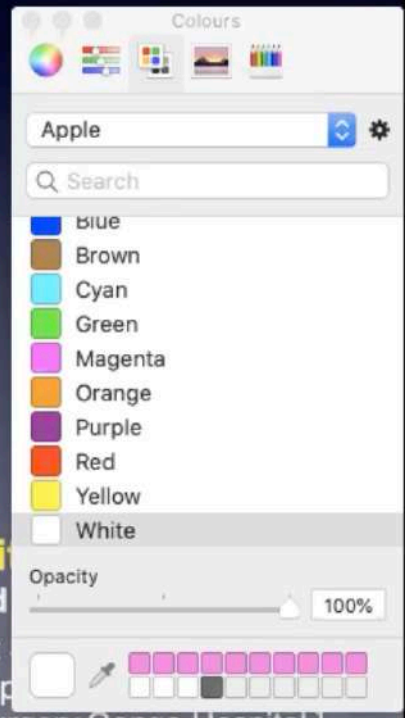
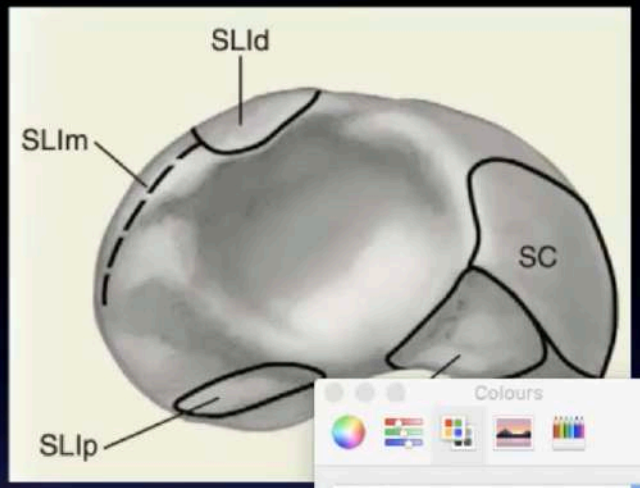
Scaphoid fracture and SNAC wrist

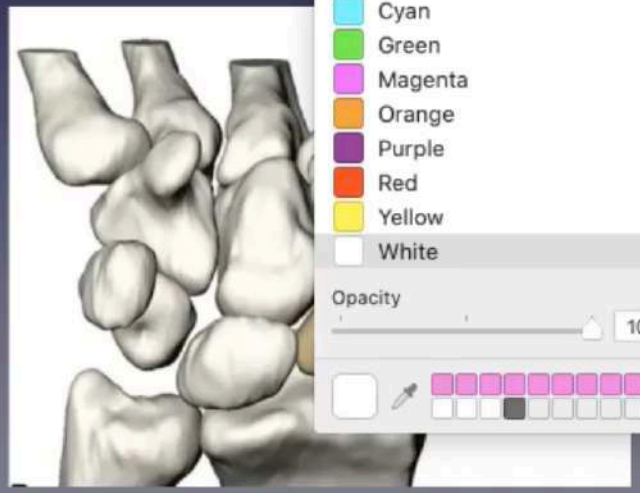


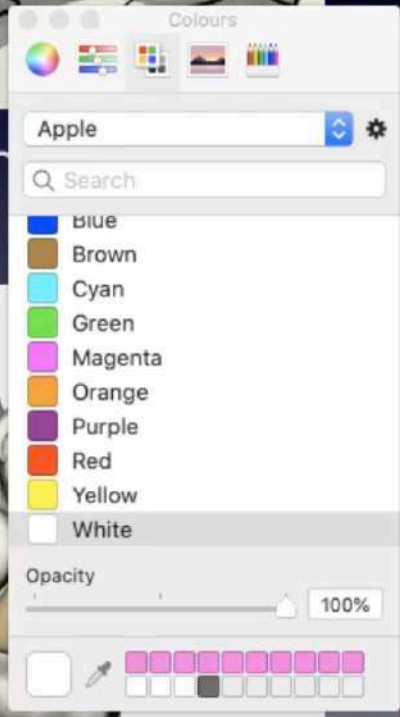
Dr.Ami
Director - Mittal Hand
[Sr. Consulant
MBBS, DNB [St Step
FNB [Hand & Microsurgery,Ganga Hospital]

Scaphoid - Anatomy

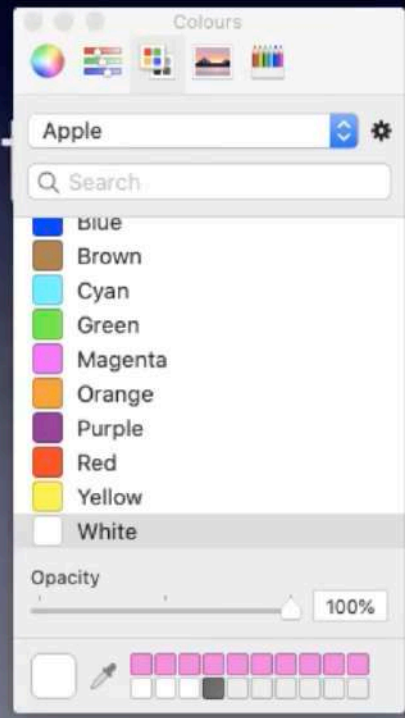


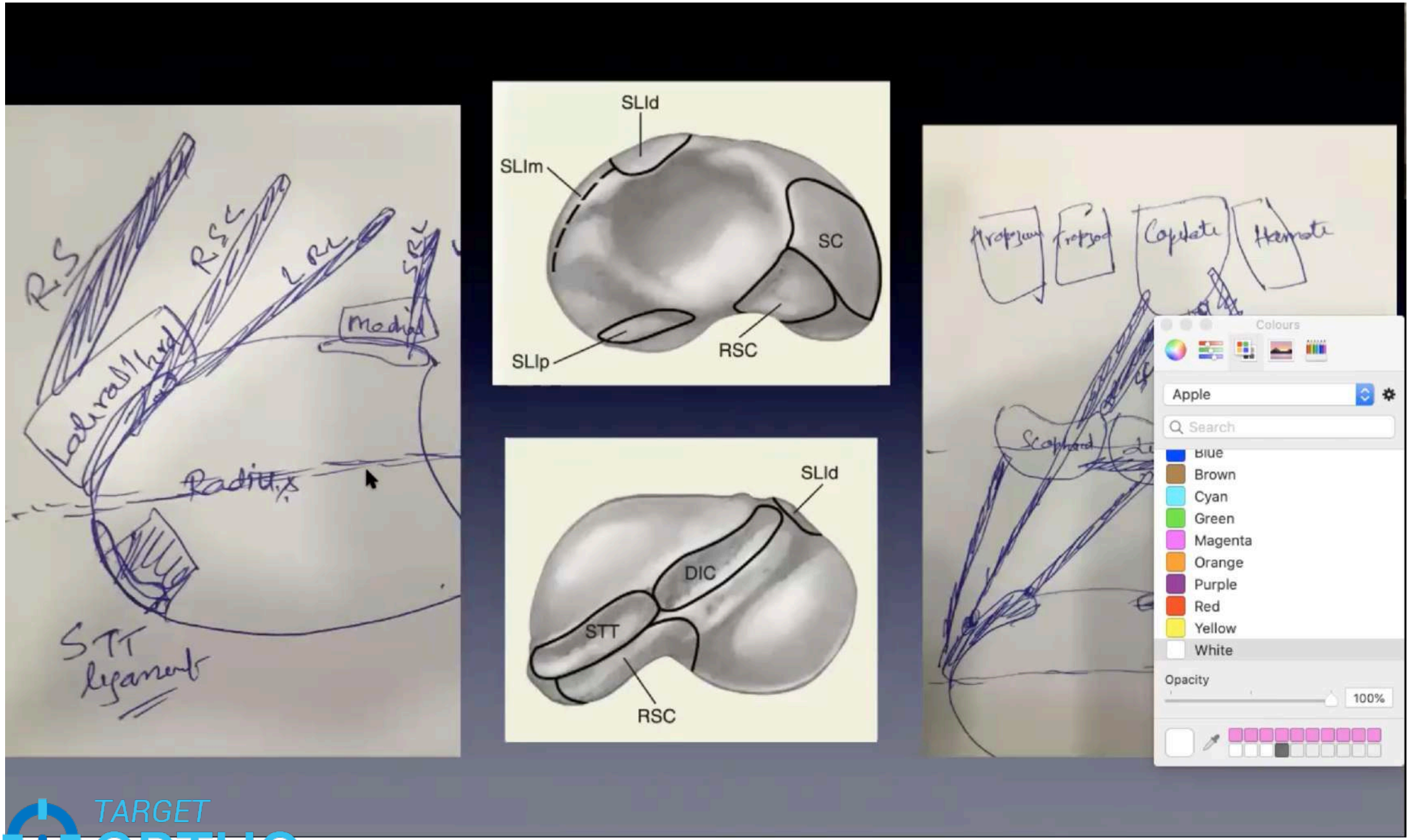
- 80% percent covered by cartilage limiting ligamentous attachmen and vascular supply
- Only bone that bridge distal and proximal row





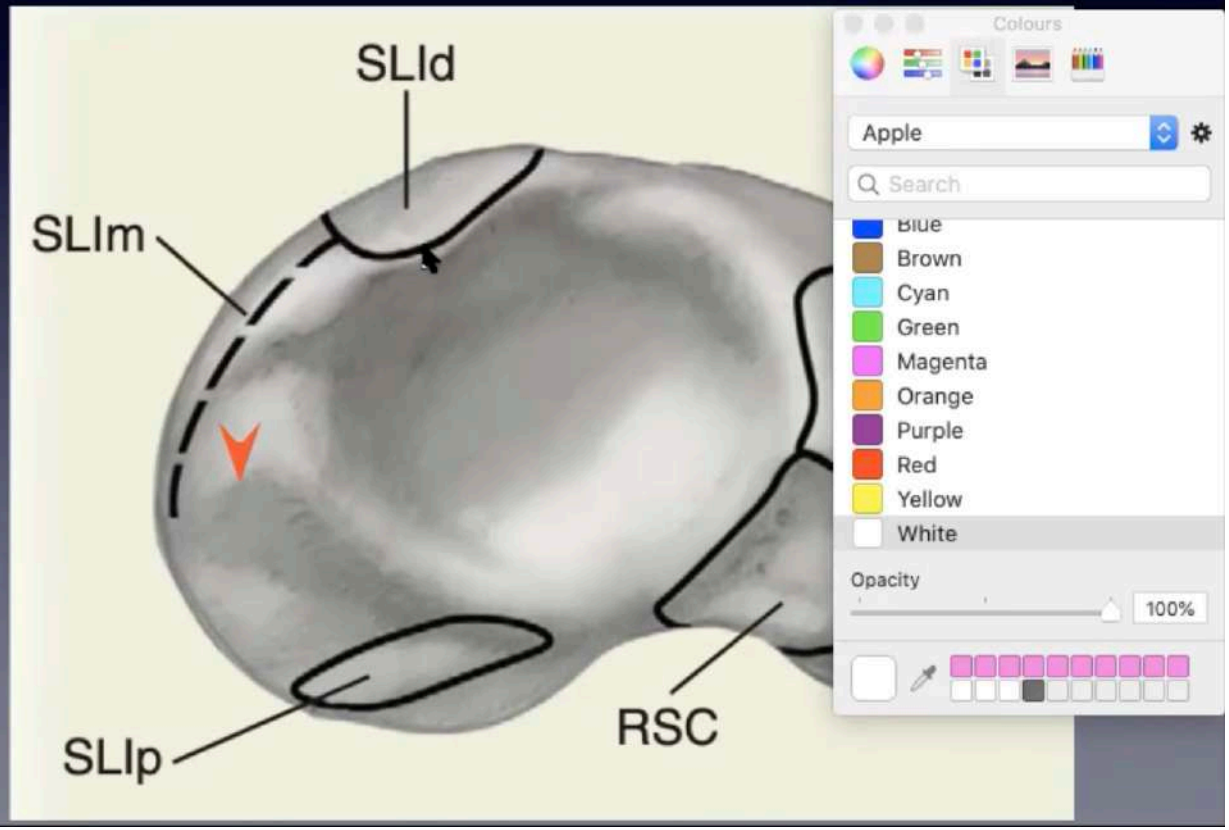
Ligamentous attachment



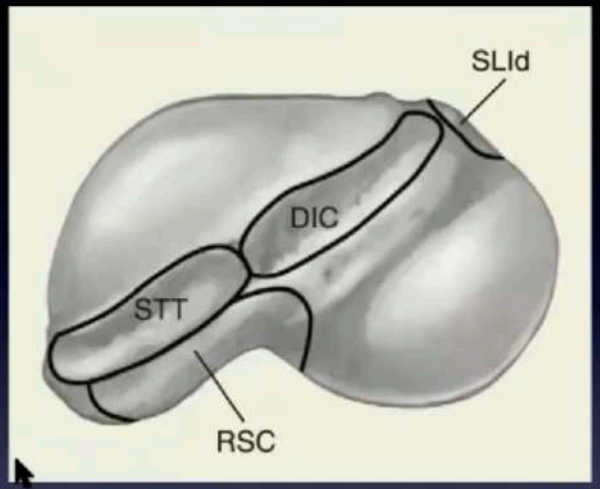


SLIL- scapholunate interosseous ligament

- **Dorsal** - strongest , resist palmar and dorsal translation
- Membranous
- **Volar** - resist rotation

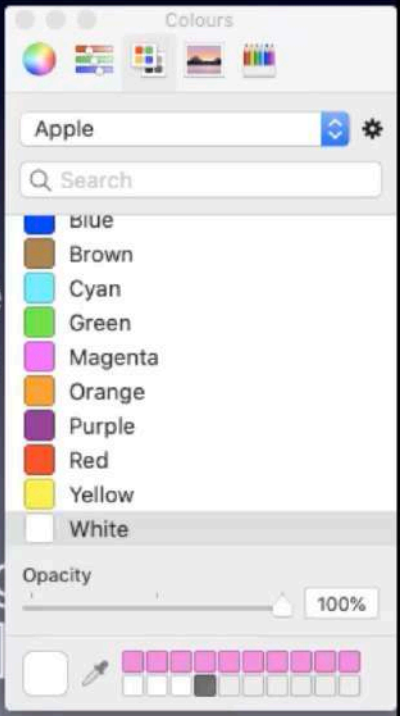


Scaphoid - Morphologic type

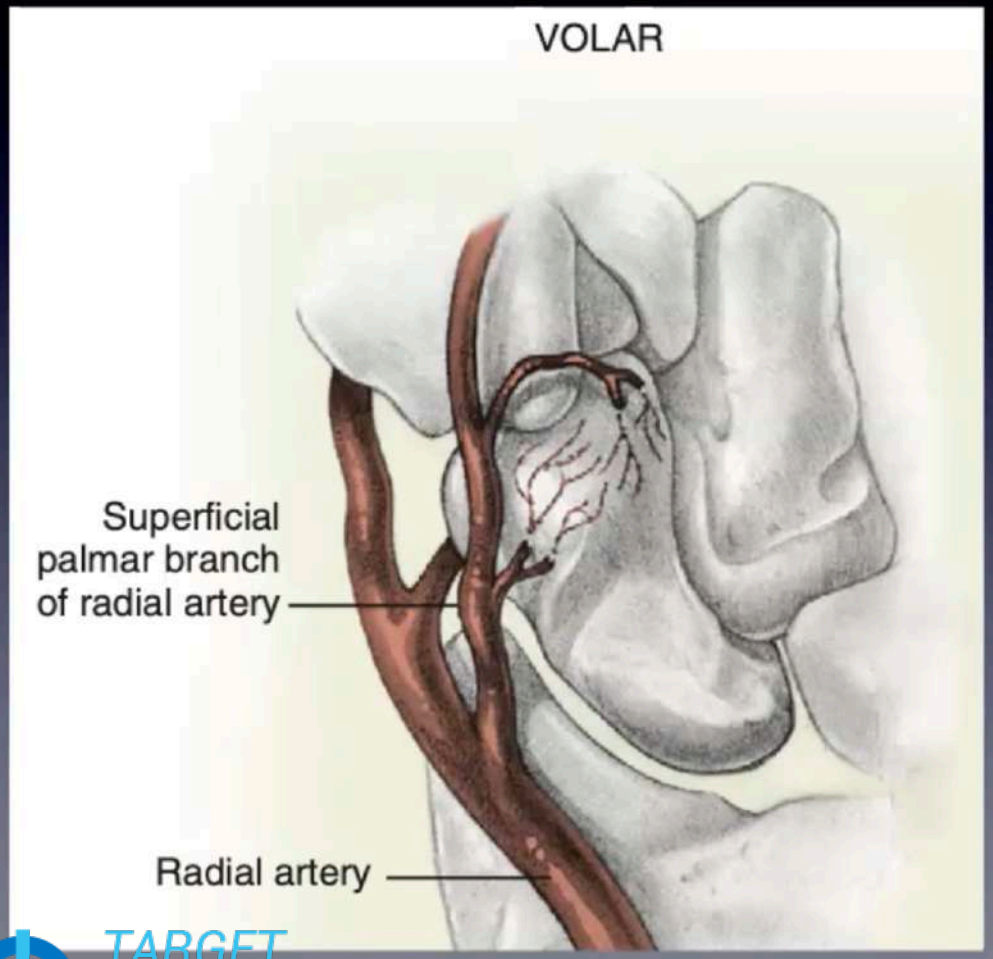


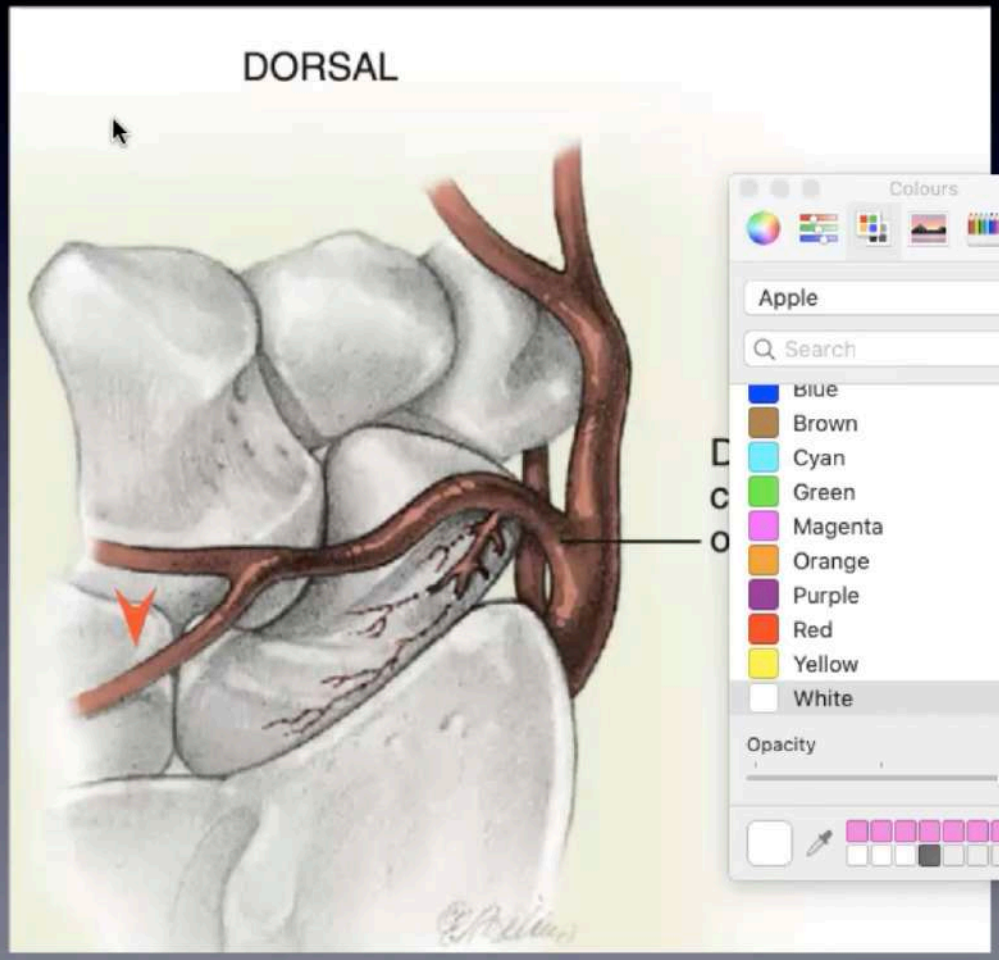
- **Type I** - Rotation or Arc type - characterised by single high cre
  dorsal aspect of scaphoid with no attachment of RSC and DIC
  ligament

- **Type II** - Flexion type - characterised by three lower crest along
  spine of scaphoid for dorsal joint capsule , DIC [PIN endings]
  RSC[has mechanoreceptor]

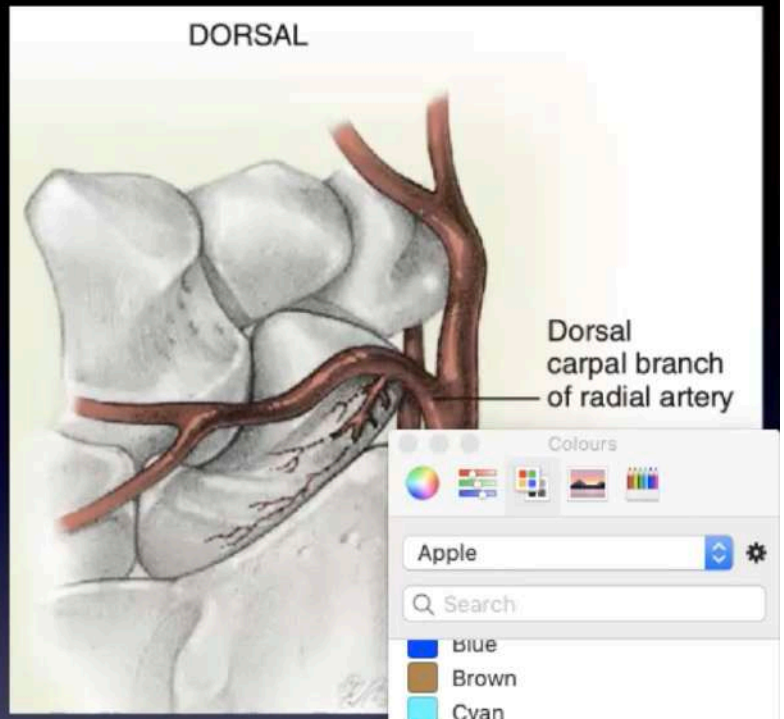


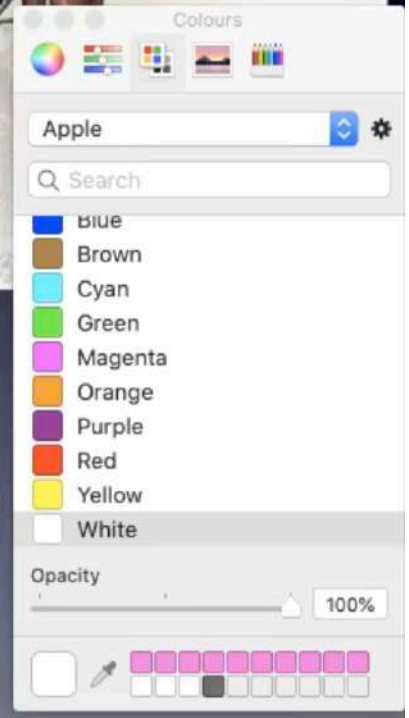
Vascular supply





Blood supply

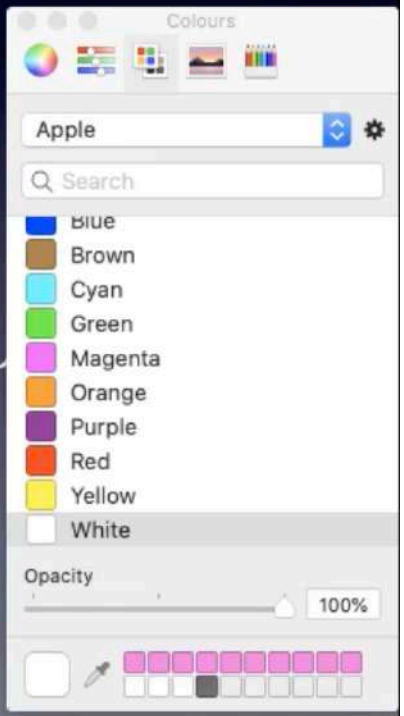




- 80 % blood supply enter through dorsal ridge and give entire to proximal pole by this only
- 20 percent vessels enter through volar tubercle

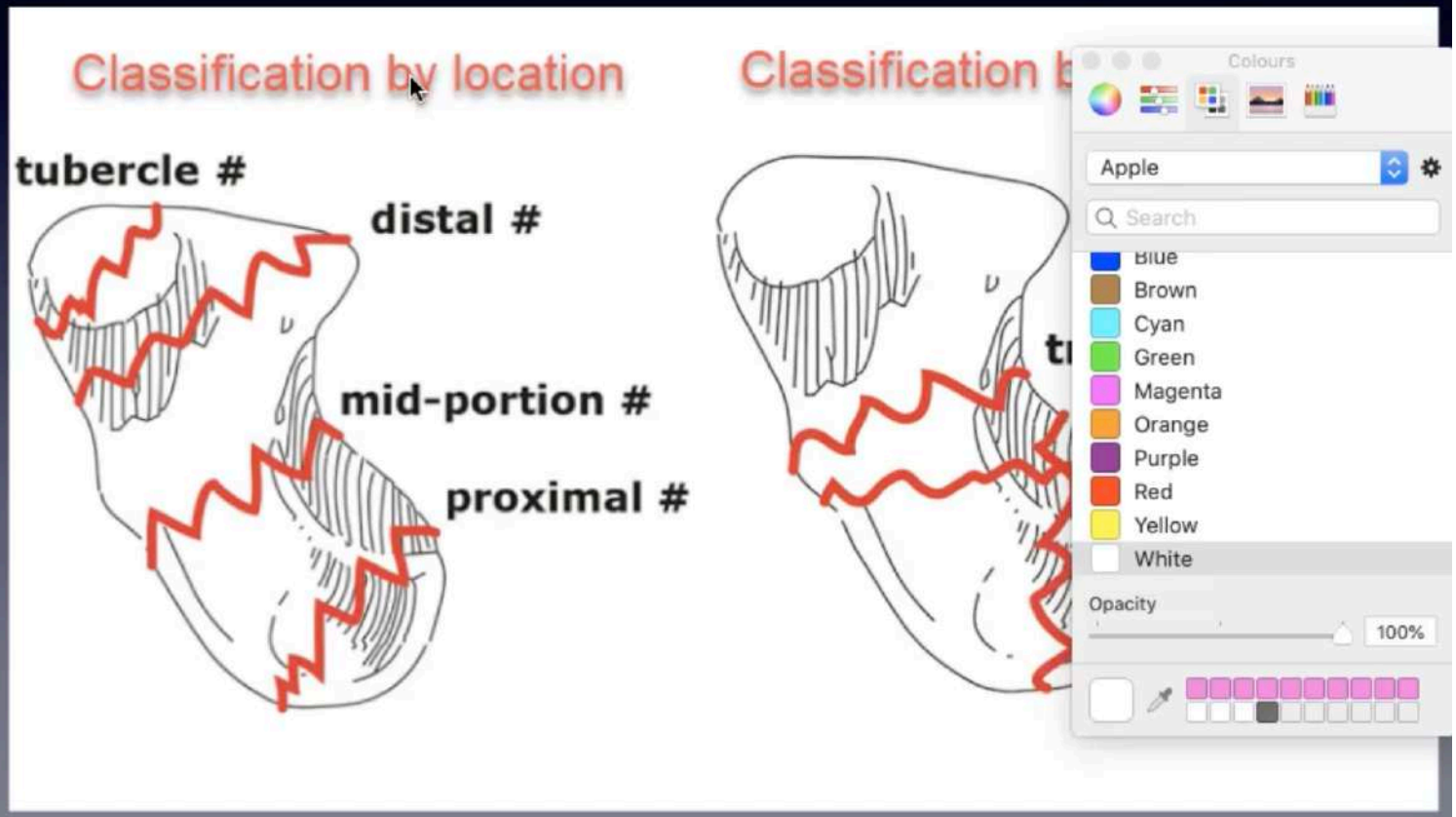
Interpretation of vascular anatomy

- High risk of AVN with proximal pole fracture
- High risk of nonunion with displacement [>1 mm] and angu
  [>15 degree angulation]



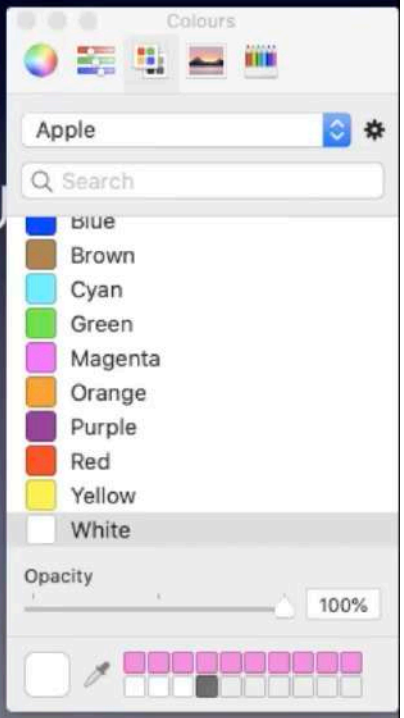
Scaphoid fracture

- Proximal pole
- Waist
- Distal pole



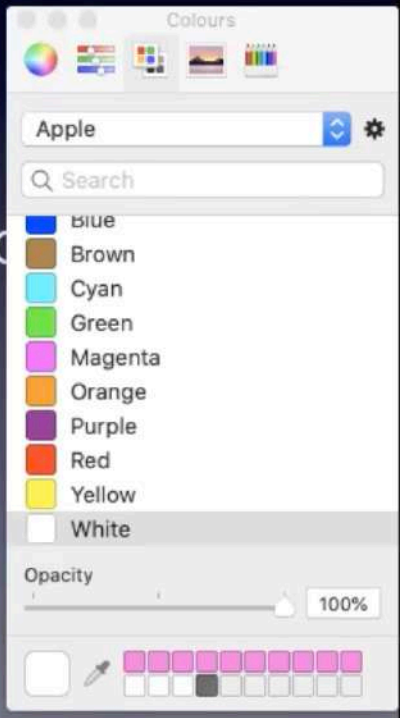
x ray

- PA / LATERAL / OBLIQUE [PARTIALLY SUPINATED WITH U
  DEVIATION]
- CLENCH FIST VIEW



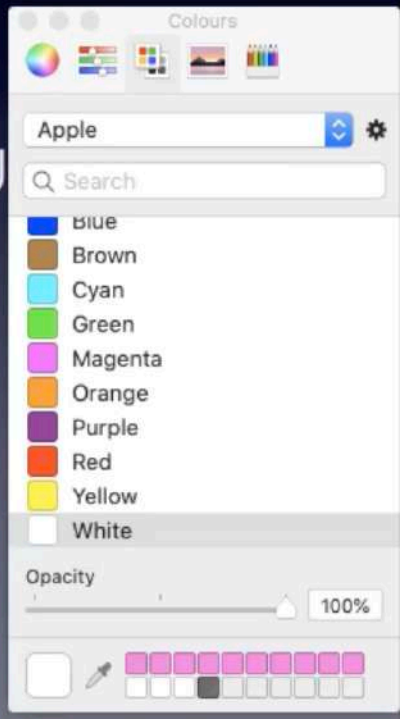
Imaging

- 25 % fracture are **not** visible on initial X ray . Repeat x ray at 10- 12 days with short arm cast immobilisation
- **MRI** within 24 hour OF INJURY - best for ACUTE / Ocult scapho and not for checking healing status
- **CT scan** - best for architecture and displacement of fracture
-



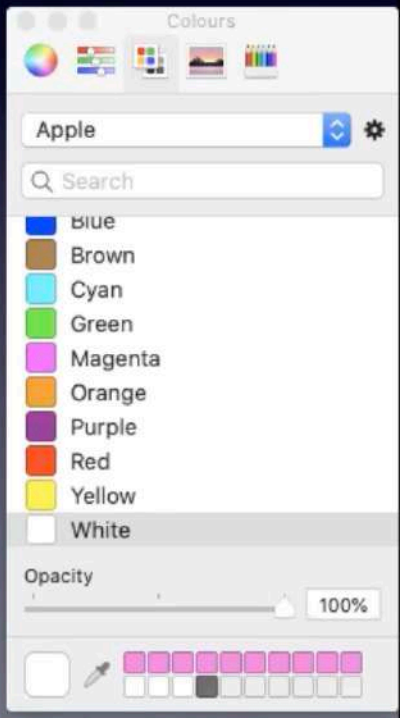
IMAGING - HEALING STATUS

- **X RAY** - CANNOT RELIABLY DETERMINE HEALING STSTU MONTHS OF PLASTER
- **CT scan** - best done at **3** months to check for union status of acute scaphoid fracture



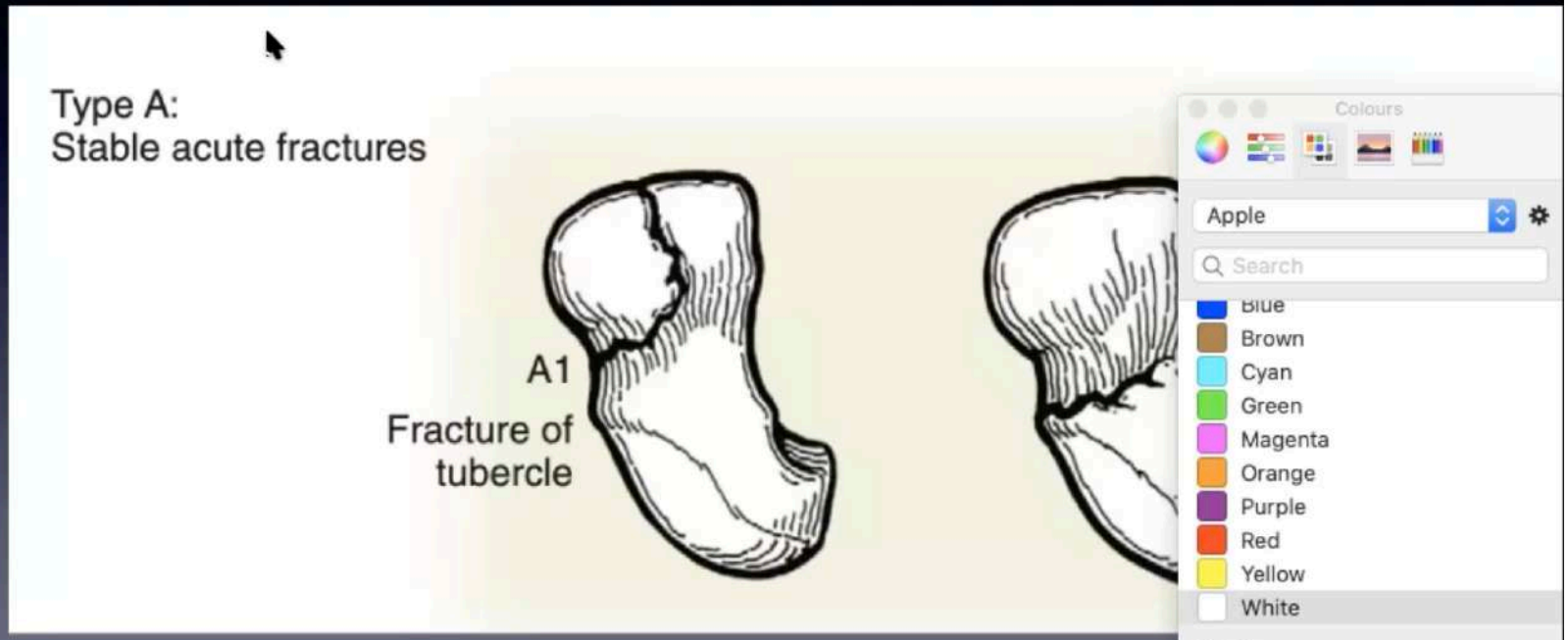
Herbert classification- scaphoid fracture

- **Has prognostic significance**



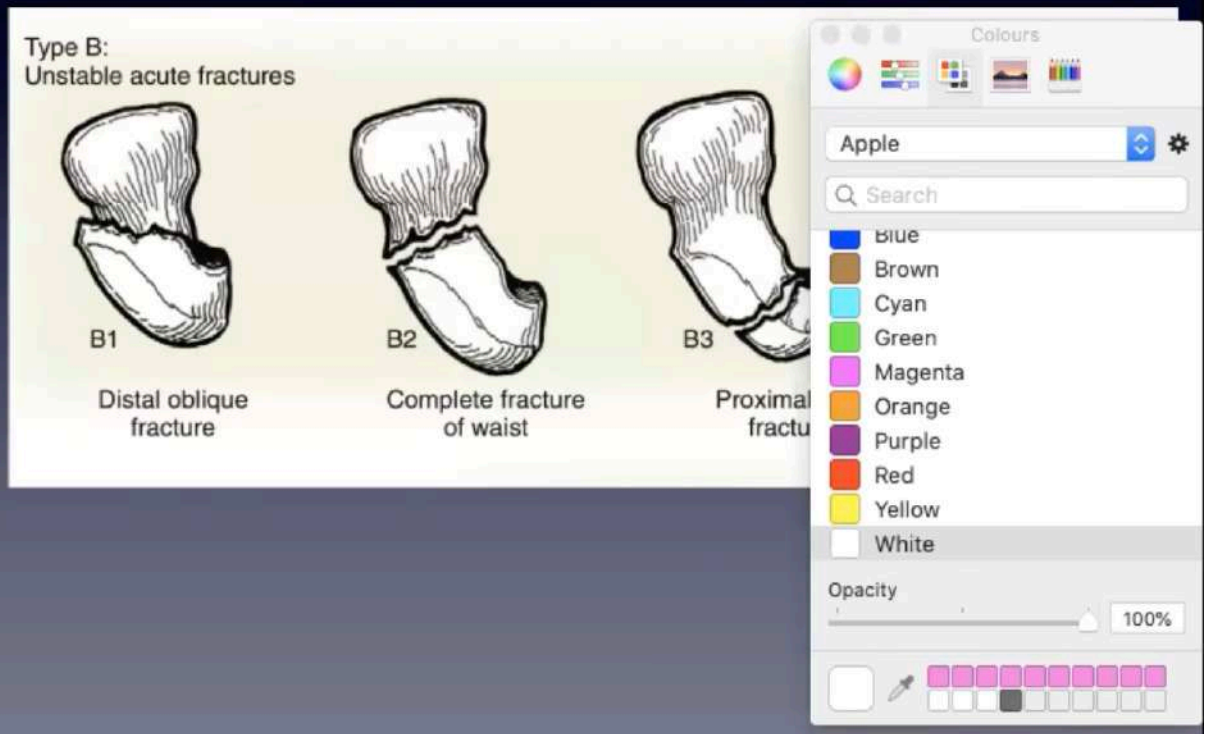
Type A-Stable fracture

- Distal pole
- Incomplete fracture



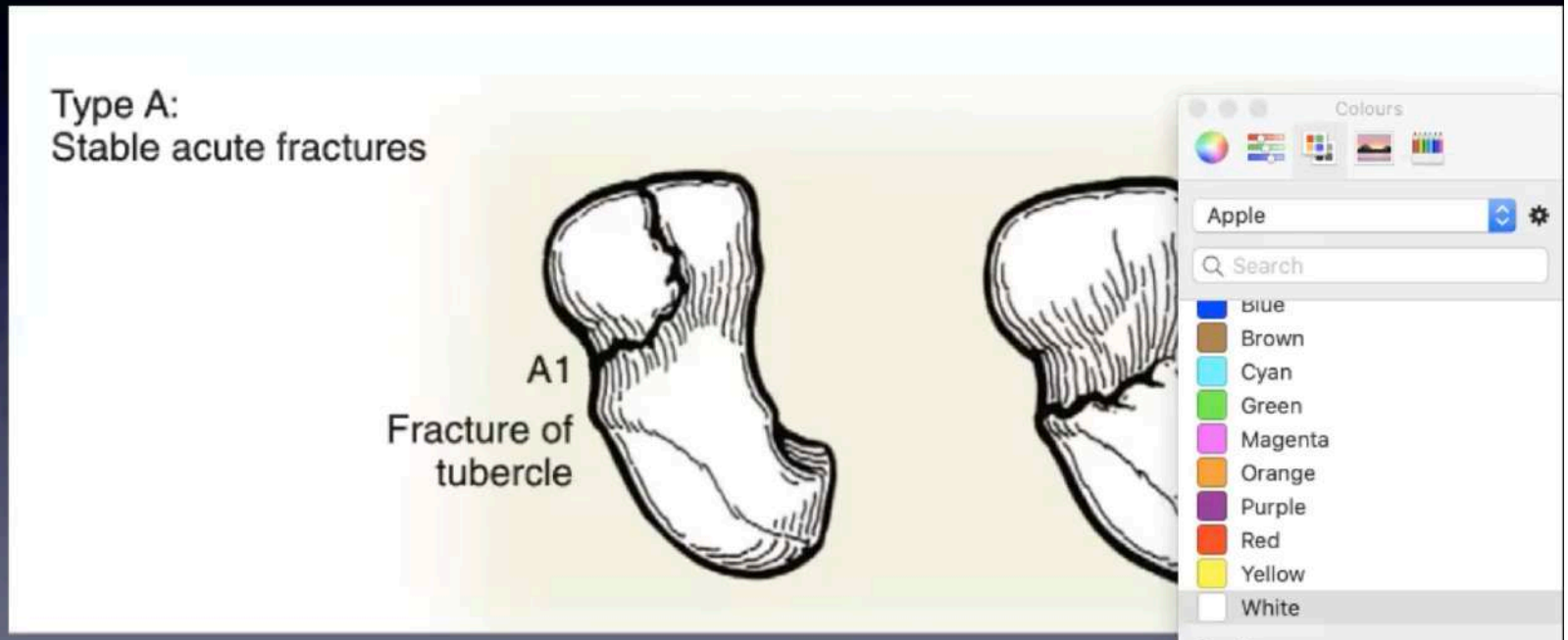
Type B-Unstable fracture

- Oblique fracture
- Displacement > 1 mm
- Interscaphoid angle > 35 degree
- Communition / Bone loss
- DISI / Perilunate
- Proximal pole



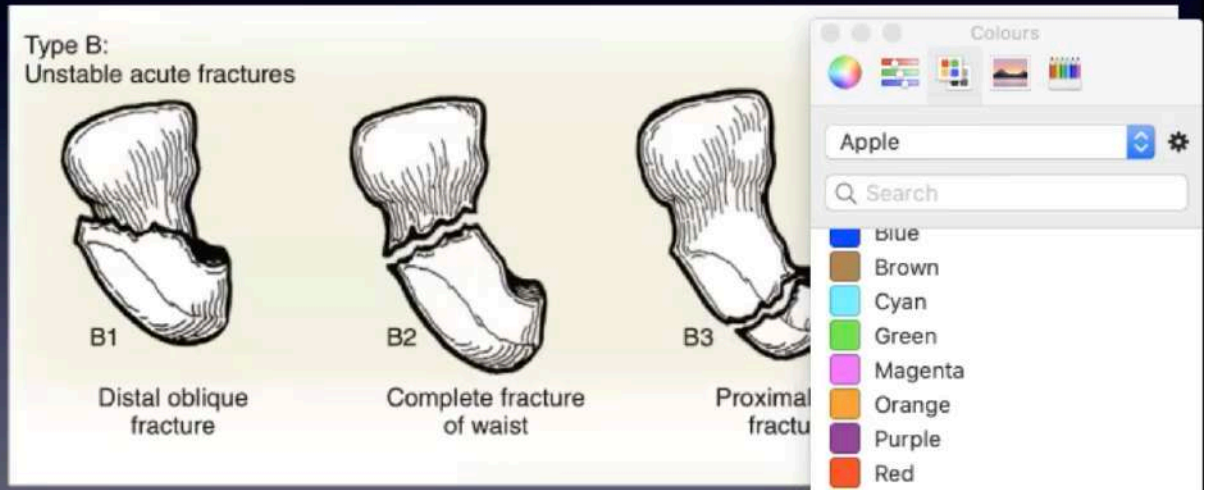
Type A-Stable fracture

- Distal pole
- Incomplete fracture



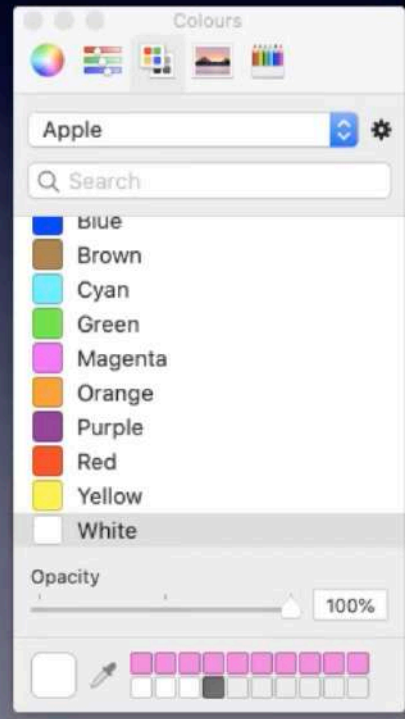
Type B-Unstable fracture

- Oblique fracture
- Displacement > 1 mm
- Interscaphoid angle > 35 degree
- Communition / Bone loss
- DISI / Perilunate
- Proximal pole



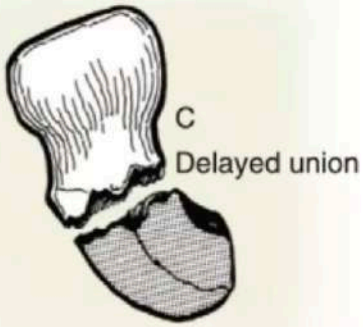
Undisplaced Proximal pole fracture - why unstable

- Small size
- Long moment arm at fracture site
- Tenuous blood supply
- Interarticular location

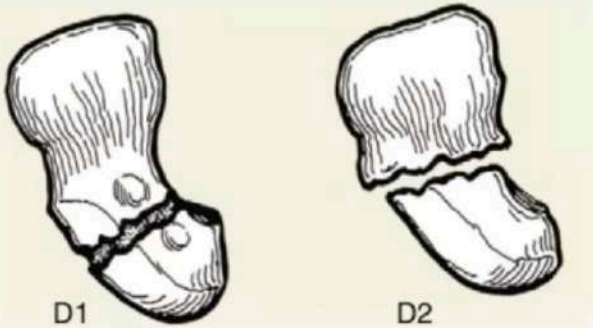


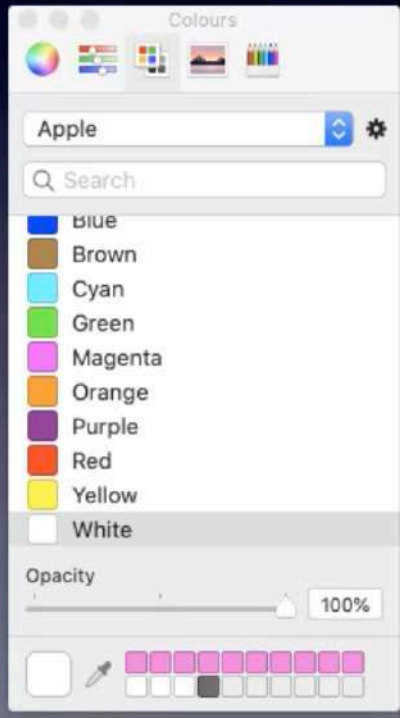
Type C- Delayed union
Type D- Estabilished nonunion

Type C:
Delayed union



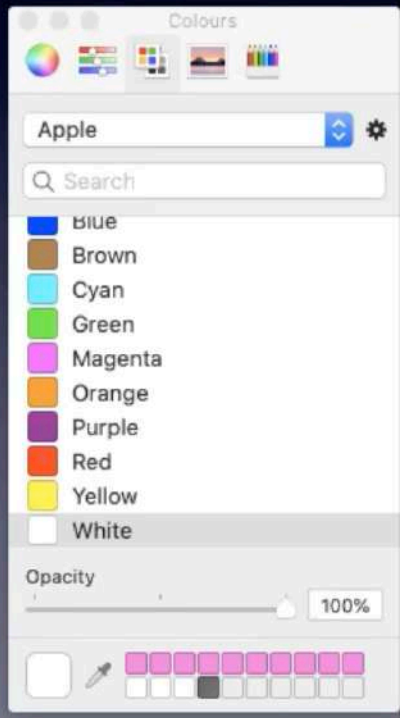
Type D:
Established nonunion





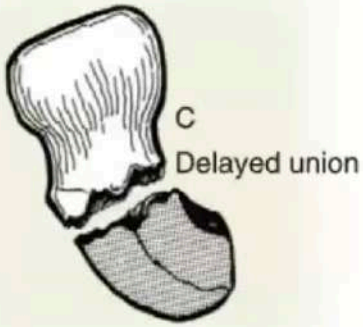
Undisplaced Proximal pole fracture - why unstable

- Small size
- Long moment arm at fracture site
- Tenuous blood supply
- Interarticular location

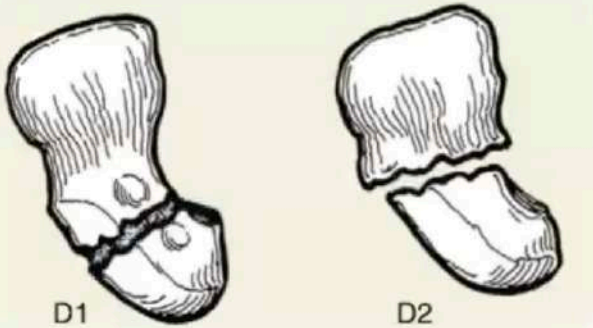


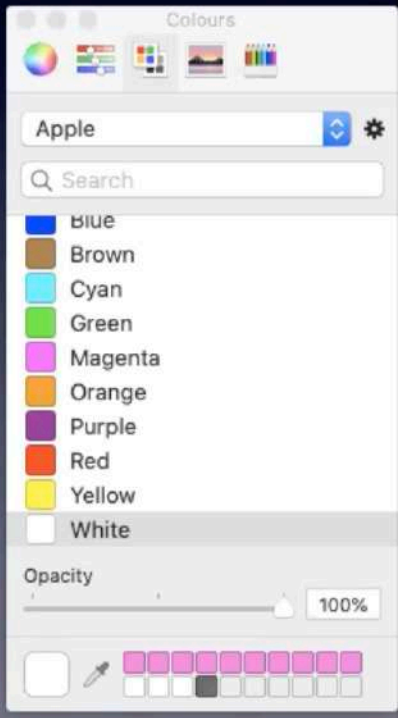
Type C- Delayed union
Type D- Estabilished nonunion

Type C:
Delayed union



Type D:
Established nonunion





Treatment of Type -A

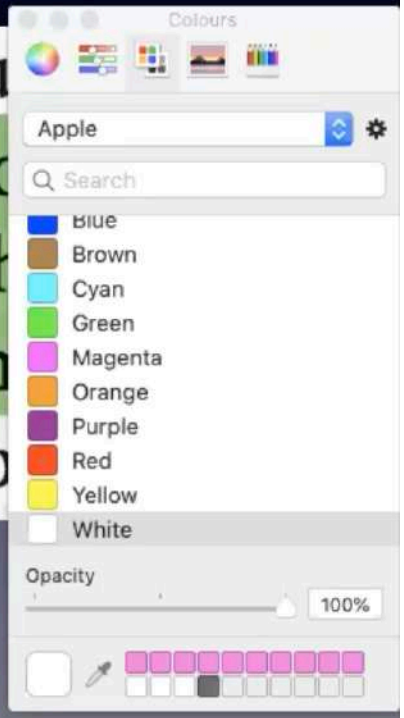
Acute and stable fracture

- Long arm cast 6 week
- Switch cast
- Short arm cast 6 week
- Others are
- Percutaneous
- ORIF

Stable Fractures, Nondisplaced	
Tubercle fracture	Short arm cast for 6 to 8 weeks
Distal third fracture/incomplete fracture	Short arm cast for 6 to 8 weeks
Waist fracture	Long arm thumb spica cast for 6 weeks, short arm cast for 6 weeks or until CT confirmed healing esp Pedia Seder pat Prefer trea Percuta fixa Active wo Athle occ Prefer mo
Proximal pole fracture, nondisplaced	Percutaneous or open internal fixation

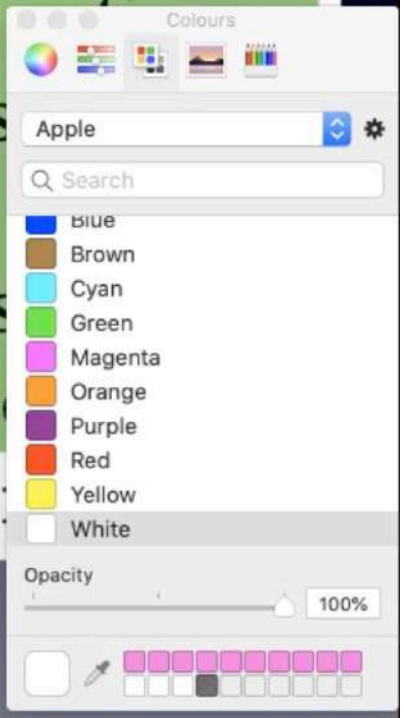
Risk

Delay in treatment reduces the likelihood of u
stable scaphoid waist fracture. Langhoff, reporting
of 285 scaphoid fractures, found that fractures th
went treatment more than 4 weeks after injury h
stantially greater risk of delayed union or nonunio



Position of immobilisation

There is no agreement in the literature as to the position of immobilization or type of cast, sugges truly stable fractures can be treated in a variety of instance, thumb spica casts, wrist extension cas neutral casts, ulnar deviation casts) with nearly e results. Historical literature suggests that the union



Treatment of Type B - Internal fixation

Acute and unstable fracture

Unstable Fractures

Displacement >1 mm

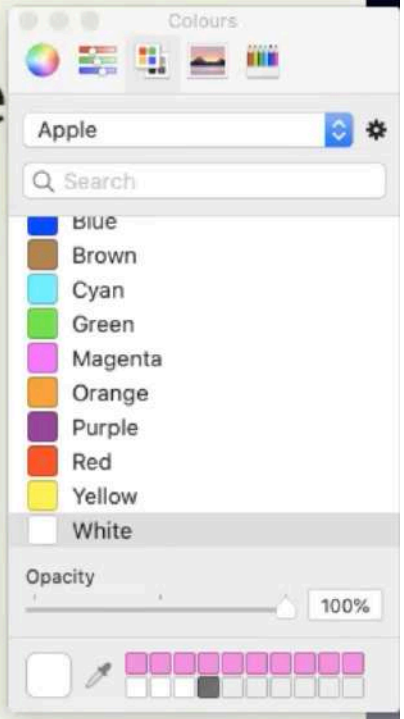
Lateral intrascaphoid angle >35°

Bone loss or comminution

Perilunate fracture-dislocation

Dorsal intercalated segmental instability alignment

Dorsal percutane screw fixation



Implants - Resist bending shearing and translation forces

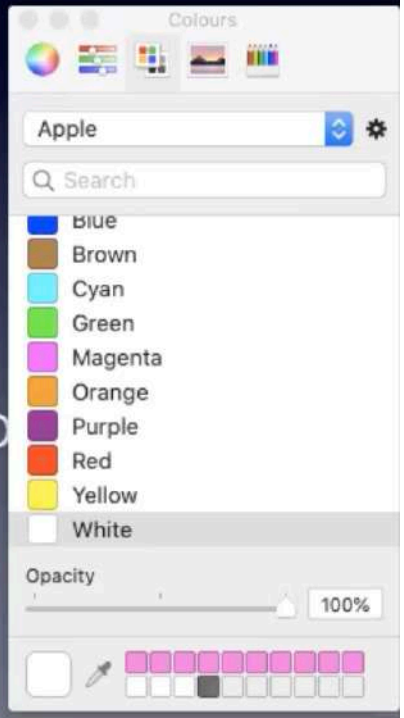
- **K wire**

- Insecure - cause minimal compression at fracture site

- **Good for**

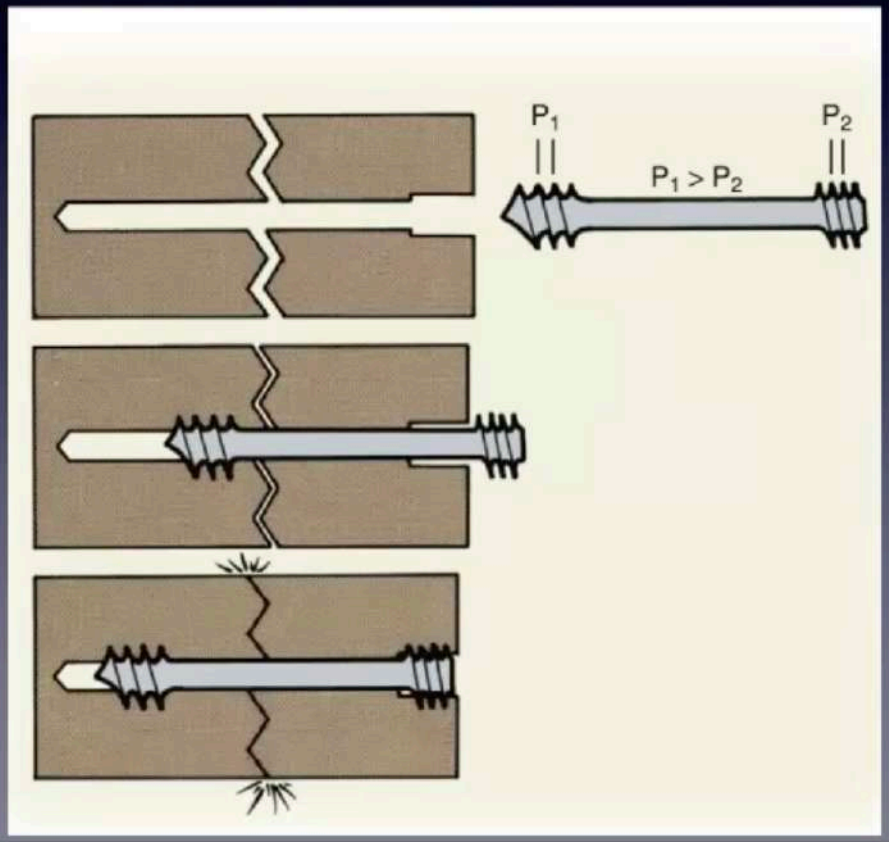
- open injury , small proximal pole fracture when fragmentatio
  concern with screw

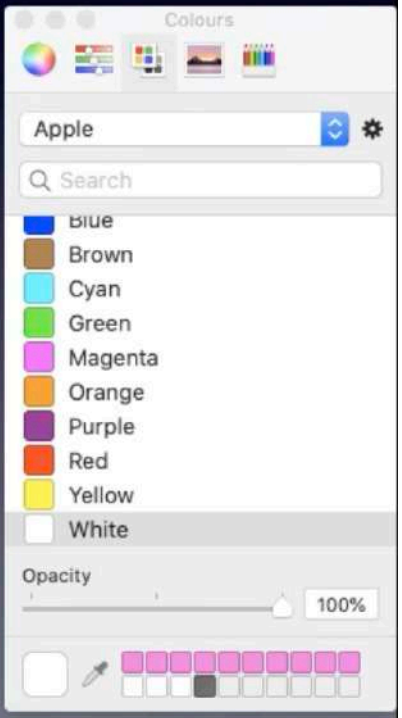
-



Implants -AO Compression screw

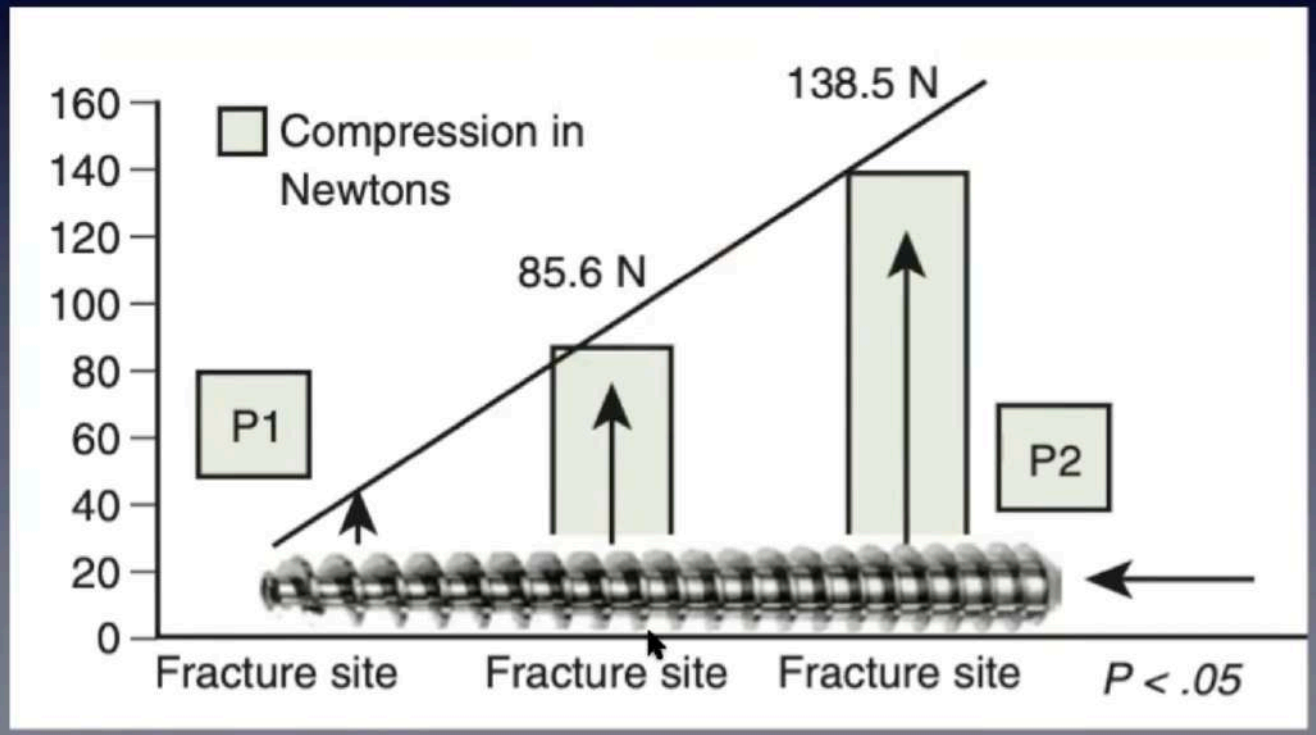
- Partially threaded + variable pitch

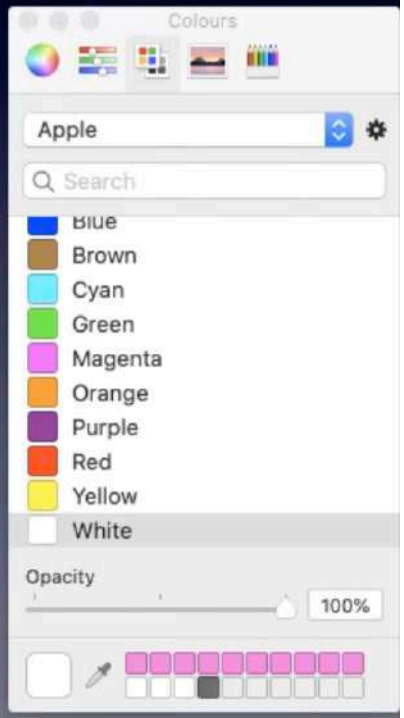




Implants -Headless compression screw [Acutrack]

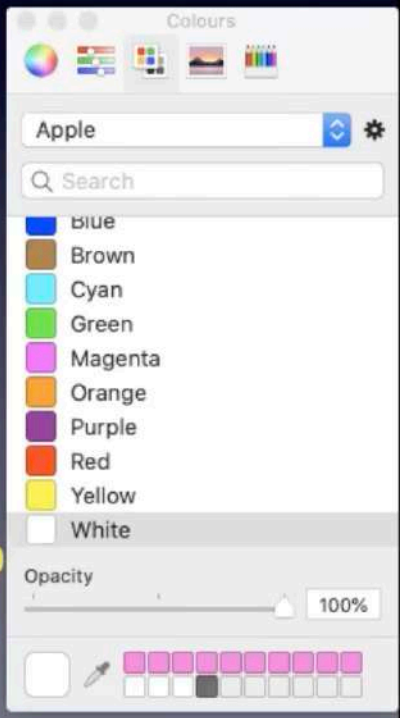
- Fully threaded + variable pitch



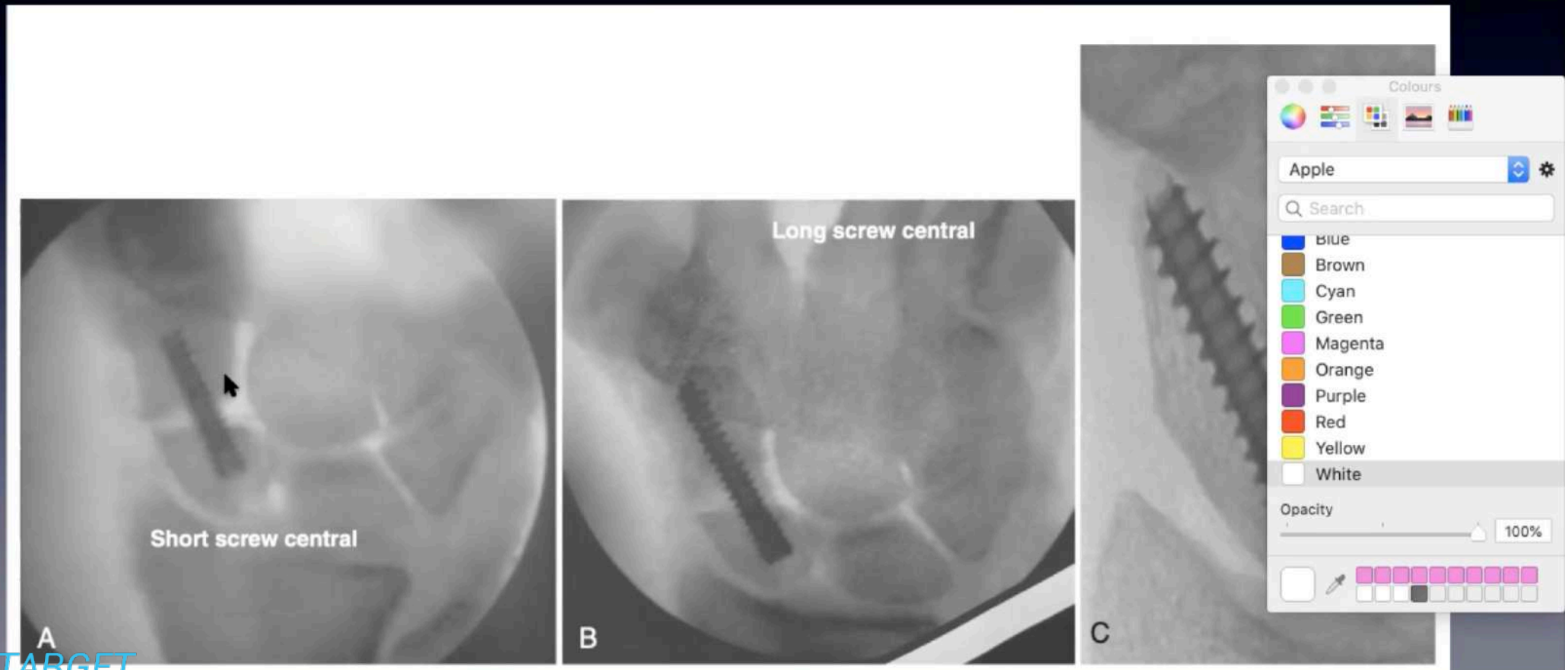


Clinical outcome of internal fixation - Five variables

- Fracture geometry
- Bone quality
- Fracture reduction
- Implant choice
- **Placement of screw in ideal position - single most impo variable for good outcome**

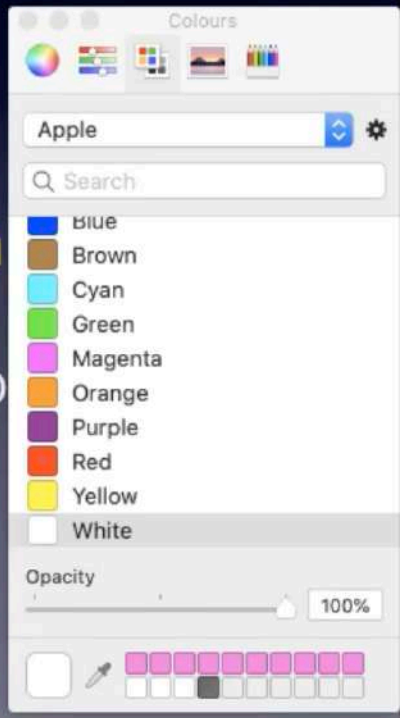


Placement of screw - most important variable
Short / Long screw
Central / Eccentric screw



Placement of screw - screw length

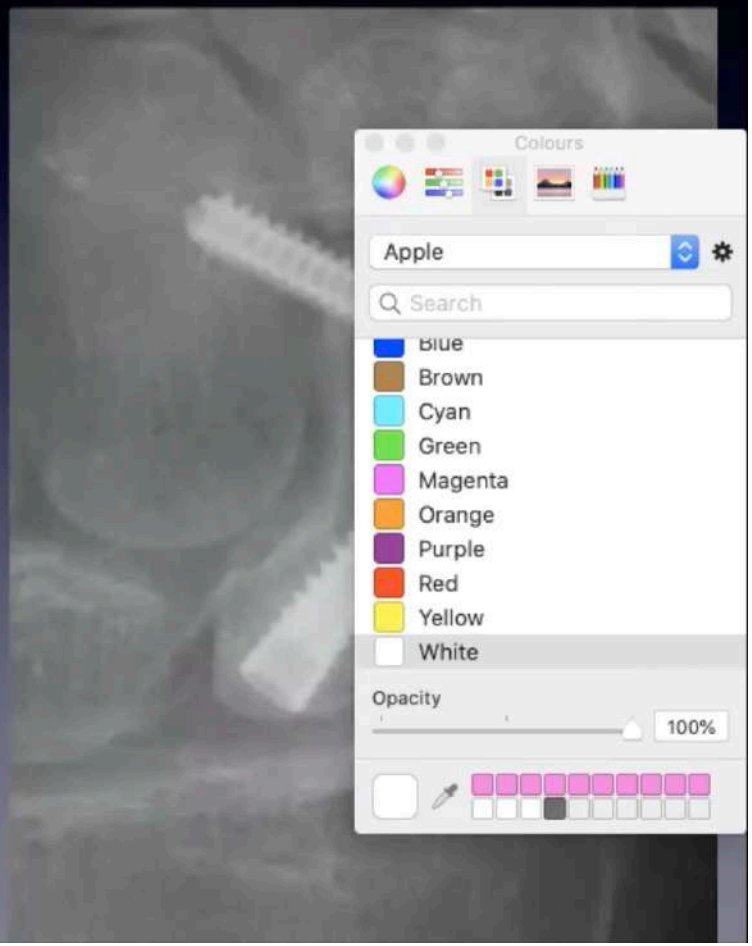
- should be 4- 5 mm shorter than measured scaphoid length
- Subchondral reaming should be 2 mm short of scaphoid co



Placement of screw

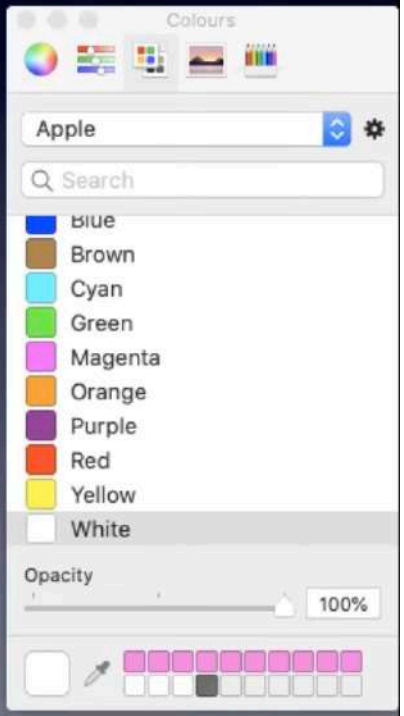
Augmentation by additional screw [distal scaphoid to capitate]

- Indicated in
- Extreme proximal pole to reduce load on it.



Type D - Estabilished scaphoid non-union

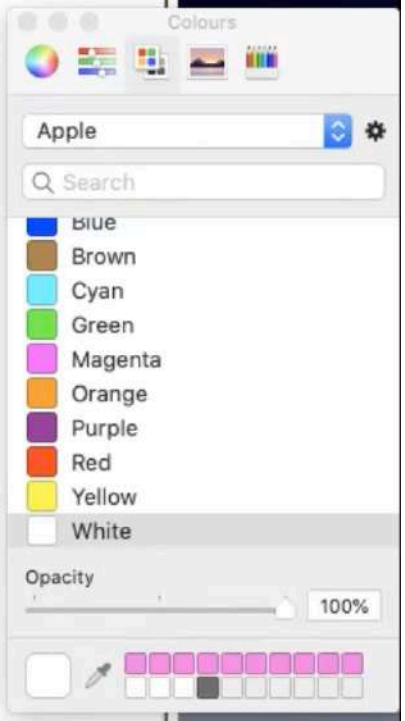
- Lichtman classification
- Giessler classification



Treatment Type D - Established nonunion

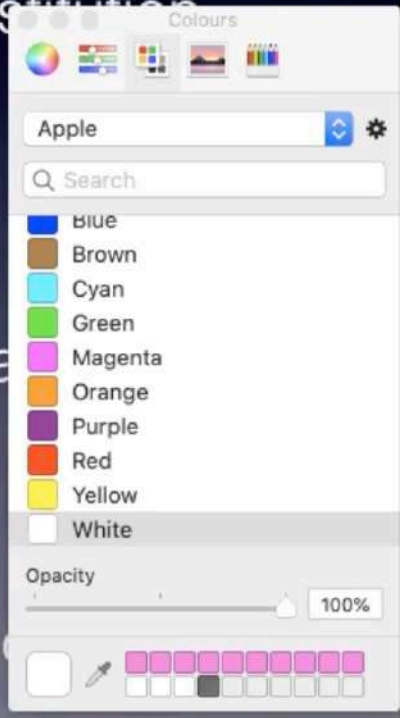
SLADE AND GIESSLER CLASSIFICATION FOR SCAPHOID NONUNION

- Type I injury : are the result of a delayed presentation (4 to 12 weeks after injury).
- Type II injuries: a fibrous union is present.
- Type III injuries: minimal sclerosis is seen at the fracture site. Sclerosis < 1 mm.
- Type IV injuries: cystic formation is present.
- Type V injuries: cystic changes > 5 mm in diameter, rotation the lunate has occurred, resulting in a humpback deformity as seen with plain radiography or CT.
- Type VI injuries: secondary degenerative changes are present, (i.e., scaphoid nonunion advanced collapse [SNAC]).



Geissler I - III [minimal bone loss]
Good healing potential

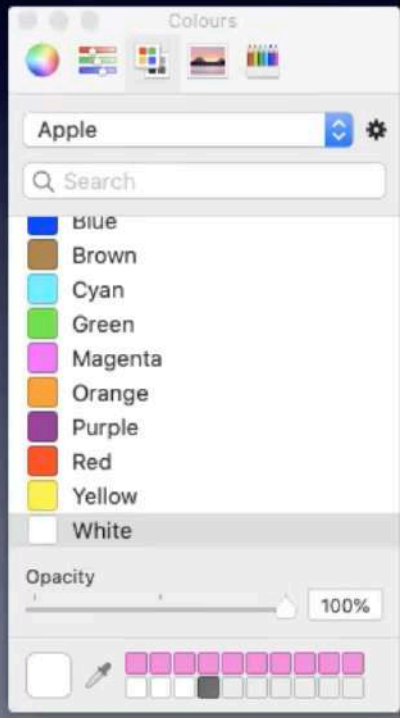
- 1-2 mm bone gap can be healed primarily by creeping substitution from surrounding viable bone
- Importance of Arthroscopic finding of
- presence of fibrocartilagenous scar at fracture site - percuta BG is possible as scar will prevent dislodge of graft into radioiocarpal joint
- Absence of fibrocartilagenous scar - leads to synovial pseu arthritis that need open procedure and BG



Gesseliers Grade IV to VI

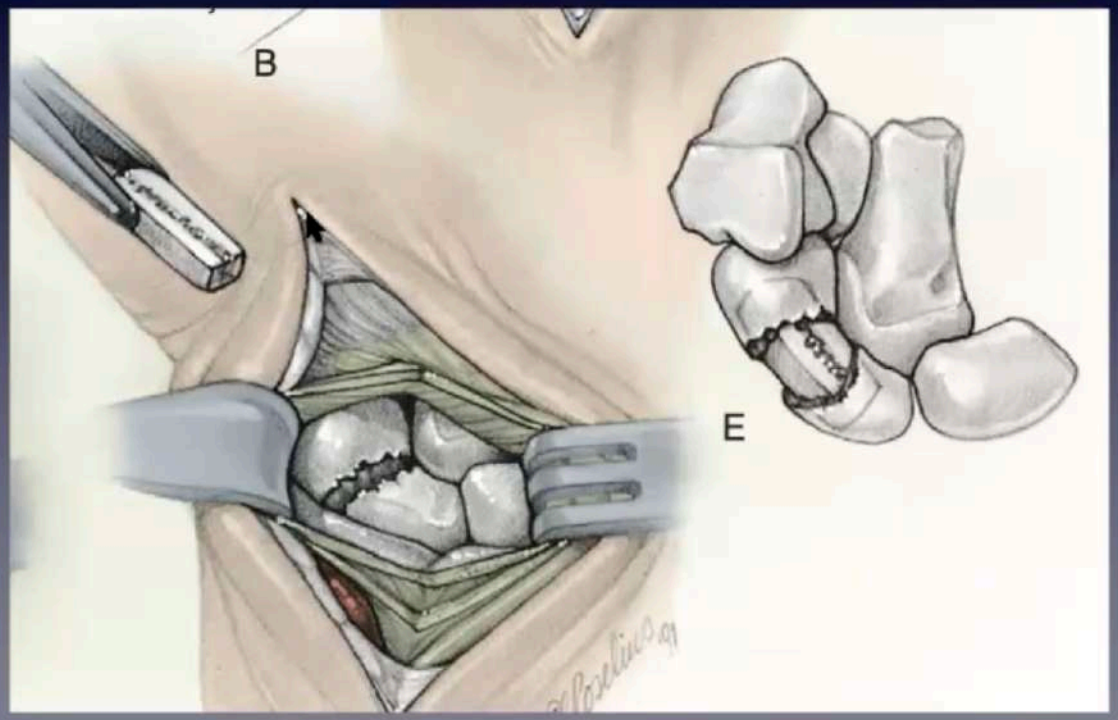
Correctly aligned Scaphoid nonunion with substantial bone loss

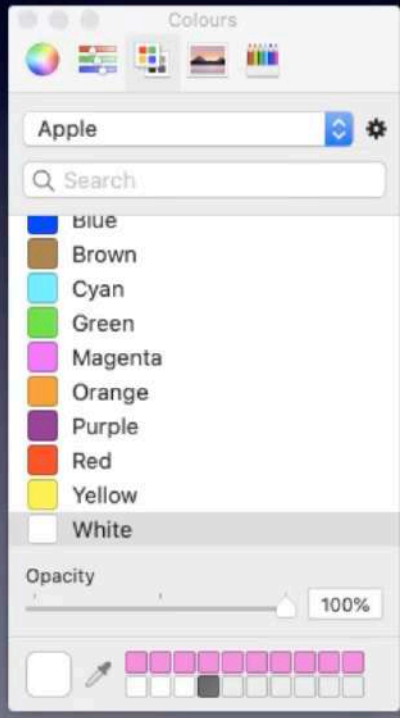
- **Grade IV** - Bone loss [cyst] - 2- 5 mm bone loss
- **Grade V** - Bone loss [cyst] 5- 10 mm
- **Grade VI** - SNAC wrist [arthritis]



Giesslers Type I - IV
Ruse Matti graft technique - Indicated

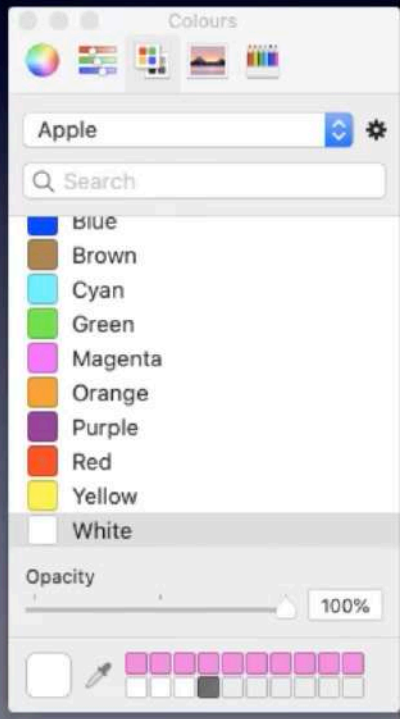
- Procedure - Use palmar approach, did cavitation on each side of fracture . any single strip BG [Radius or Illiac]





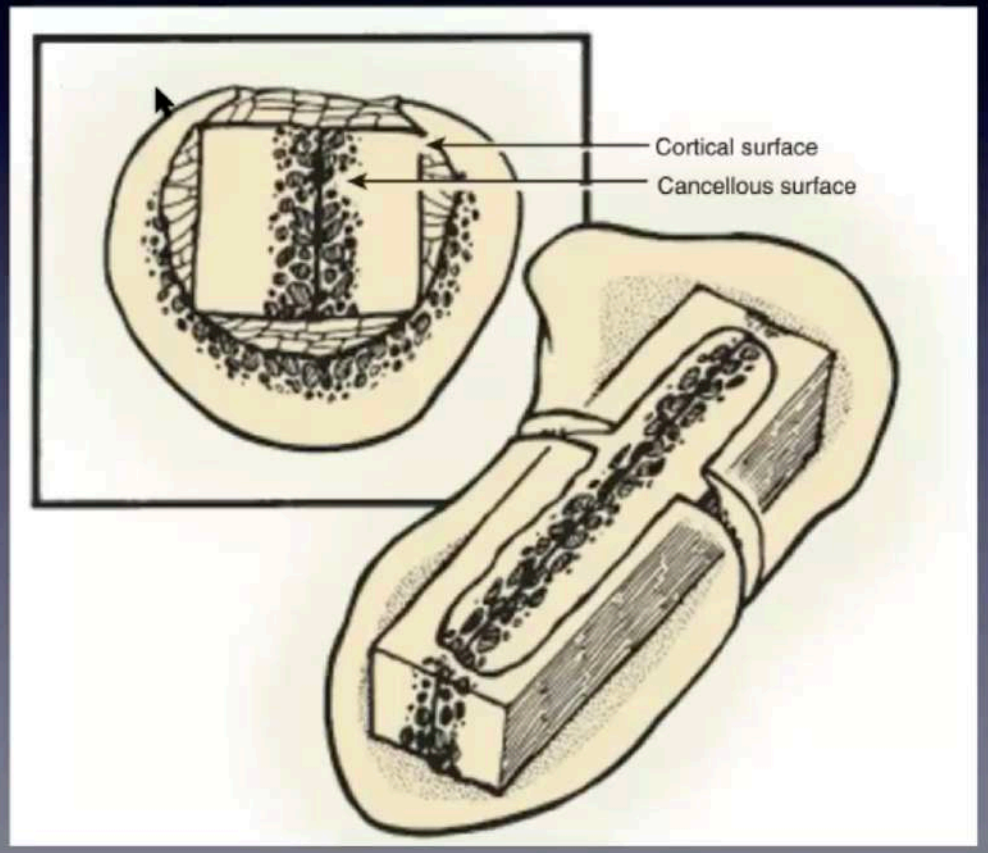
Ruse Matti graft - contraindication

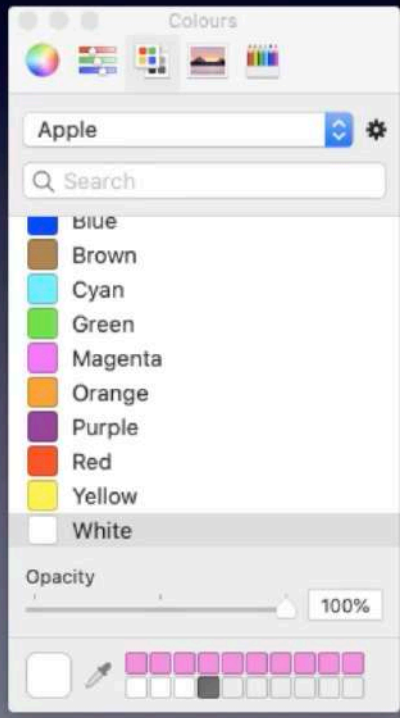
- Large cyst
- AVN of proximal pole
- Deformity [humpback] , DISI
- SNAC wrist



Giesslers Type I - IV

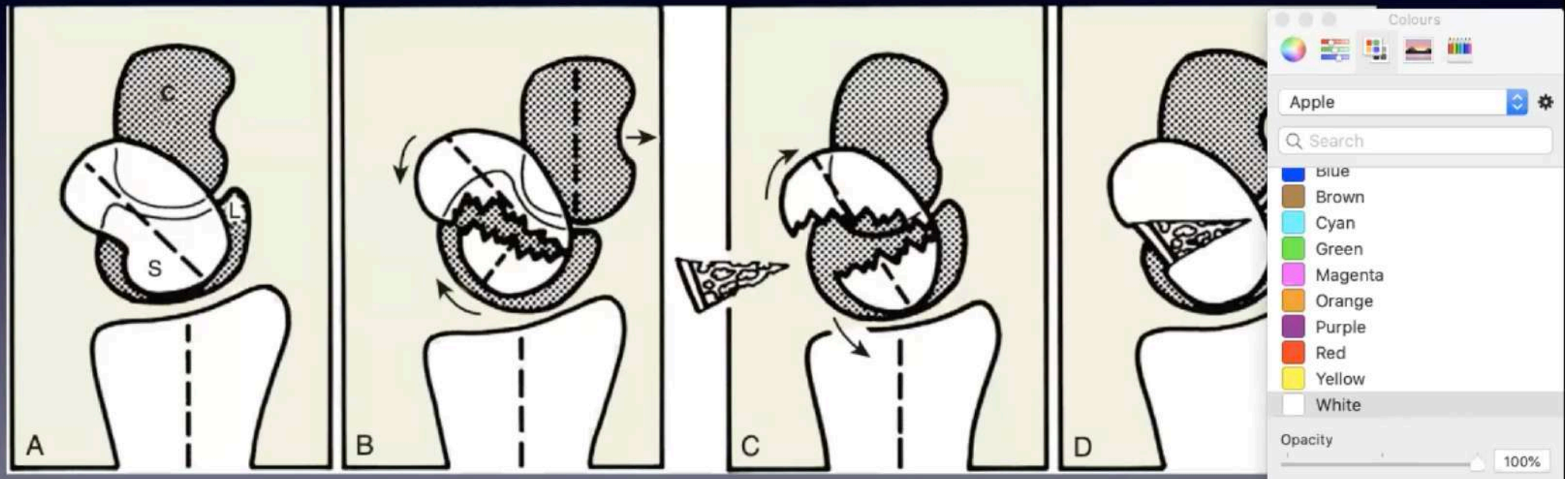
- Green modification- Two parallel cortico canecellous graft facing each other





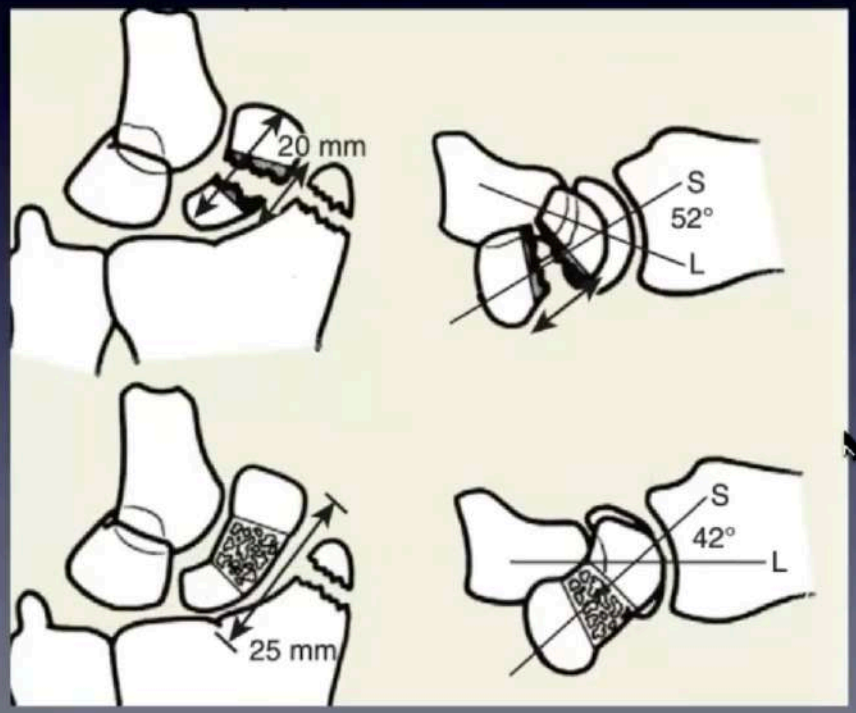
Grade V - Correction of scaphoid nonunion with deformity

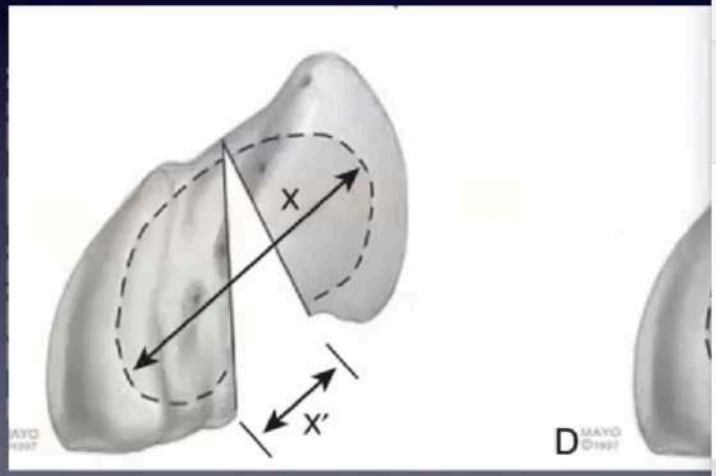
Anterior wedge BG

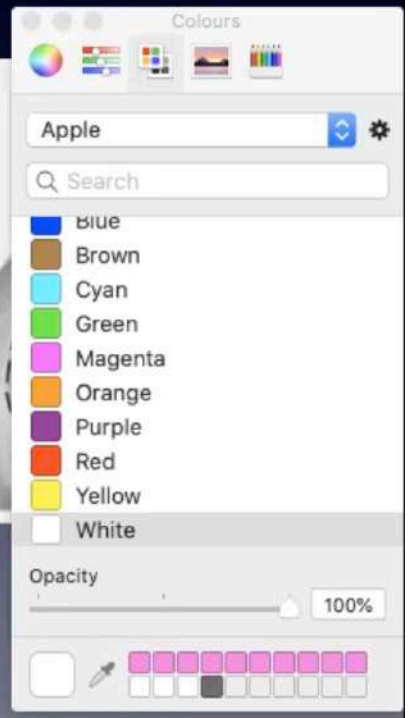


Grade V - Correction of scaphoid nonunion with deformity

Anterior wedge BG



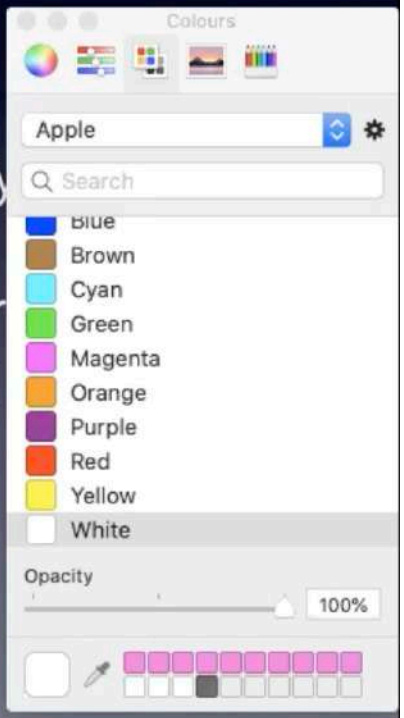




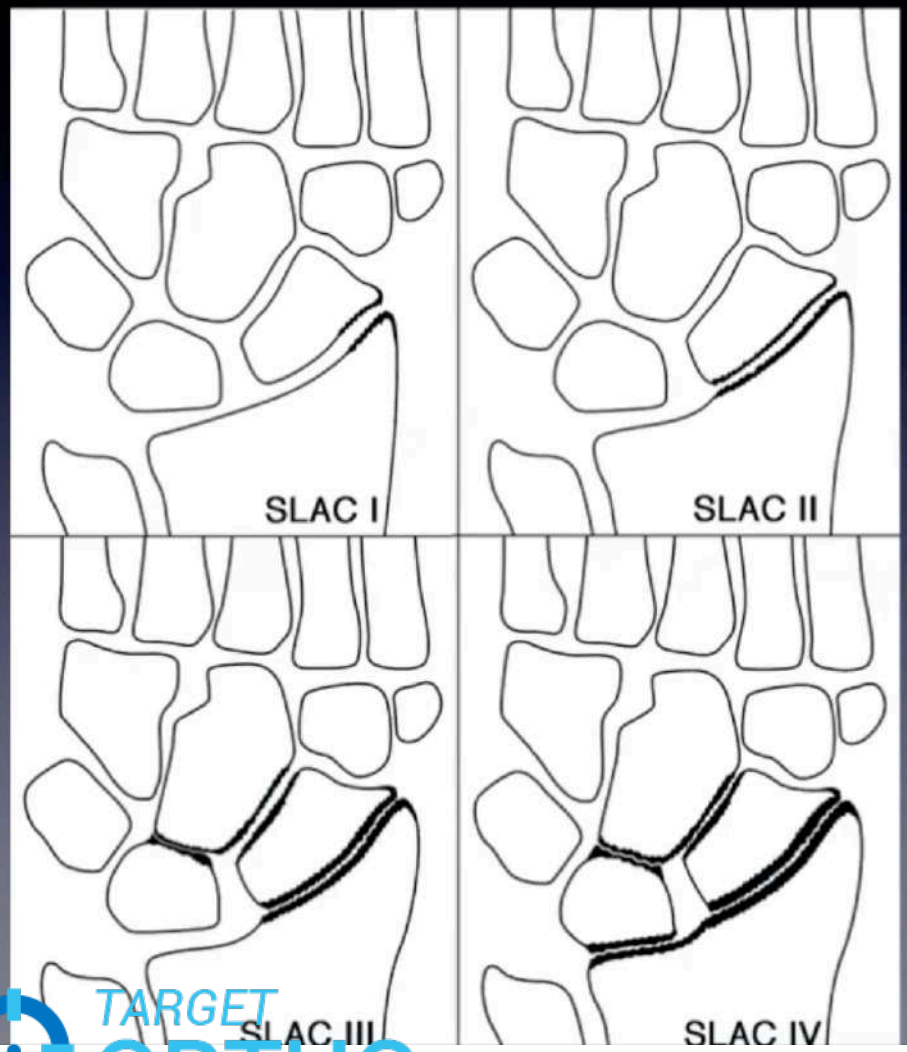
Grade V - Correction of scaphoid nonunion with deformity

Anterior wedge BG

- Pre op measurement scaphoid length and deformity
- Use of palmar approach - reduce danger of vascular supply
- Wedge shape Iliac crest BG after resection of pseudo arthr
  better ability to resist compression forces than radial styloid
  proposed by FISK
- Internal fixation

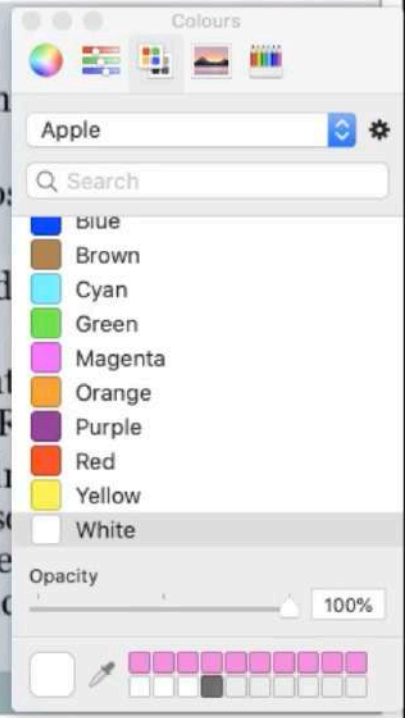


Giesslers grading Type VI- SNAC wrist



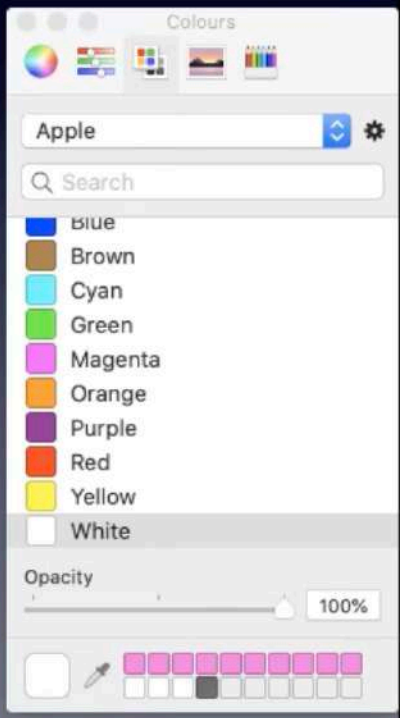
Watson staging (often used by hand surgeons)

- **I**: osteoarthritis of the articulation between
  and the scaphoid
- **II:** osteoarthritis involving the whole radio
  articulation
- **III:** osteoarthritis of the radioscaphoid and
  articulations
- **IV:** osteoarthritis of the radiocarpal and int
  articulations +/- distal radioulnar joint (DR
- NOTE: Note that the radiolunate joint is al
  until very last stages of the disease. It is als
  the scaphoid fossa in the radius may be dee
  cases of CPPD in contrast to post-traumatic



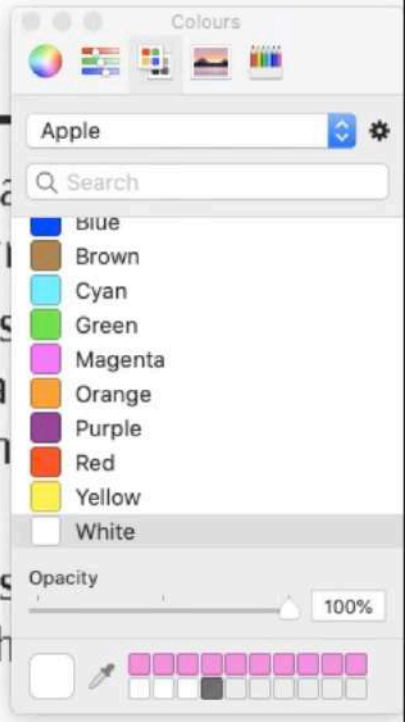
Salvage procedure for scaphoid nonunion - SNAC arthritis

- Radial styloidectomy +/- scaphoid fixation
- Distal pole excision +/- Scaphocapitate fusion
- PRC [proximal row carpectomy]
- Scaphoid excision + Intercarpal fusion



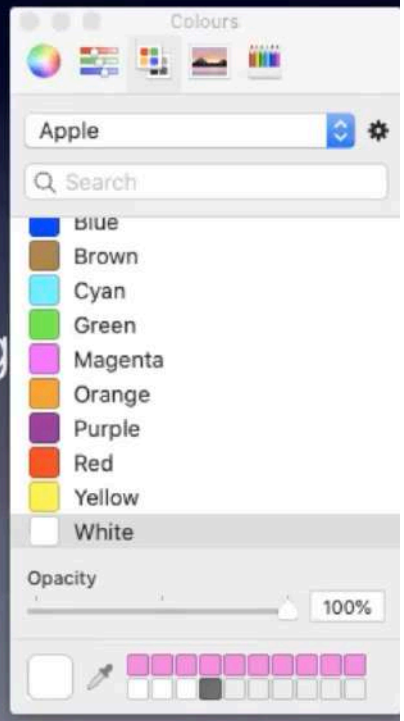
Treatment plan - SNAC wrist

Stage	Severity of arthrosis	Therapy
I	Arthrosis between radial styloid and distal fragment of scaphoid	Resection of radial styloid a reconstruction with bone gr
II	Arthrosis between distal fragment of scaphoid and scaphoid fossa	A: Four-corner fusion with s B: Resection of proximal ca C: Lunocapitate fusion with triquetrum excision
III	Arthrosis of midcarpal joint	A: Four-corner fusion with s B: Lunocapitate fusion with triquetrum excision



Radial styloidectomy

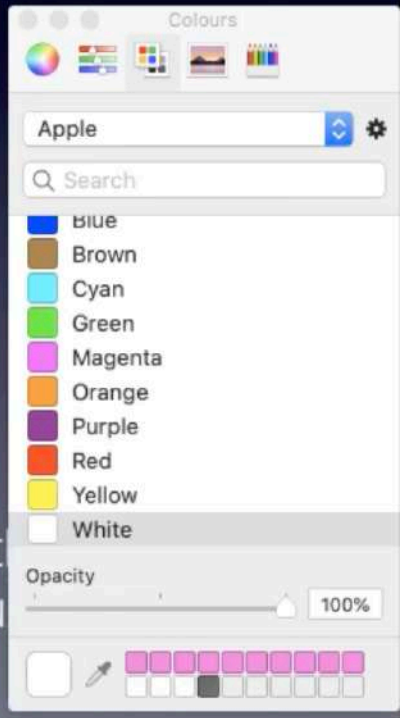
- It works best along with fixation of scaphoid
- Should **not be excised more than 1 cm** to prevent RSC lig Injury



Distal pole excision

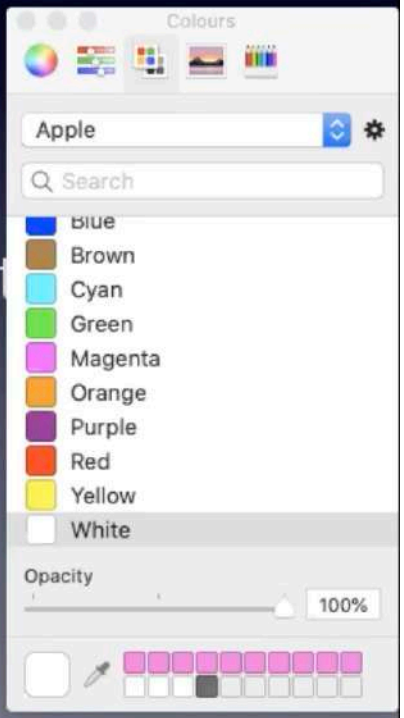
Indication

- in STT arthritis and contraindicated in Capitolunate arthritis
- There is DISI in few of cases following distal pole excision so
- **Add scaphocapite fusion**
- if instability of capitolunate like subluxation or DISI
- Proximal scaphoid nonunion - scaphoid excised from mid waist - so t ligament attached to waist is preserved to prevent capitolunate sublu DISI .



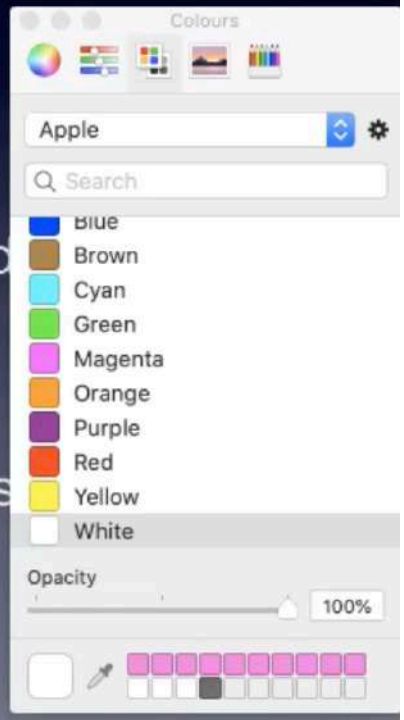
PRC- Excision of Scaphoid , lunate , triquetrum

- First bone to excise is scaphoid preserving - RSC ligament
  prevents ulnar translation of carpus bone



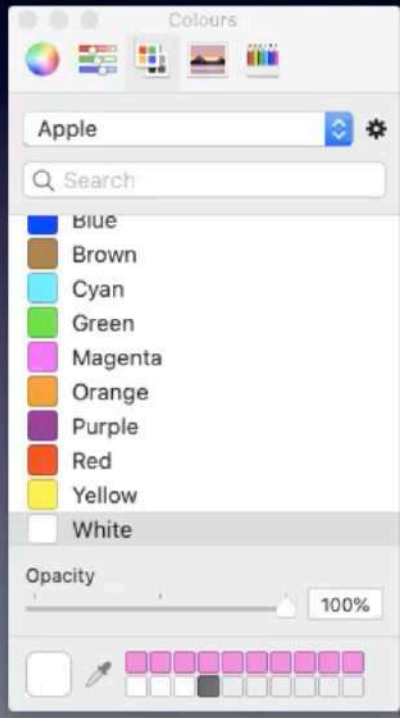
PRC - Indication and advantage

- Stage I or Stage II without capitolunate arthritis .
- Low demand - because in manual labour it will fail due to result of early radiocapitate arthritis
- Older than 40 y - because with time radiocapitate arthritis result so avoid
- **Advantage** -
- simple motion preserving , no risk of nonunion , short period of immobilis rehab .
- 50- 60 percent ROM and 70- 80 percent Grip strength of normal side



Contraindication - PRC

- In heavy manual labours
- Inflammatory arthritis



Intercarpal fusion - Four corner fusion

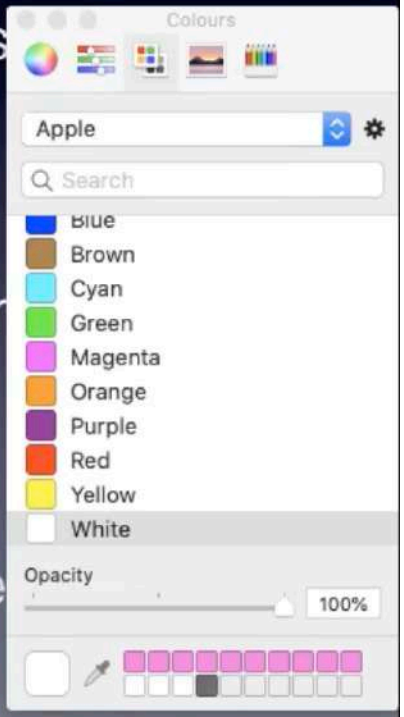
- Stabilize the mid carpal joint - capitolunate fusion + triquetrum hamate fusion + lunotriquetrum fusion along with excision of s

- **Indication**

- in SNAC I , SNAC II with capitolunate arthritis [mid carpal ar ie intact radiolunate joint .

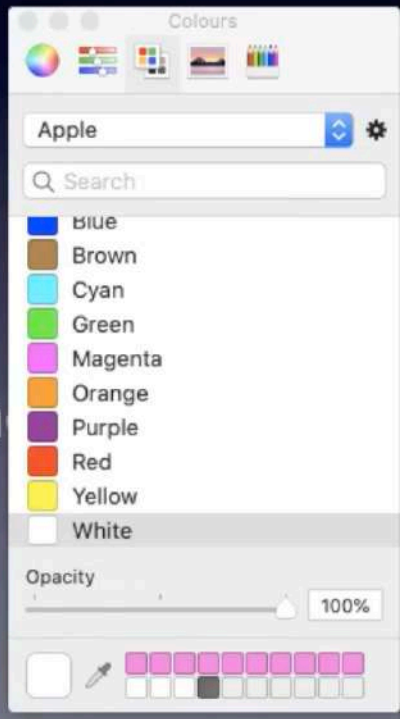
- **Tip** - Reduce lunate extension to neutral and capitate dorsal subluxation - to prevent radiocapitate abutment during wrist e

.



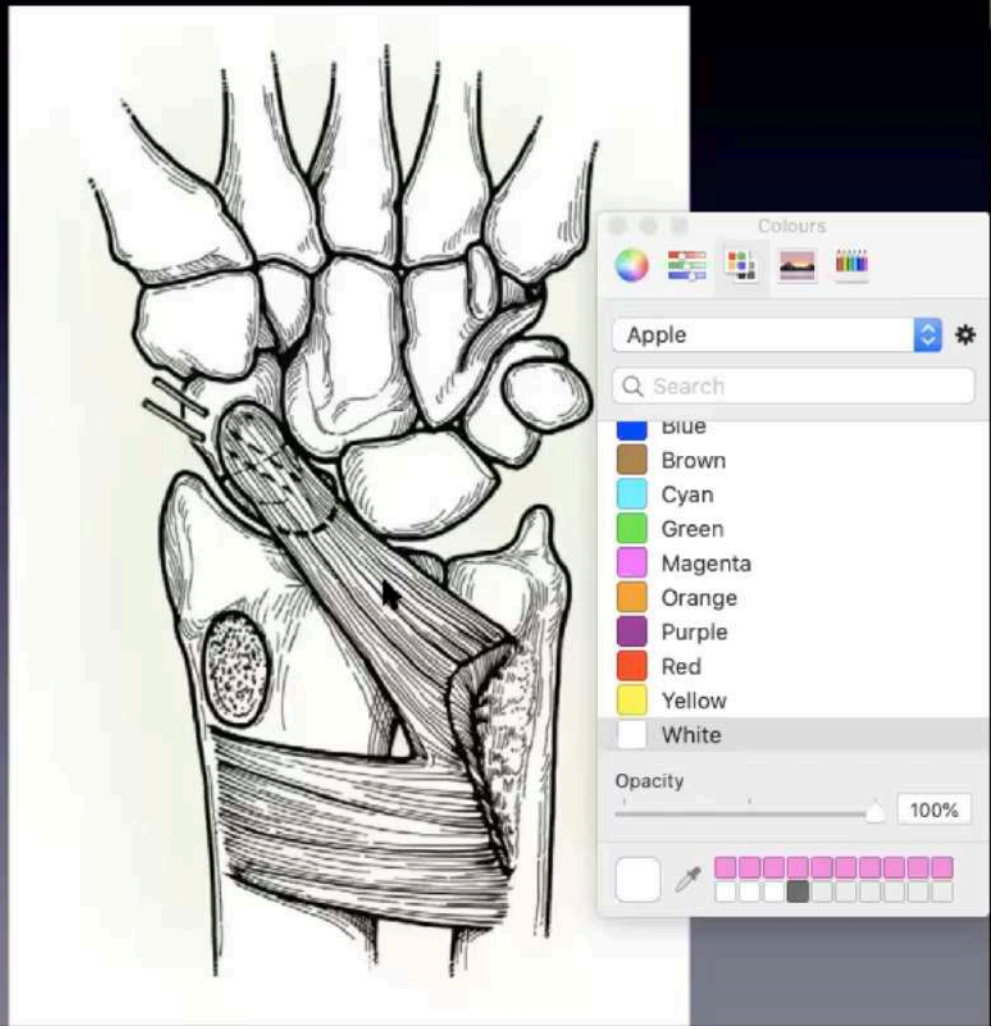
Treatment - AVN scaphoid

- Pissiform bone graft
- Pronator quadratus graft
- Supra compartmental and intercompartmental vessel aroun
  radial metaphysis

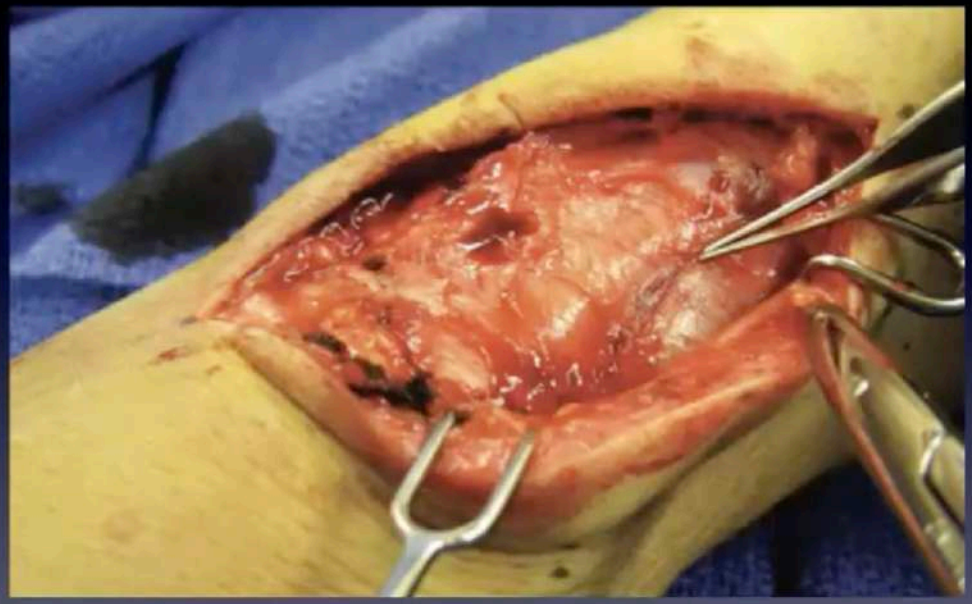


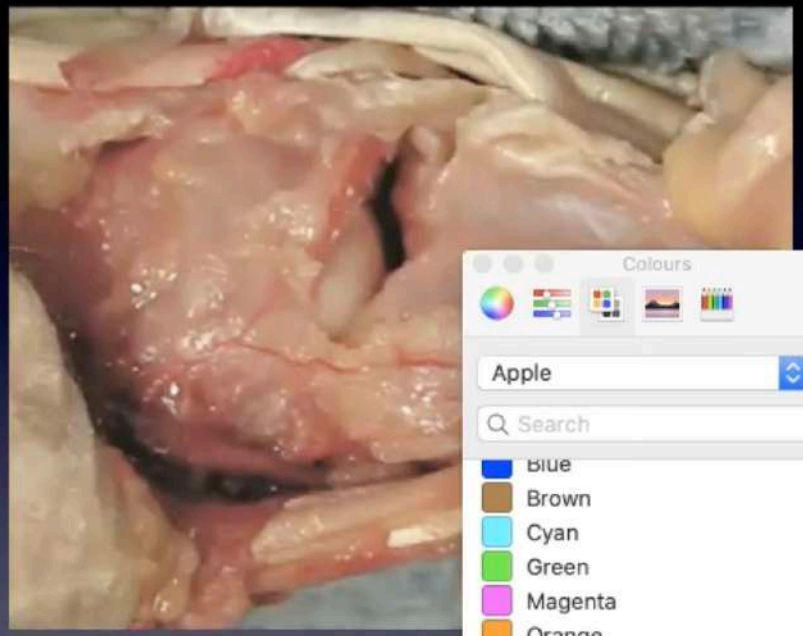
Treatment - AVN scaphoid

- Pronator Quadratus graft



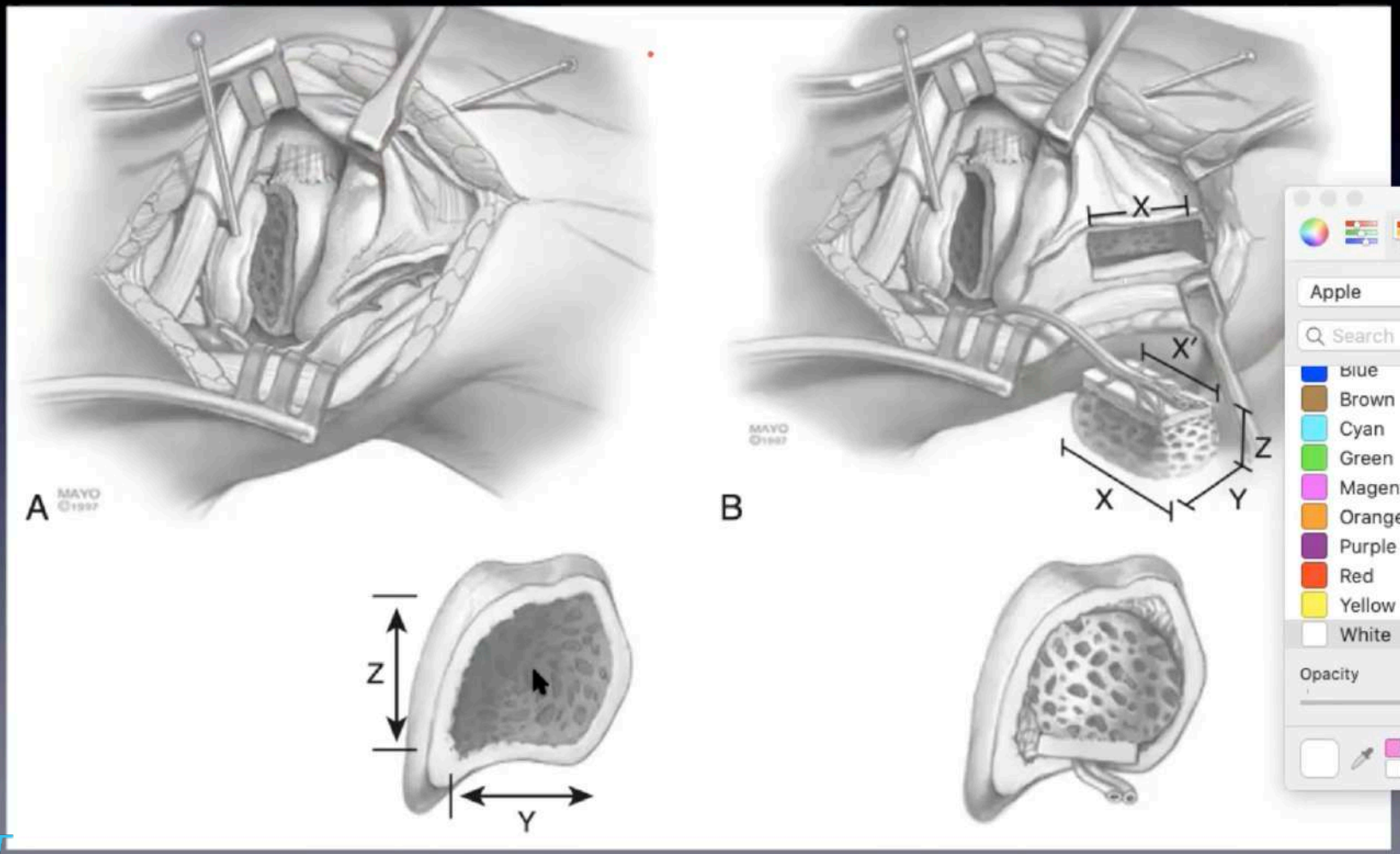
1,2 ICSRA





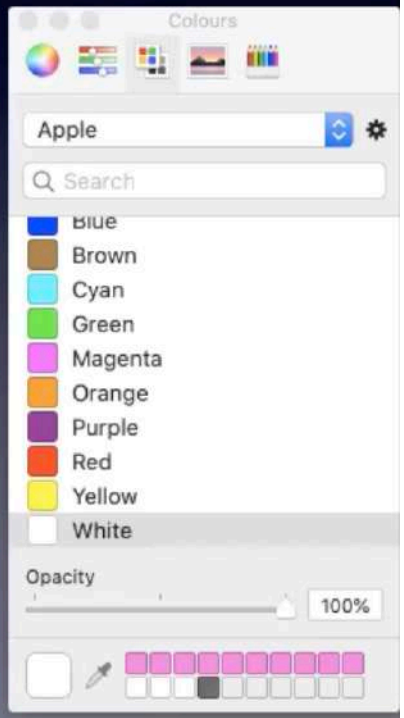
- Branches off the radial artery - 5 cm proximal to radioiocarpa
  and lie superficially between 1st and 2nd extensor compart
- Relatively short pedicle

Vascularised distal radius bone graft



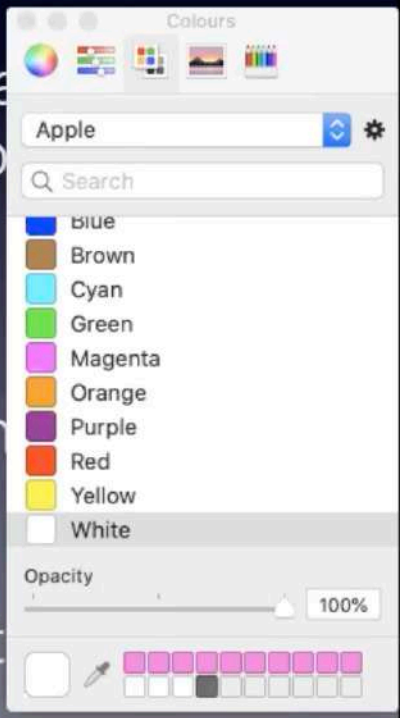
Medial femoral condyle graft

- Healing time is short than 1,2 ICSRA
- Rate of union is higher than 1,2 ICSRA



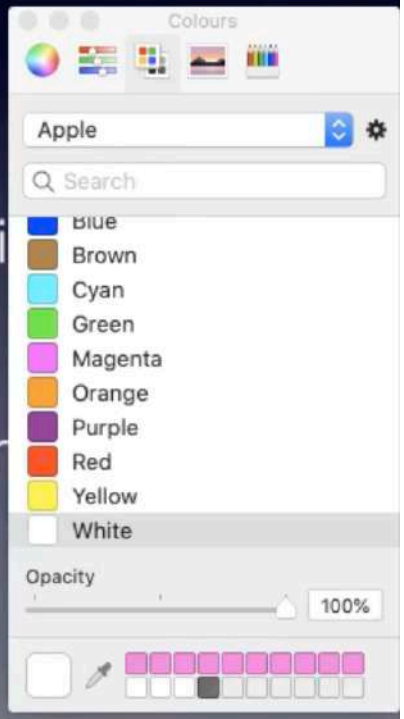
Open -Dorsal

- **Ligament sparing capsulotomy** - Radial based flap - incising radoiocarpal and DIC , protecting the dorsal interosseous ligament
- Capsular incision begins from dorsoradial border and split the ra ligament at point distal to lister tubercle to the triquetrual insertio
- DIC ligament is split from triquetral insertion to the distal pole .
- Distal boundary of dissection - is the vascular supply entering th scaphoid
- **Entry point on proximal pole** - 1-2 mm radial to its junction wit of membranous portion of SL ligament .



Open -Volar approach

- Splitting the Radioscapho-capitate ligament
- Ideal entry point - is 2 mm ulnar and dorsal to tip of scaphoi
  tubercle .
- Ulnar deviation of wrist - extend the scaphoid to make the th
  tubercle more accessible .



Scaphoid Union alone is not the criteria to measure success of scaphoid fracture

- Symptomatic scaphoid malunion with Severe DISI suffered pain restricted ROM have satisfactory result with corrective osteotomy with wedge bone graft
- It has role in prevention or slowing the premature wrist arthri high demand patients .