissinger rods (switching sticks), Cannulas

Motorised Instruments

Shavers and Burrs

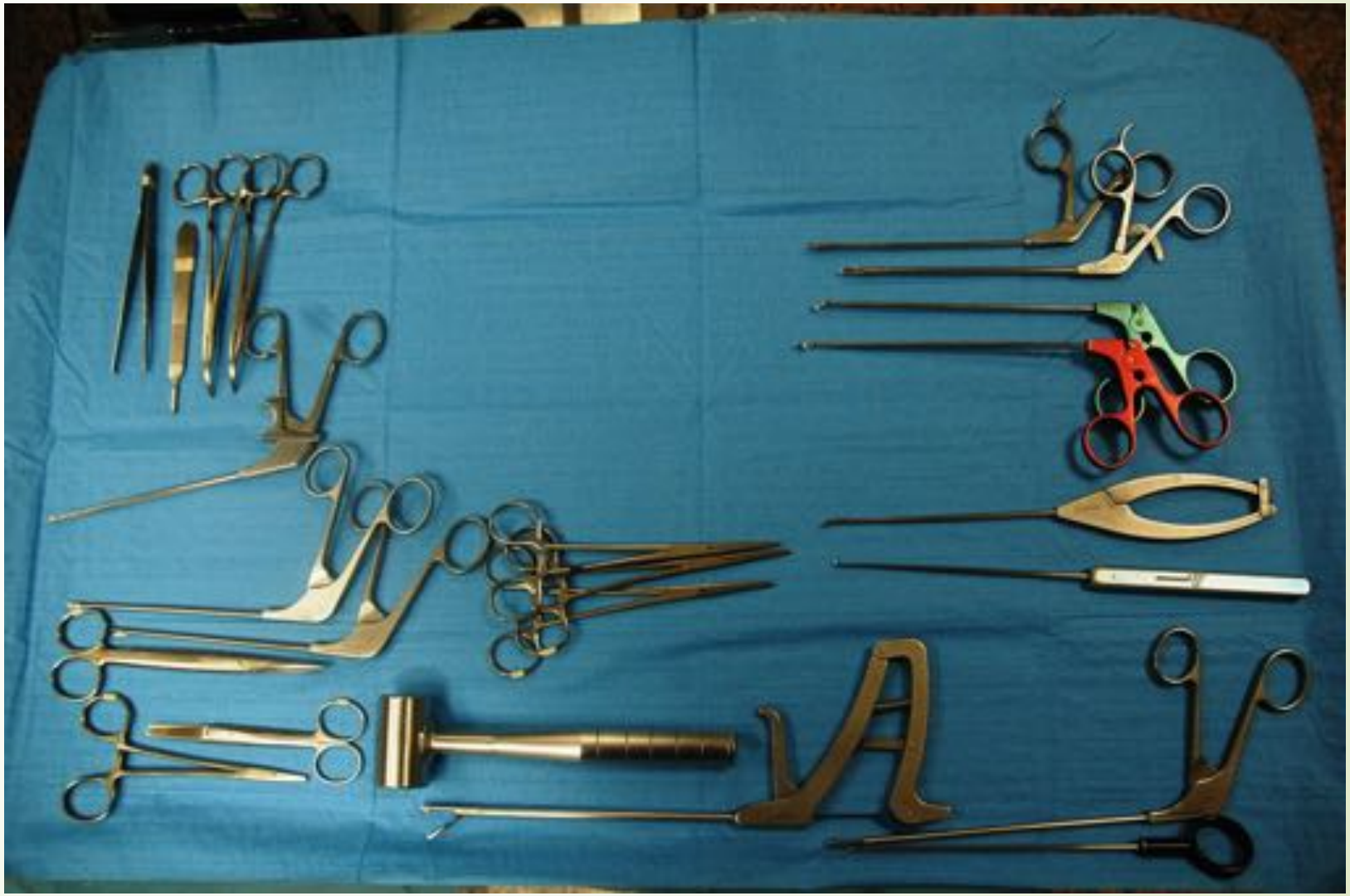
Electrosurgical Instruments

Electrocautery, Radiofrequency, Laser

Special Instruments

ACL/PCL sets jigs, Tendon strippers, Meniscus repair sets, OATS Set, Shoulder set, Suture anchors, Screws and Buttons

MECHANICAL INSTRUMENTS



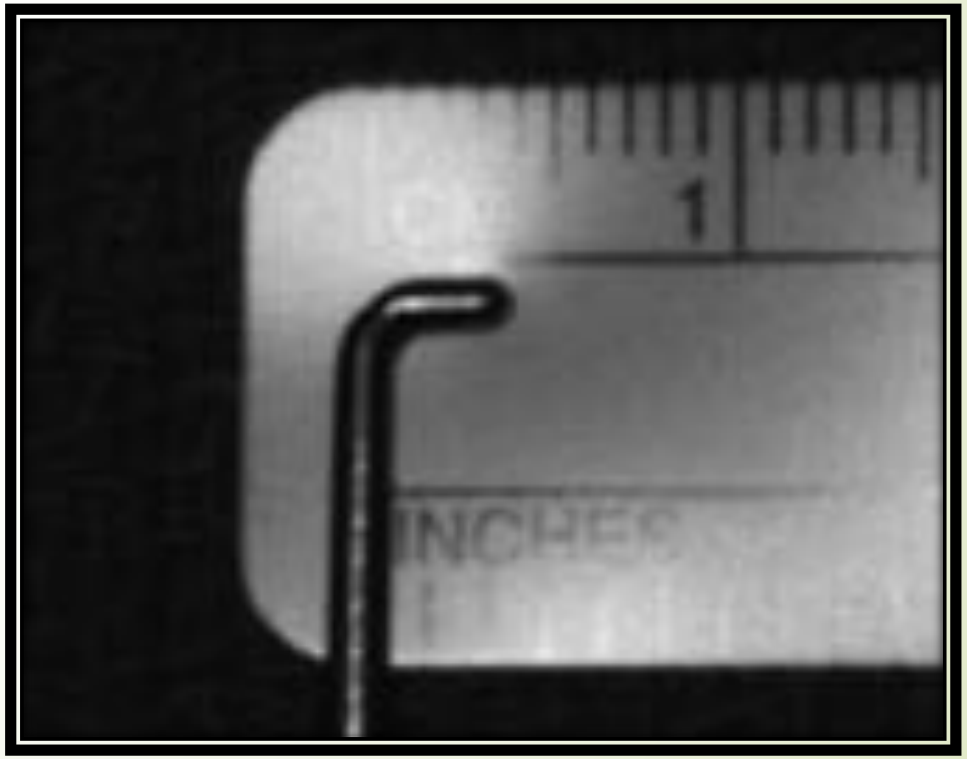
PROBE

12 cm shaft

TWO FOLD USE

Extension of surgeon's finger: Palpates and manuvres intra articular structures

Measurement device **(scale)**



PUNCH *AND* GRASPER *AND* RETRIEVER

Basket Forceps

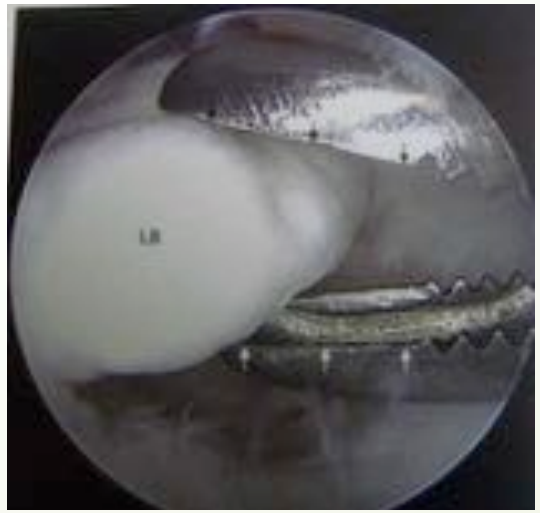
JAWS

Biter

Catcher

Suture

12 cm shaft



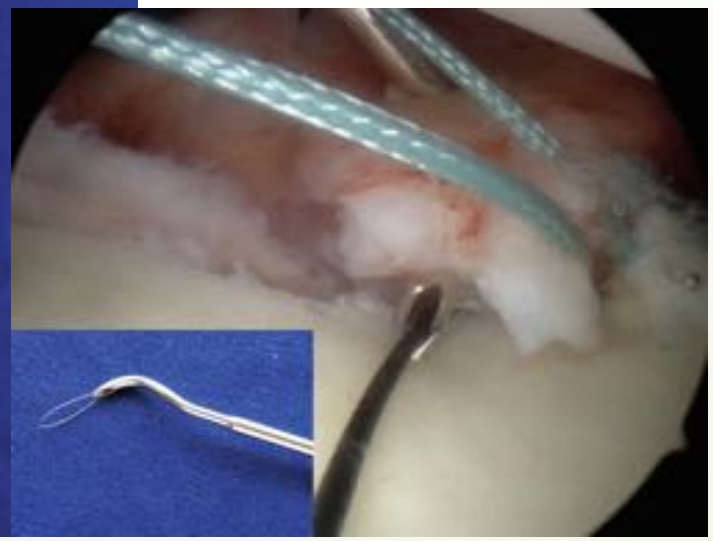
Available with 15° up and down biting options

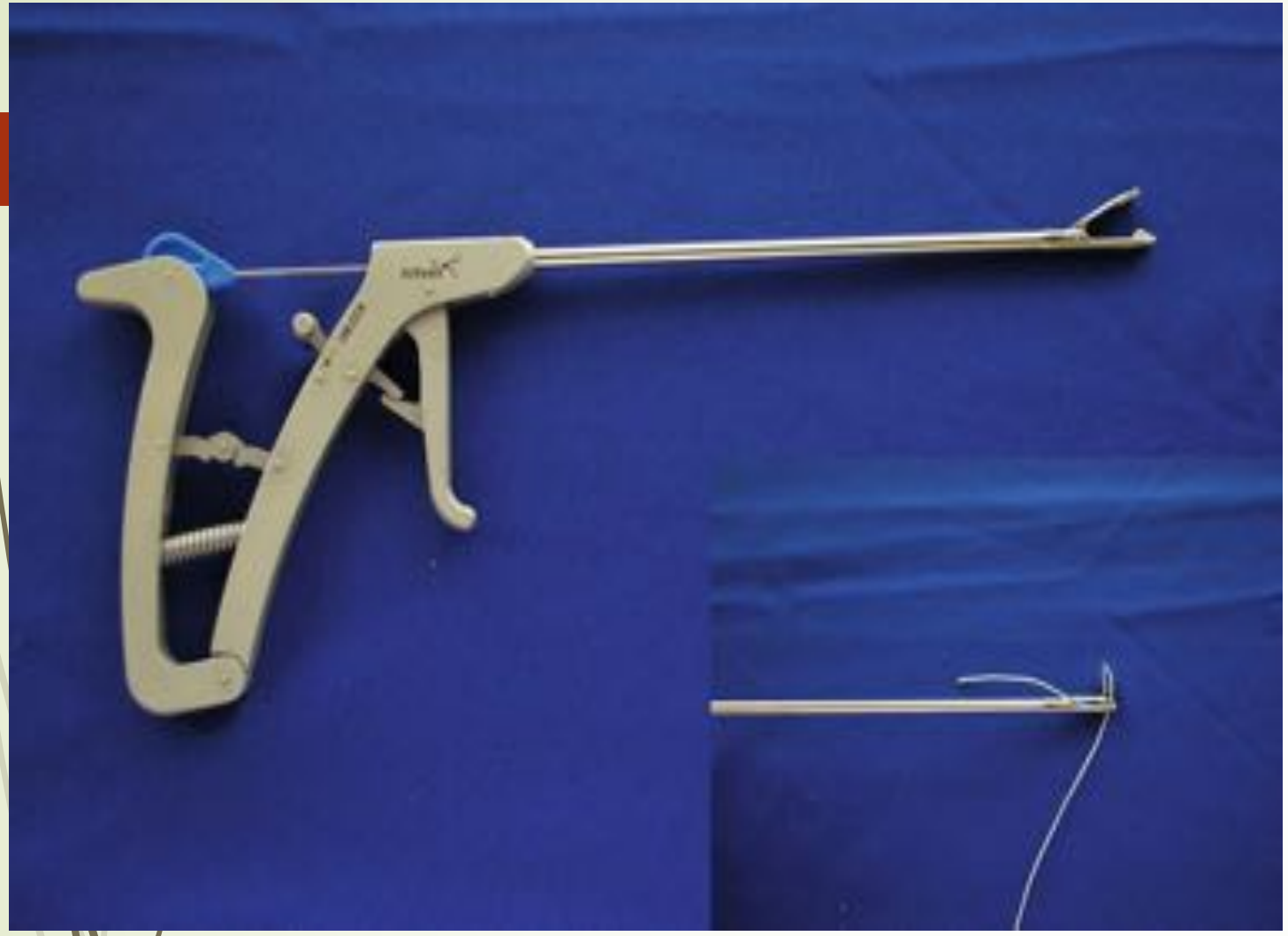
SWITCHING STICKS *AND* CANNULAS

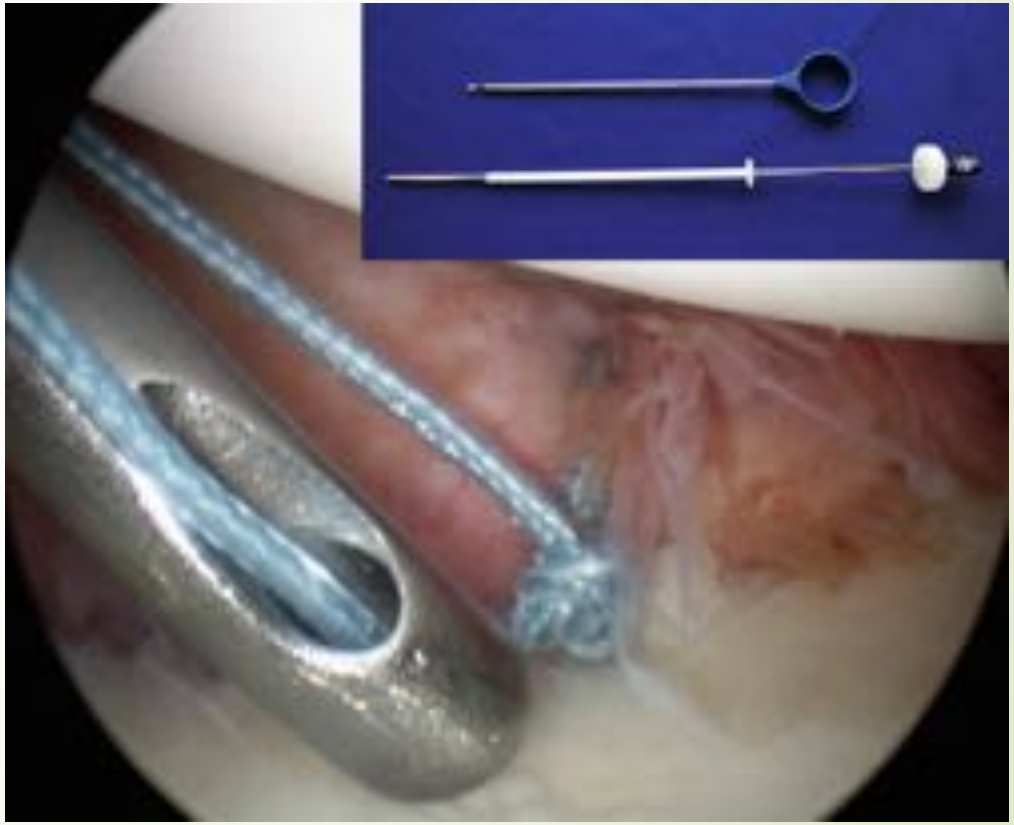
Wissinger Rods

4 mm OD

SUTURE PASSERS







KNOT PUSHERS

Single Hole: Most commonly used.

Double Hole: Best avoids suture twisting. But difficult to use so almost discarded.

Double diameter knot pusher: Creates very good loop and knot security but again difficult to use.

12 cm shaft

End splitting knot pusher: Creates the strongest knots. Learning curve.

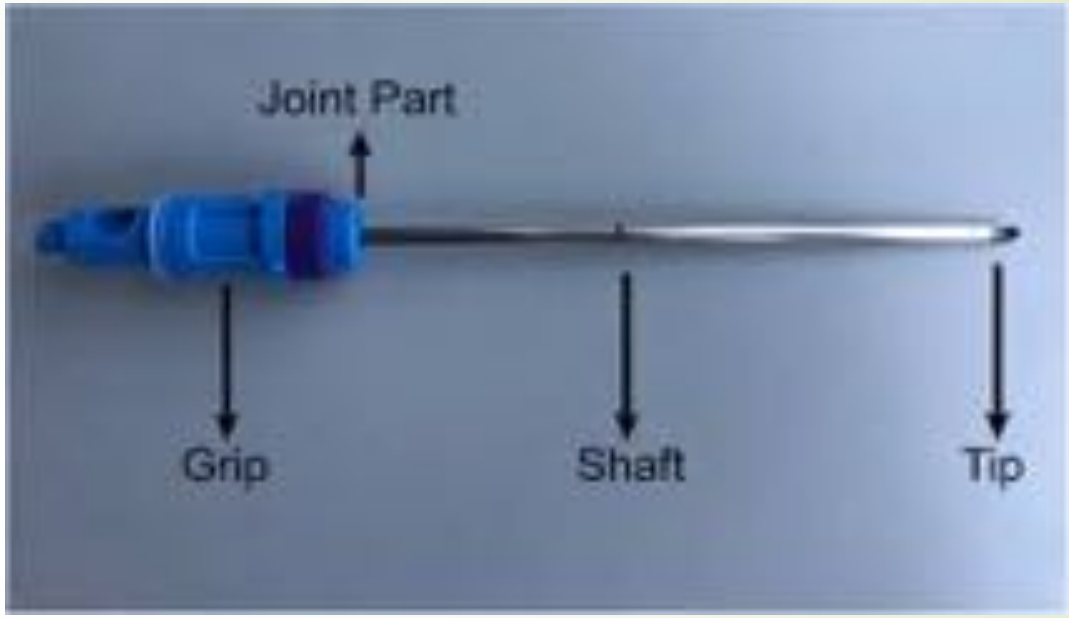
TENDON STRIPPERS

30 cm length and 5.5 mm diameter

MOTORIZED INSTRUMENTS

Lengths: 70 mm, 120 mm, 180 mm

SHAVER *AND* BURR



Diameters available

- 3.5 mm
- 4.5 mm
- 5.5 mm

12 cm shaft

Handpiece – Autoclavable

Blades- Disposable

Shaver was invented by **Johnson**

The side-cutting shaver has a small window that does not allow exposure to the blade's distal tip.

The open-ended shaver is the most aggressive and has the distal tip of the blade exposed.

The most commonly used is a combination of the 2 types, which is called a FULL-RADIUS RESECTOR. It has only partial exposure of the tip of the blade and the side-cutting window

Teeth on barrel and on the blade

SHAVER

BURR

RPMs

Cutting soft tissues:
1000-3000/min

Burring Bone:
3000-9000/min

Outer hollow sheath & inner cutting rotating cannula. Sheath sucks tissue inside for cutting by inner cannula.

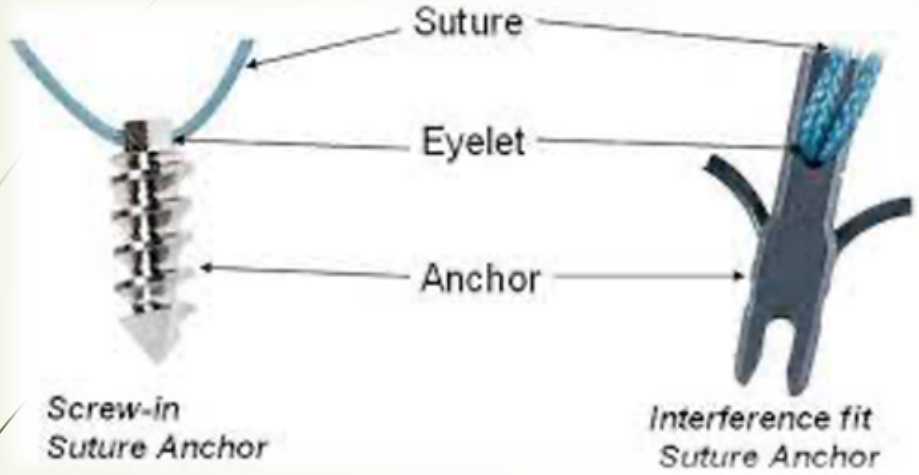
ELECTROSURGICAL INSTRUMENTS

Electrocautery
Haemostasis
(Lateral retinacular release)

Laser (YAG laser)
Delivers high energy with precision
Uses- Chondroplasty
Drawbacks-Expensive

Radiofrequency
Can coagulate and can cause thermal shrinkage
Drawbacks- Articular cartilage damage, Osteonecrosis

SPECIAL INSTRUMENTS



The first of this type was FiberWire (Arthrex) which has a braided polyester coat around a central core of multiple small strands of UHMWPE.

Ultrahigh molecular weight polyethylene (UHMWPE)-containing sutures!

FIBERWIRE

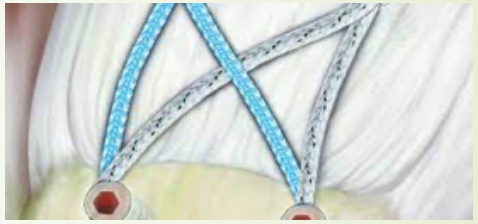
SUTURES

ETHOBOND

Nonabsorbable
braided Polyester suture

Mechanical irritation, Tissue abrasion, Impingement, Knots slip under load

FiberTape/ TigerTape are **ultra-high strength, 2 mm width tapes**. The tapes provide broad compression and increased tissue cut-through resistance making it an excellent choice for knotless rotator cuff repair



ORTHOCORD

This most recent addition is by DePuy-Mitek). OrthoCord combines both UHMWPE suture with a degradable suture. The size No. 2 combines 32% UHMWPE with 68% polydioxanone (PDS) and is coated with polyglactin.

The OrthoCord design has a PDS core with a UHMWPE sleeve and leaves a lower profile after the PDS reabsorbs while retaining the outer sleeve strength.

A biocomposite not only degraded but offer the chance of osteoconductive ingrowth of bone into the space occupied by the anchor.

Biocomposite materials are combinations of a degradable polymer (PLLA) with a bioceramic (β-TCP).

BIOCOMPOSITE

JuggerKnot (Biomet) is made from a single strand of No. 1 braided UHMWPE suture. The "anchor" portion is created with a short sleeve of braided polyester suture in the middle of the suture and is inserted into the bone. Traction on the suture bunches up the "V"-shaped suture sleeve creating the anchor within the bone.

ALL SUTURE ANCHORS

NON-METALLIC

SUTURE ANCHORS

METALLIC

Low cost, clear on postoperative imaging, fewer concerns about anchor migration, Lack of Osteolysis

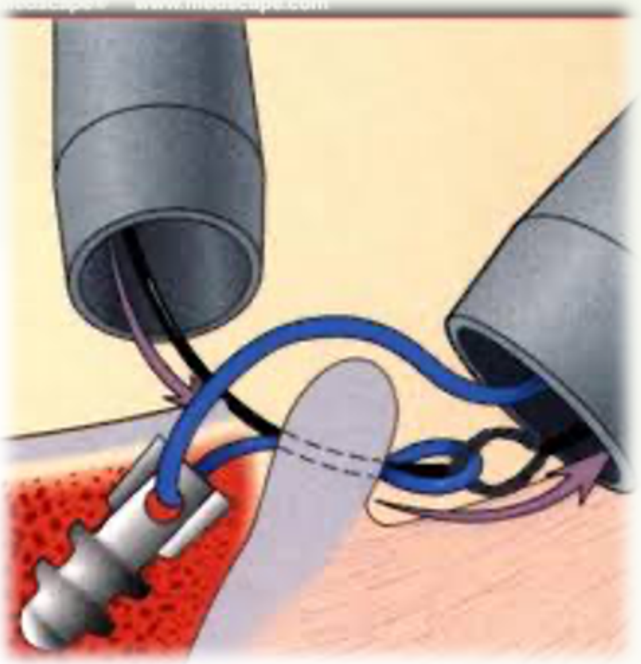
Potential for causing suture abrasion, chondral injury in improper placement

PEEK

Radiolucent (but not absorbable; plastic), Can be drilled through during a revision procedure (although not all plastic can be removed),

Since they do not absorb they present the same concerns as a metal anchor

KNOTTED



KNOTLESS

SUTURE ANCHORS

THE MODERN WEAPON

Extra time consumption and possible disadvantages of knots like theoretical risk of tissue irritation, potential postoperative joint clicking from large knots and surgeons knot-tying skill have given way to KNOTLESS REPAIR techniques!

KNOTLESS ANCHOR

A channel is located at the tip of the anchor that functions to capture the loop of suture after it has been passed through the ligament. The ligament is tensioned as the anchor is inserted into bone!

Double suture loop
Better strength

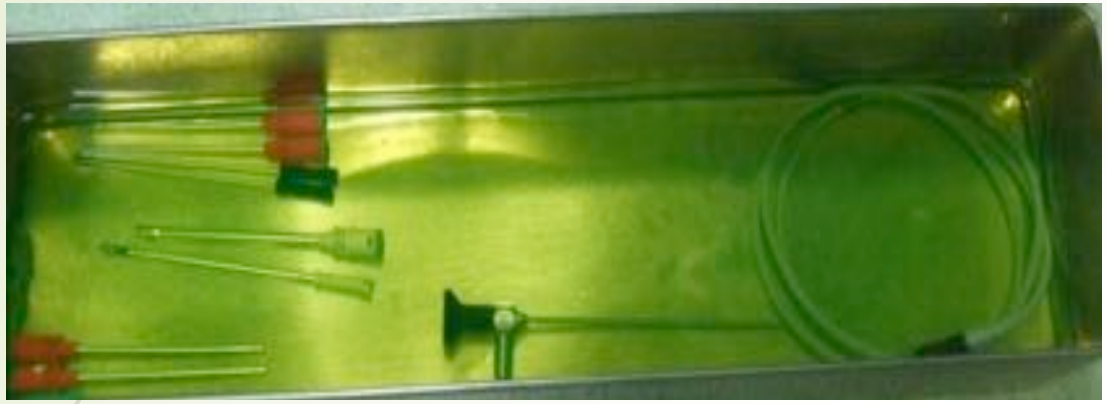
SIZES

SUTURE ANCHORS

MISSED INSTRUMENTS

No scissors; No knives ??

Sterilization ??



Cidex (Glutaraldehyde)

Steris solution (Paracetic acid)

> 30 min

KNOT TYING

All knots should be backed up with three RHHALs!

Five open throws

Surgeon's square knot

NON-SLIDING

SLIDING

NON LOCKING

Duncan loop

LOCKING

PROXIMAL: Nicky's knot (Easier but can loosen)

MIDDLE: SMC knot, Tennesse slider

DISTAL: Roeder and Weston knots (Prevent slippage best but learning curve)

Knot Failure: Slippage or displacement > 3 mm

Knot Security: Ability to withstand slippage and maintain the tension. Depends on friction and slack between throws

Loop Security: Refers to ability of the suture loop to withhold tissue and hold tension (after the knot is tied and tensioned)

Some important definitions

THANK YOU

Most common complication of Arthroscopy is Haemarthrosis particularly after Synovectomies and Lateral retinacular release!