1

FACT

AS OF 2019, MORE THAN 600,000 KNEE REPLACEMENTS ARE PERFORMED EACH YEAR IN THE UNITED STATES.

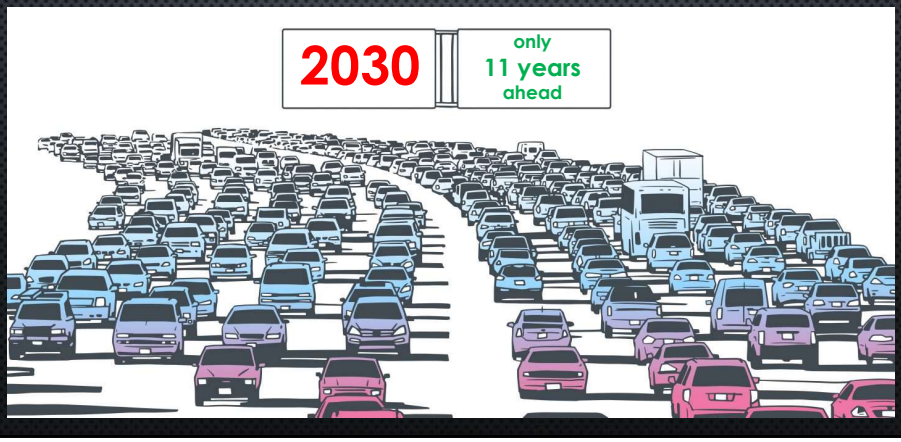
2019

2

FACT

As of 2019, more than 600,000 knee replacements are performed each year in the United States.

Recent estimates project that, in the next eleven years, that number will increase to 3.48 million.



3

HIP AND KNEE REPLACEMENT TODAY

Christopher Blair, DO, MBA

Fellowship-Trained Adult Hip and Knee Replacement Surgeon

Texas Physical Therapy Association

Annual Conference

The Woodlands, Texas

4

Christopher Blair, DO, MBA

Texas A&M University
College Station, TX

University of North Texas Health Sciences Center – Fort Worth
Fort Worth, TX – DO, 1993

Cox School of Business, Southern Methodist University
Dallas, TX – MBA, 2000

Texas Wesleyan School of Law
Fort Worth, TX

Broward Health Medical Center (Level I Trauma Center)
Fort Lauderdale, FL – Orthopedic Surgery Residency

Hedley Orthopaedic Institute
Phoenix, AZ – Adult Hip and Knee Replacement Fellowship

5

DISCLOSURES

Innomed – Surgical instrumentation development

Intuitive Surgical – Common Stock shareholder

No Relevant Disclosures

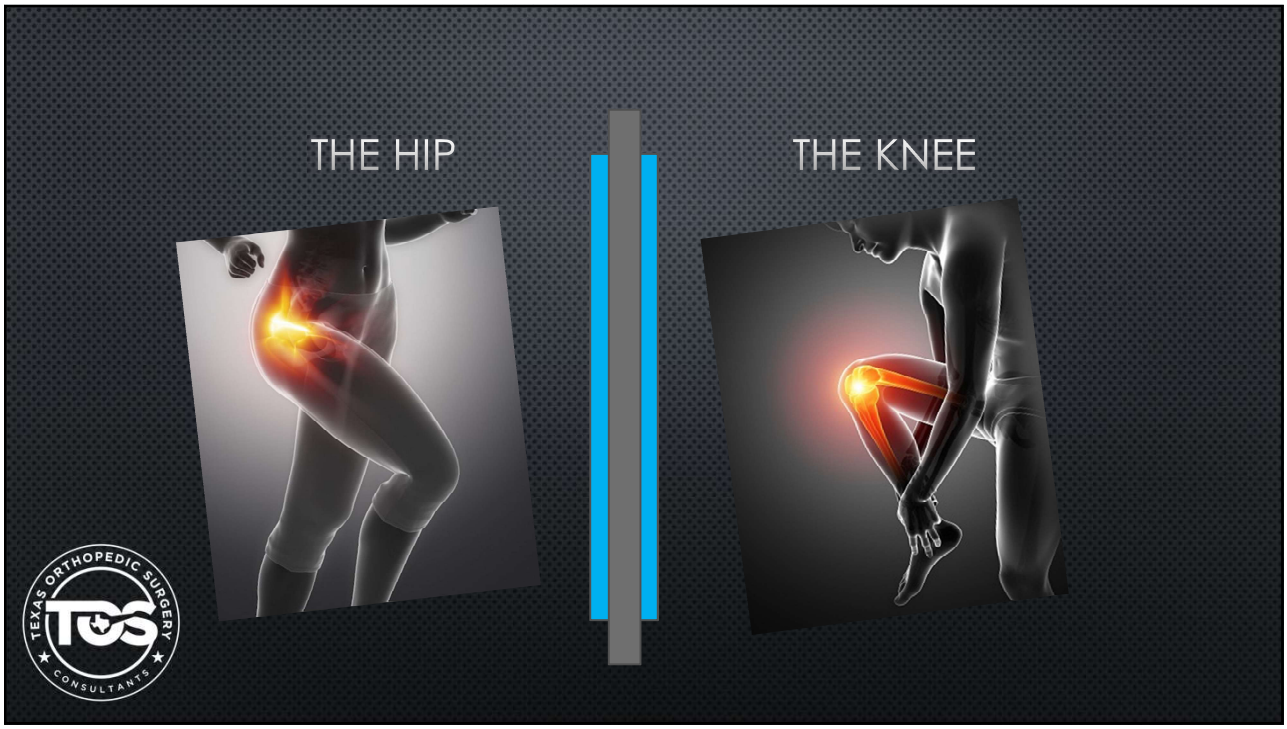
6


HIP AND KNEE PAIN – AN AGE OLD PROBLEM
TEXAS ORTHOPEDIC SURGERY CONSULTANTS
TOS

7


HIP AND KNEE PAIN – AN AGE OLD PROBLEM
2020
US
1962
1890s
Germany
TEXAS ORTHOPEDIC SURGERY CONSULTANTS
TOS

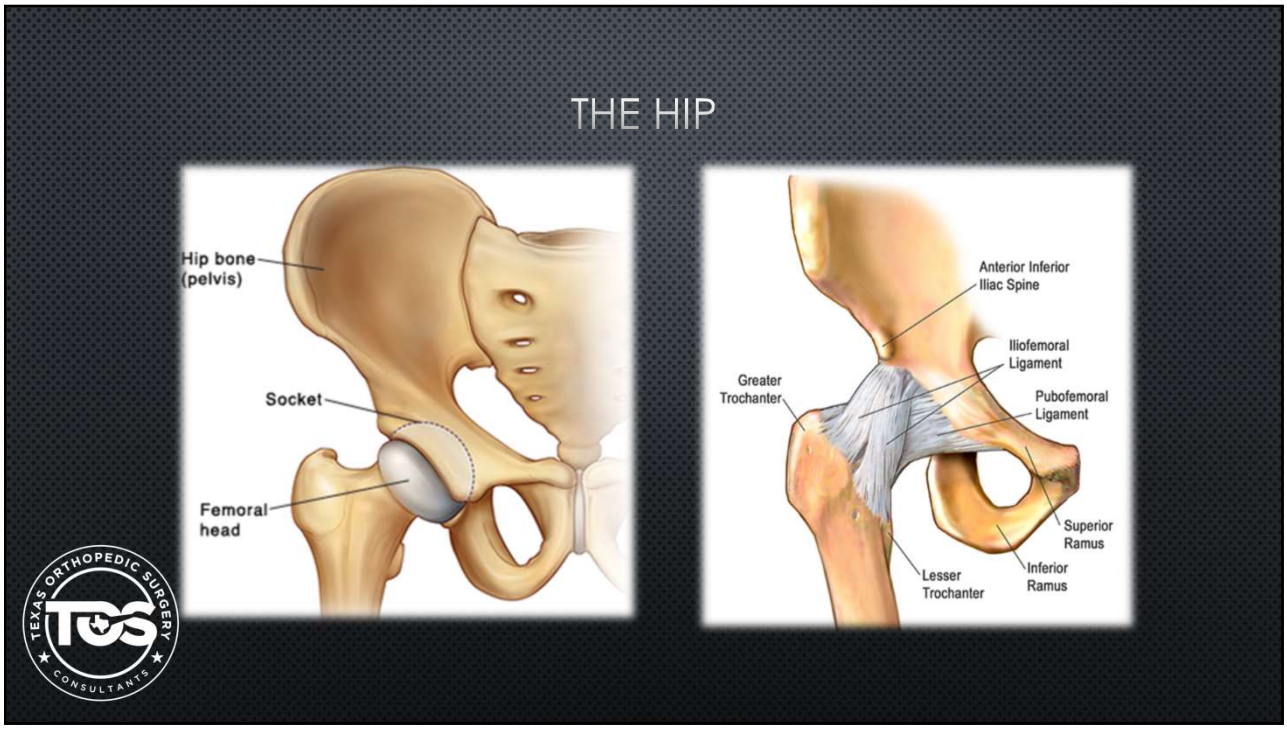
8


THE HIP
THE KNEE
TEXAS ORTHOPEDIC SURGERY
TOS
CONSULTANTS

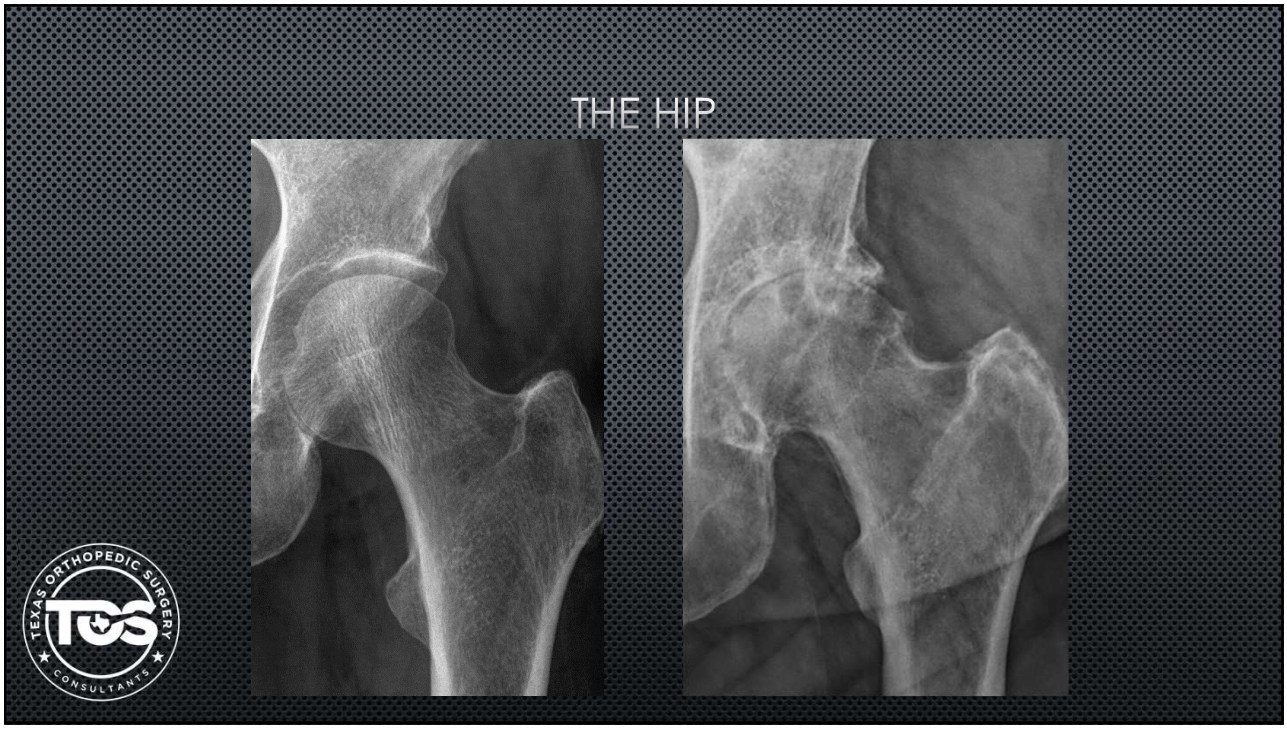
9


THE HIP
TEXAS ORTHOPEDIC SURGERY
TOS
CONSULTANTS

10


THE HIP
Hip bone (pelvis)
Socket
Femoral head
Anterior Inferior Iliac Spine
Iliofemoral Ligament
Greater Trochanter
Pubofemoral Ligament
Superior Ramus
Inferior Ramus
Lesser Trochanter

11

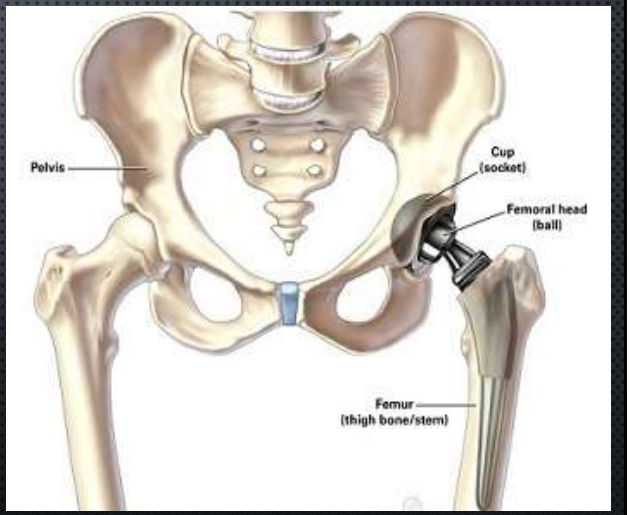

THE HIP

12

THE HIP

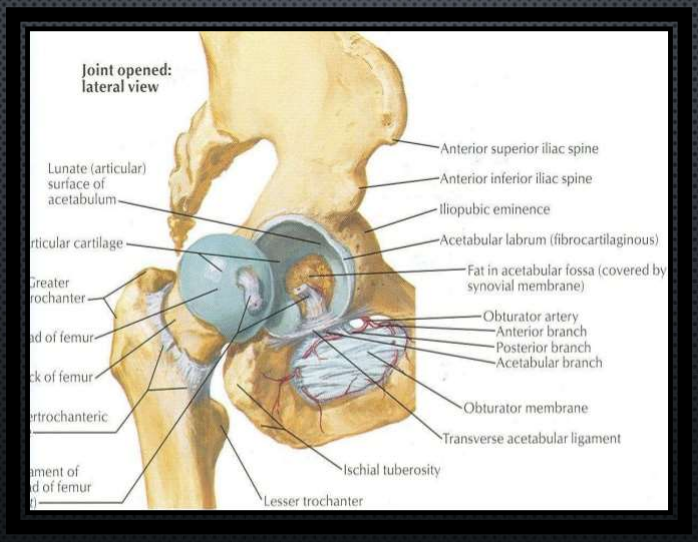
13

THE HIP



14

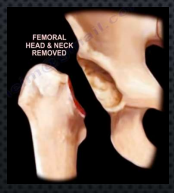
EVOLUTION OF TOTAL HIP REPLACEMENT



15

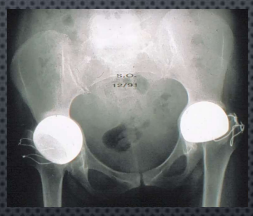
EVOLUTION OF TOTAL HIP REPLACEMENT

Girdlestone



Gathorne Robert Girdlestone
1928

Cup (Mold) Arthroplasty



Smith-Peterson
1920s-1960s

Arthrodesis

10-20 years

16

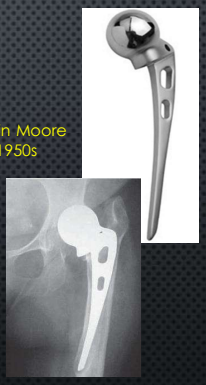
EVOLUTION OF TOTAL HIP REPLACEMENT

Hemiarthroplasty

Early Postop Protocol

- Hospitalized x 3 months
- Traction x 6 weeks
- **50% failure rate**
- **50% required walking aid**

Austin Moore 1950s



Fred Thompson (MMA – Wiltse)

17

EVOLUTION OF TOTAL HIP REPLACEMENT

INDUSTROUS CREATIVITY…

1930s

1930s
Phillip Wiles
Middlesex Hospital

1946
Robert and Jean Judet
Acrylic Femoral Head

Early 1950s
John Charnley
PTFE
Teflon bearing

1960s
McKee-Ferrar
MoM cemented

Mid 1960s
Peter Ring
MoM uncemented

1970s

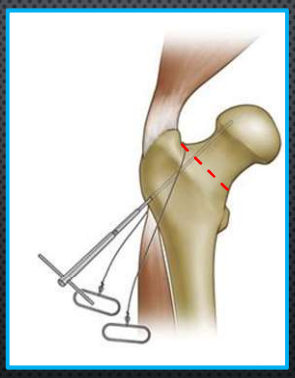
18

CHARNLEY'S LOW FRICTION ARTHROPLASTY

1962 – FIRST REPRODUCIBLE TOTAL HIP REPLACEMENT

19

CHARNLEY'S LOW FRICTION ARTHROPLASTY



1962 – FIRST REPRODUCIBLE TOTAL HIP REPLACEMENT

20

CHARNLEY'S LOW FRICTION ARTHROPLASTY

- 3 PERSON OR TEAM (CHARNLEY, ASSISTANT, NURSE)
- RECONSTRUCTION VS REPLACEMENT
- FOCUS ON INFECTION REDUCTION (24%)
  - LAMINAR FLOW (ADOPTED FROM MANHATTAN PROJECT)
  - BES (SPACE SUITS)

1962 – FIRST REPRODUCIBLE TOTAL HIP REPLACEMENT

21

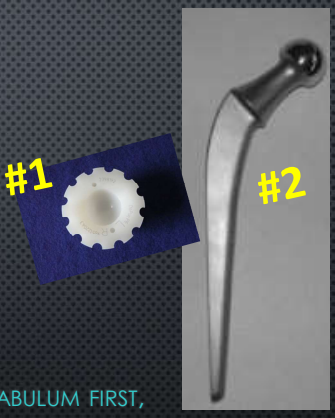
CHARNLEY'S LOW FRICTION ARTHROPLASTY

ACETABULUM FIRST,
FOLLOWED BY FEMORAL IMPLANT

1962 – FIRST REPRODUCIBLE TOTAL HIP REPLACEMENT

22

CHARNLEY'S LOW FRICTION ARTHROPLASTY



ACETABULUM FIRST,
FOLLOWED BY FEMORAL IMPLANT

1962 – FIRST REPRODUCIBLE TOTAL HIP REPLACEMENT

23

TWO STEPS FORWARD AND ONE STEP BACK

ADVANTAGES

REPRODUCIBILITY

ADAPTABLE

SETBACKS

LIMP

BONE RESORPTION / OSTEOLYSIS (? MMA ?)

1970 – FDA DECLARES MMA A "DRUG"

FIXATION

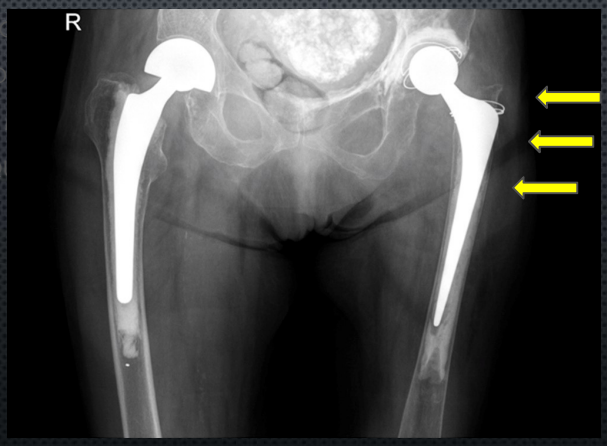
INFECTION

DVT / BLOOD CLOTS

24

EVOLUTION IN TOTAL HIP REPLACEMENT

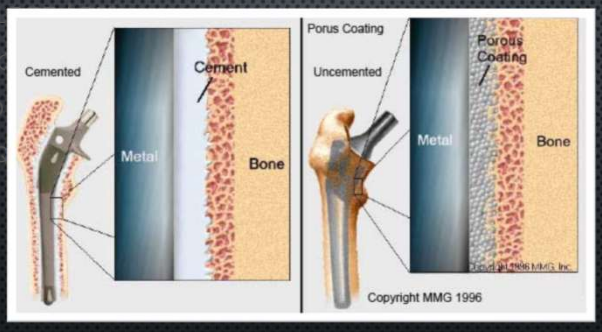
- From Cemented Fixation to Biologic Fixation
- Intraoperative Bl
- Postoperative Co
- Monoblock and
- Surgical Techniqu



25

EVOLUTION IN TOTAL HIP REPLACEMENT

- From Cemented Fixation to Biologic Fixation
- Intraoperative Bl
- Postoperative C
- Monoblock and
- Surgical Technic



26

EVOLUTION IN TOTAL HIP REPLACEMENT

Depuy AML

27

EVOLUTION IN TOTAL HIP REPLACEMENT

Depuy AML

28

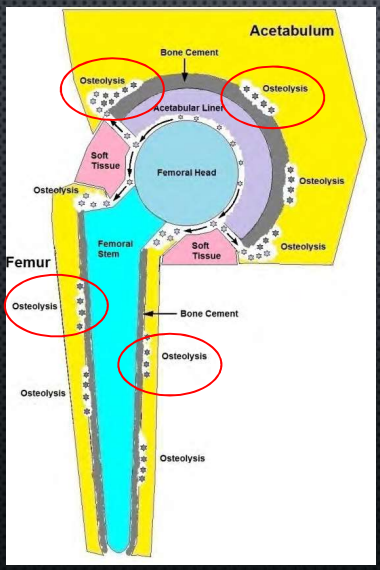
EVOLUTION IN TOTAL HIP REPLACEMENT

Depuy AML

Howmedica PCA femoral stem

29

EVOLUTION IN TOTAL HIP REPLACEMENT



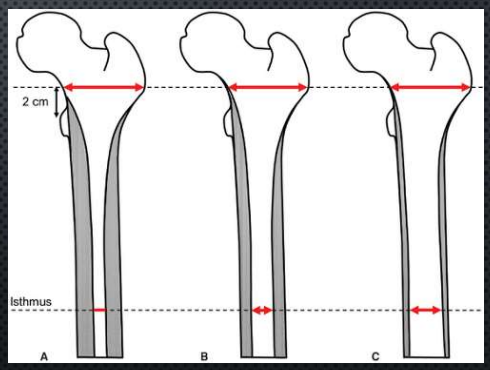
"CEMENT DISEASE" = **PARTICLE DISEASE**

1990 – UHMWPE (DEPUY + DUPONT)

30

EVOLUTION IN TOTAL HIP REPLACEMENT

Monoblock and Modular Implant Designs



31

EVOLUTION IN TOTAL HIP REPLACEMENT

1962 – Charnley Low Friction Arthroplasty

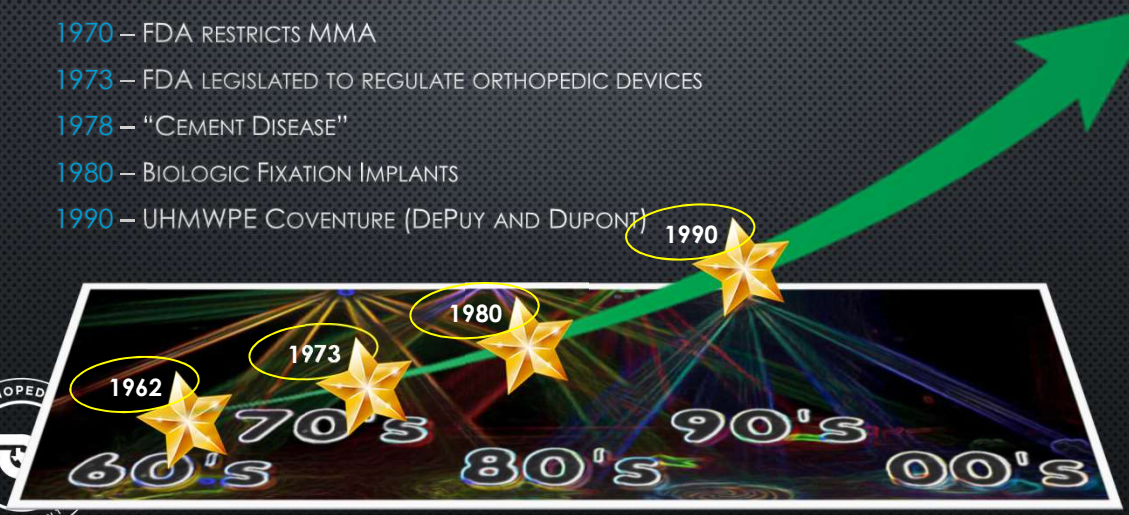
1970 – FDA restricts MMA

1973 – FDA legislated to regulate orthopedic devices

1978 – "Cement Disease"

1980 – Biologic Fixation Implants

1990 – UHMWPE Coventure (DePuy and Dupont)

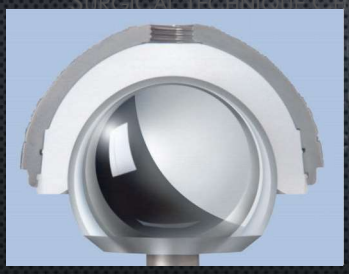


32

EVOLUTION IN TOTAL HIP REPLACEMENT

"Those who cannot remember the past are condemned to repeat it"
– George Santayana

MONOBLOCK AND MODULAR IMPLANT DESIGNS



1991 - 2011

33

EVOLUTION IN TOTAL HIP REPLACEMENT

INTRAOPERATIVE BLOOD LOSS

34

EVOLUTION IN TOTAL HIP REPLACEMENT

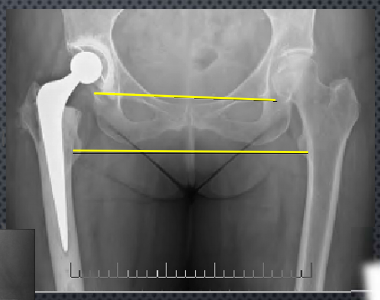
POSTOPERATIVE COMPLICATION RISKS

MONOBLOCK AND MODULAR IMPLANT DES

SURGICAL TECHNIQUE CHANGES

FROM CEM

INTRAOPER



35

EVOLUTION IN TOTAL HIP REPLACEMENT

CHARNLEY 1960-1975

INCIDENCE OF FATAL PE

- WITHOUT PROPHYLAXIS
  - 2.3%
- WITH PROPHYLAXIS
  - 0.3%

36

EVOLUTION IN TOTAL HIP REPLACEMENT

Surgical Technique

37

EVOLUTION IN TOTAL HIP REPLACEMENT

SURGICAL TECHNIQUE CHAN
FROM CEMENTED FIXATION
INTRAOPERATIVE BLOOD LO
POSTOPERATIVE COMPLICA
MONOBLOCK AND MODUL

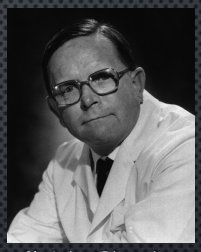
"All Roads Lead to Rome"

38

EVOLUTION IN TOTAL HIP REPLACEMENT

CHARNLEY – SUPIN

Trendelenburg gait



Sir John Charnley
1911-1982

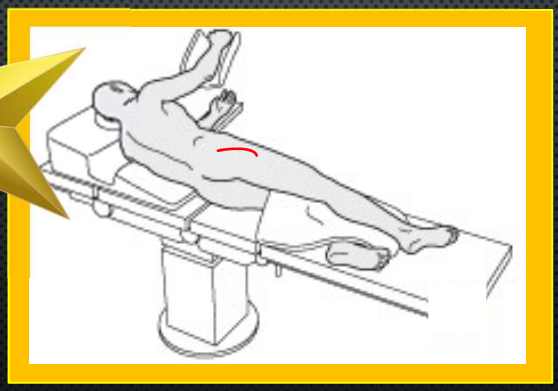
39

EVOLUTION IN TOTAL HIP REPLACEMENT

MOORE – LATERAL POSITIONING, STANDARD POSTERIOR APPROACH

AVOIDED REQUIREMENT FOR OSTEOTOMY

GOLD STANDARD



Austin Talley Moore
1899-1963

1950s
Introduction of hemiarthroplasty

Austin Moore femoral prosthesis

40

EVOLUTION IN TOTAL HIP REPLACEMENT

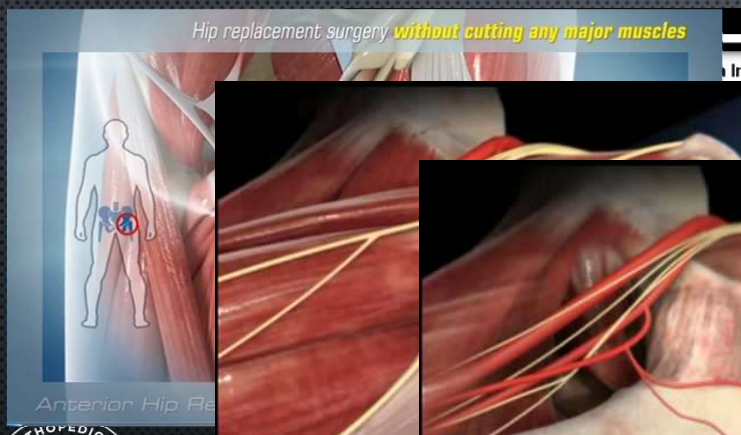
HARDINGE – SUPINE OR LA… …PROACH

DIVISION OF AB… …OSSIFICATION

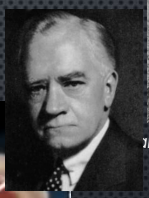
Kevin Hardinge, MD
1939-

41

EVOLUTION IN TOTAL HIP REPLACEMENT



…rl Heuter (Germany)
1838-1882

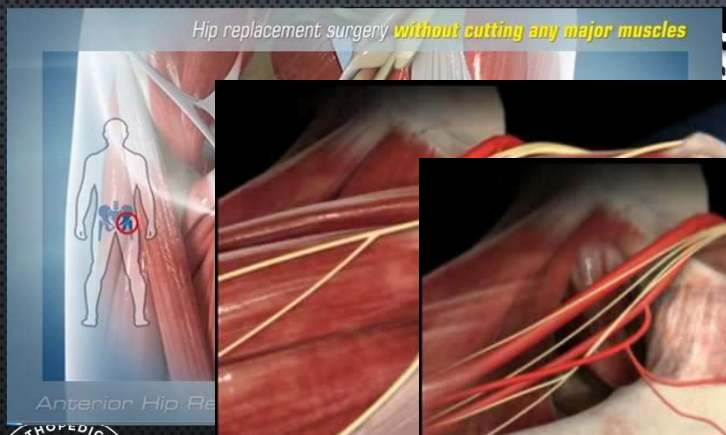


Marius Smith-Peterson
1886-1953

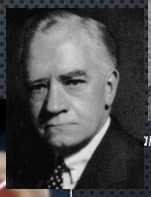
Kristaps Keggi, MD
Early 1980s

42

EVOLUTION IN TOTAL HIP REPLACEMENT



Carl Heuter (Germany)
1838-1882



Marius Smith-Peterson
1886-1953

Joel Matta, MD

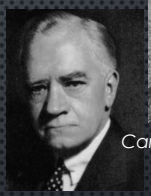
Kristaps Keggi, MD
Early 1980s

43

EVOLUTION IN TOTAL HIP REPLACEMENT

MATA – MODIFIED SUPINE POSITIONING, DIRECT ANTERIOR APPROACH

Carl Heuter (Germany)
1838-1882



Marius Smith-Peterson
1886-1953

Joel Matta, MD

Kristaps Keggi, MD
Early 1980s

44

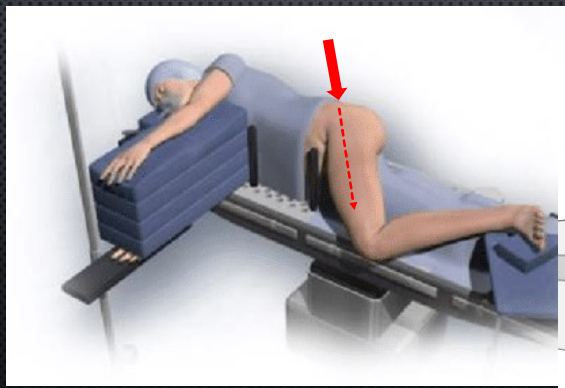
EVOLUTION IN TOTAL HIP REPLACEMENT

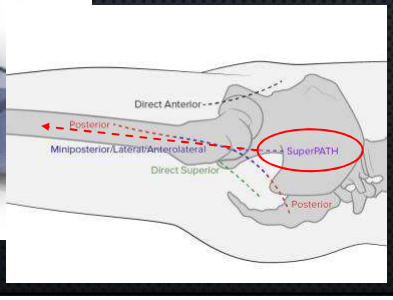
45

EVOLUTION IN TOTAL HIP REPLACEMENT

CHOW – LATERAL POSITIONING, SUPERPATH APPROACH

Jimmy Chow, MD

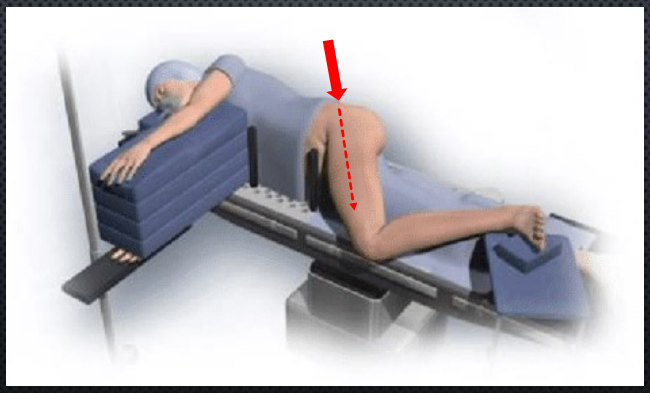




46

EVOLUTION IN TOTAL HIP REPLACEMENT

CHOW – LATERAL POSITIONING, SUPERPATH APPROACH



Jimmy Chow, MD

47

"MINIMALLY INVASIVE" TOTAL HIP REPLACEMENT

	SuperPath®	Direct Anterior	Posterior	Anterior Supine Intermuscular
Mean Length of Stay in US	1.6 days[1-3, 20]	2.9 days[5,13, 15-17]	3.49 days[5,13, 15-17]	2.39 days[10,11]
Mean Operative Time	80 mins[1]	98.6 mins[5,7,13,15-17]	93.6 mins[5,7,13,15-17]	82.3 mins[10-12]
Mean Blood Loss	328 mL[1]	381.9 mL[5,15,17]	311.1 mL[5,15,17]	490.7 mL[11,12]
Complication Rate	2.7-4.7%[2,3]	13.1%[5,7,13-19]	11.2%[5,7,13,15-19]	8.2%[10,11]
Mean Cup Inclination	40.1°[1,3]	42.3°[5,7,13,15,17-19]	41.0°[5,7,13,15,17-19]	43.7°[11]
Special Table Required	No	Yes	No	No
Patient Restrictions in US	None		Abduction pillow	Patients instructed to use walker for 2 weeks[10]
Discharge Status				
Home	91.5%[20]	81.2%[5, 16, 17]	70.9%[5,16,17]	NR
SNF	4.1%[20]	6.9%[5,13]	10.4%[5,13]	NR
HHC	3.8%[20]	9.1%[5,13]	6.4%[5]	NR
HCAHPS				
Overall Rating (%)	91.0%[2]	NR	NR	NR
Willingness to Recommend (%)	96.0%[2]	NR	NR	NR
Pain Management (%)	92.0%[2]	NR	NR	NR

48

TOTAL HIP REPLACEMENT : AN ELECTIVE PROCEDURE

- NO SMOKING, NO NARCOTICS X 3 MONTHS PREOP
- HIBICLENS PREOP
- MUPIROCIN NASAL SWABS
- SUPERPATH TECHNIQUE FOR THA
- REGIONAL ANESTHESIA
- USE OF TRANEXAMIC ACID (TXA) HELPS MITIGATE BLOOD LOSS
- MULTIMODAL ANALGESIA BEGINS IN PREOP HOLDING AREA
- B/L THIGH-HIGH TED HOSE IN PACU, MOBILIZE DAY OF SURGERY

49

AFTERCARE FOR TOTAL HIP REPLACEMENT

- IMMEDIATE POST-OP → UP AND WALKING THE AFTERNOON OF SURGERY (WALKER, PT)
- MULTIMODAL PAIN THERAPY CONTINUES
- POD 1 , 2 → DISCHARGE TO HOME, RXS FOR PAIN AND BLOOD CLOT PROPHYLAXIS
- 7-14 DAYS AFTER → SURGICAL BANDAGE REMOVED IN SURGEON'S OFFICE
- WEEKLY OUTPATIENT PHYSICAL THERAPY (PT) CONTINUES UNTIL RECHECK
- TRANSITION FROM WALKER TO CANE PER PT DIRECTION

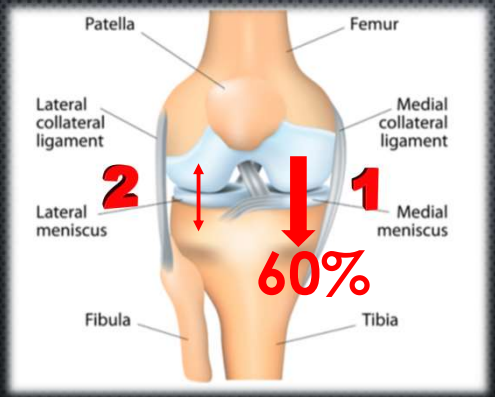
- 6 WEEKS AFTER → FOLLOW UP WITH SURGEON

50

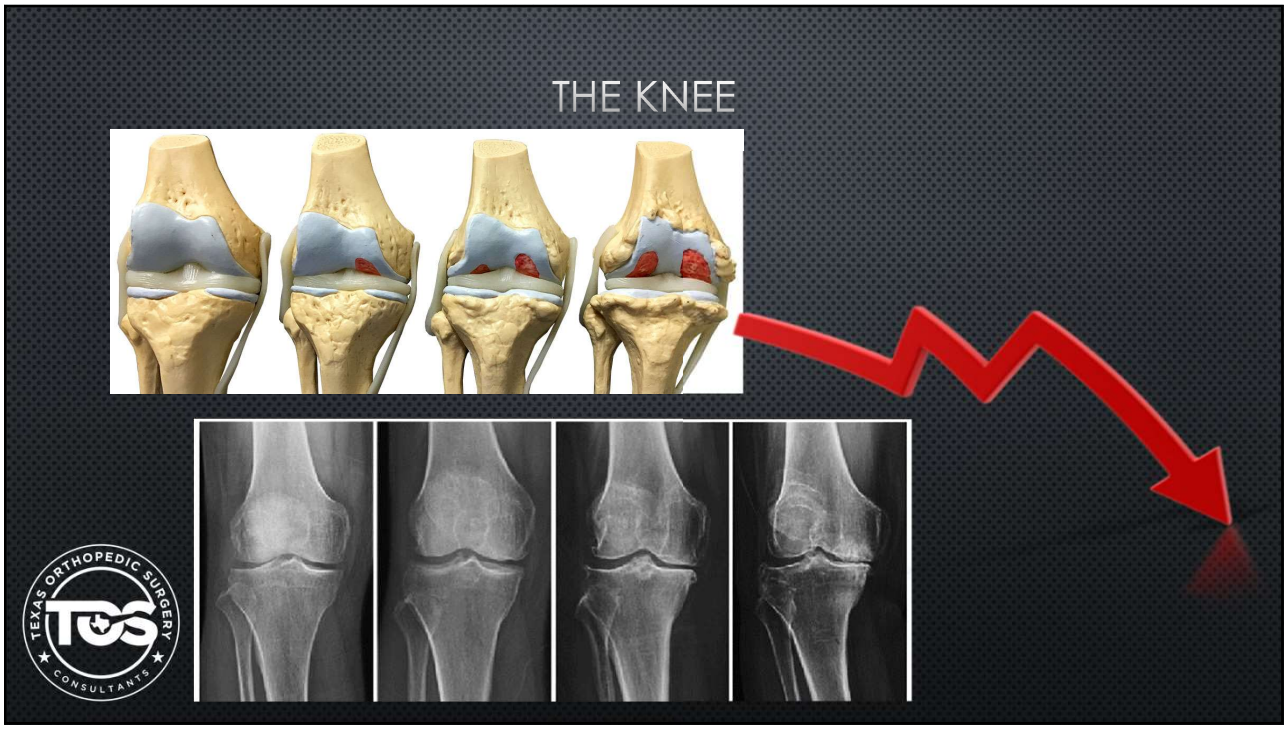
THE KNEE

51

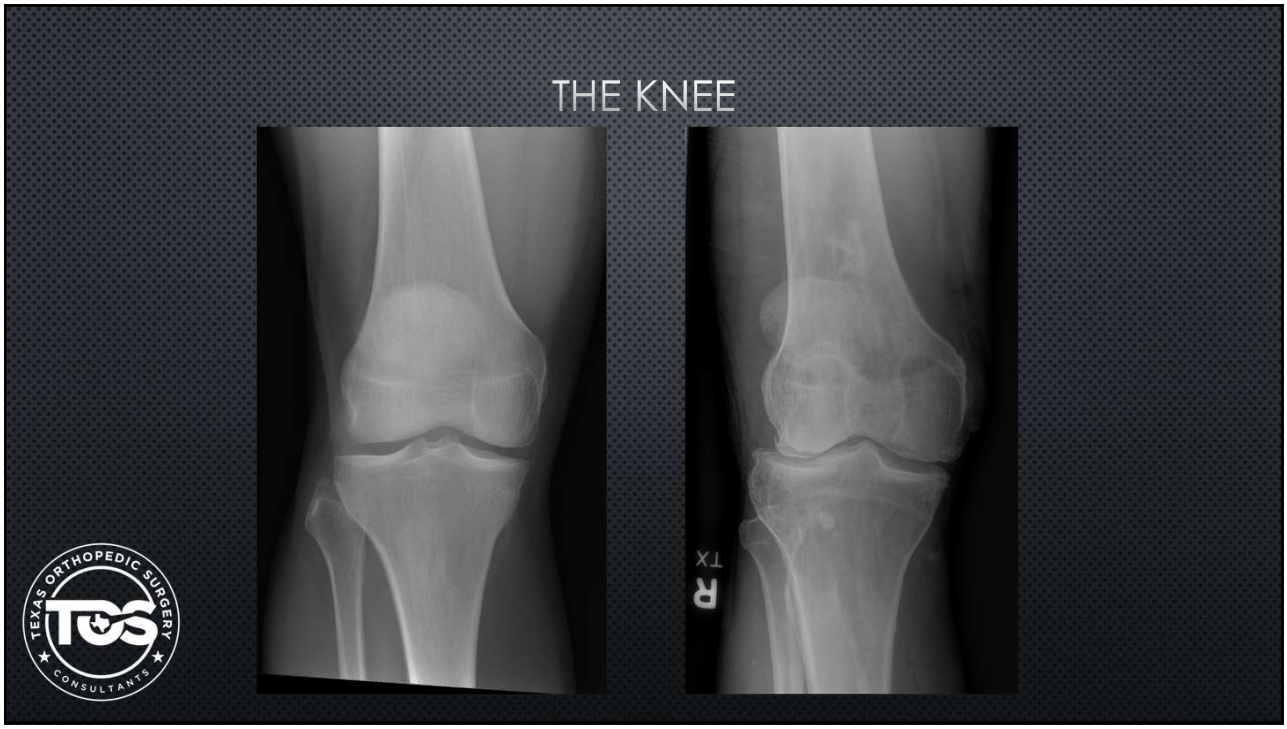
THE KNEE



52

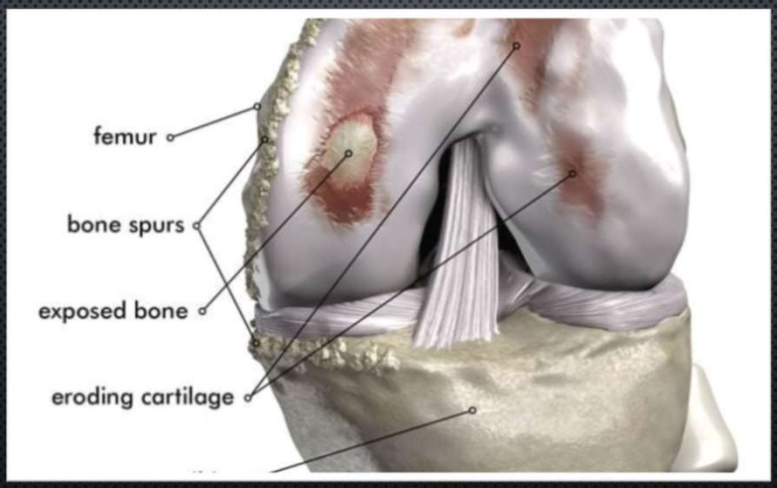

THE KNEE
TEXAS ORTHOPEDIC SURGERY
TOS
CONSULTANTS

53


THE KNEE
TEXAS ORTHOPEDIC SURGERY
TOS
CONSULTANTS
R
TX

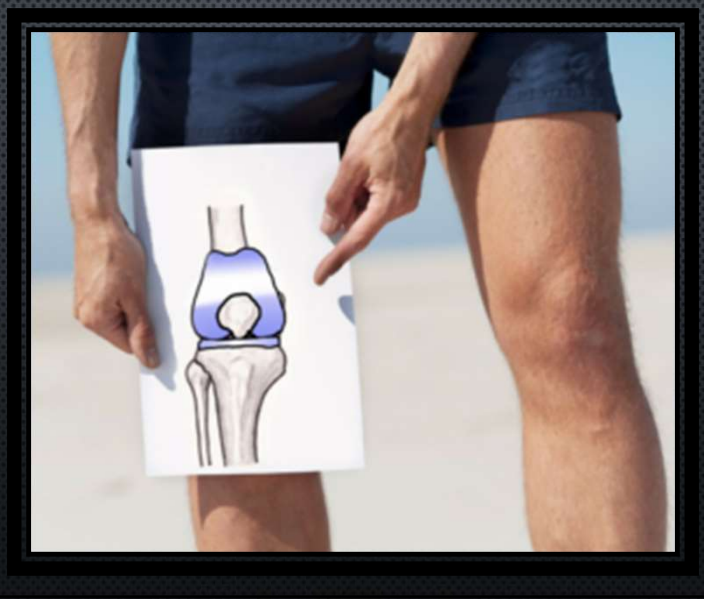
54

THE KNEE

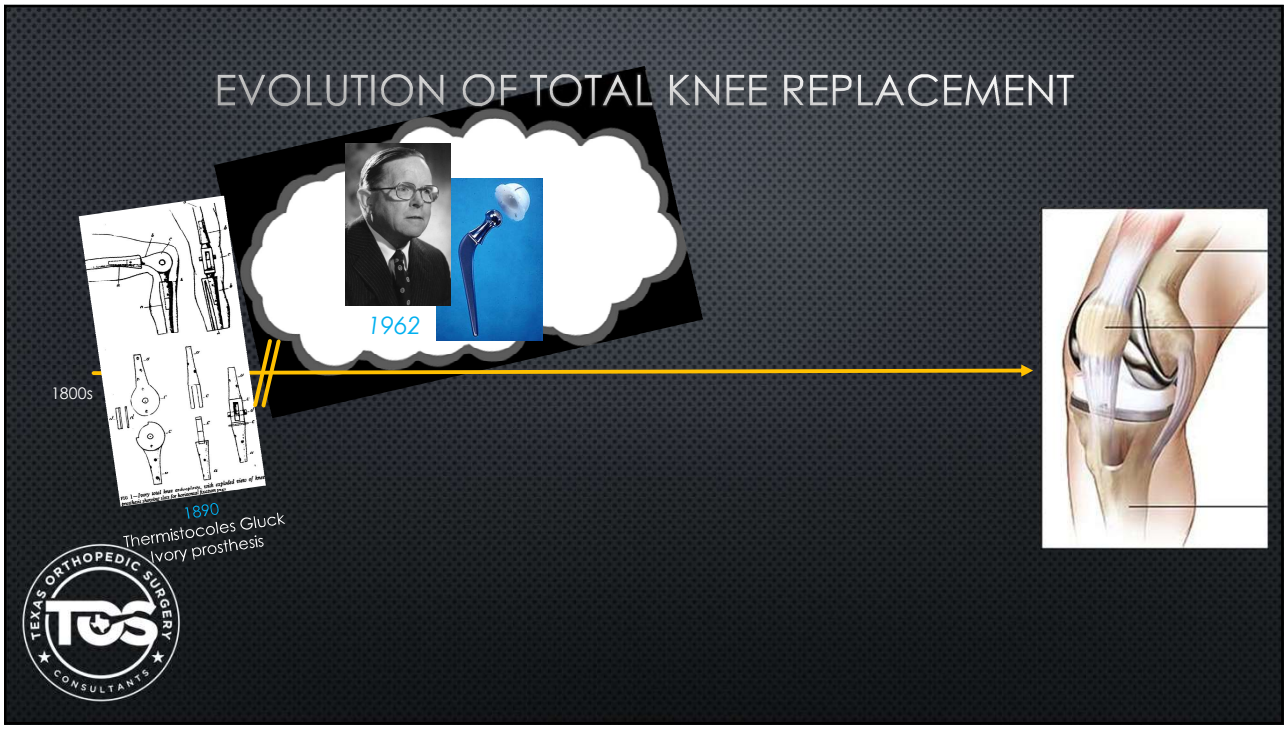


55

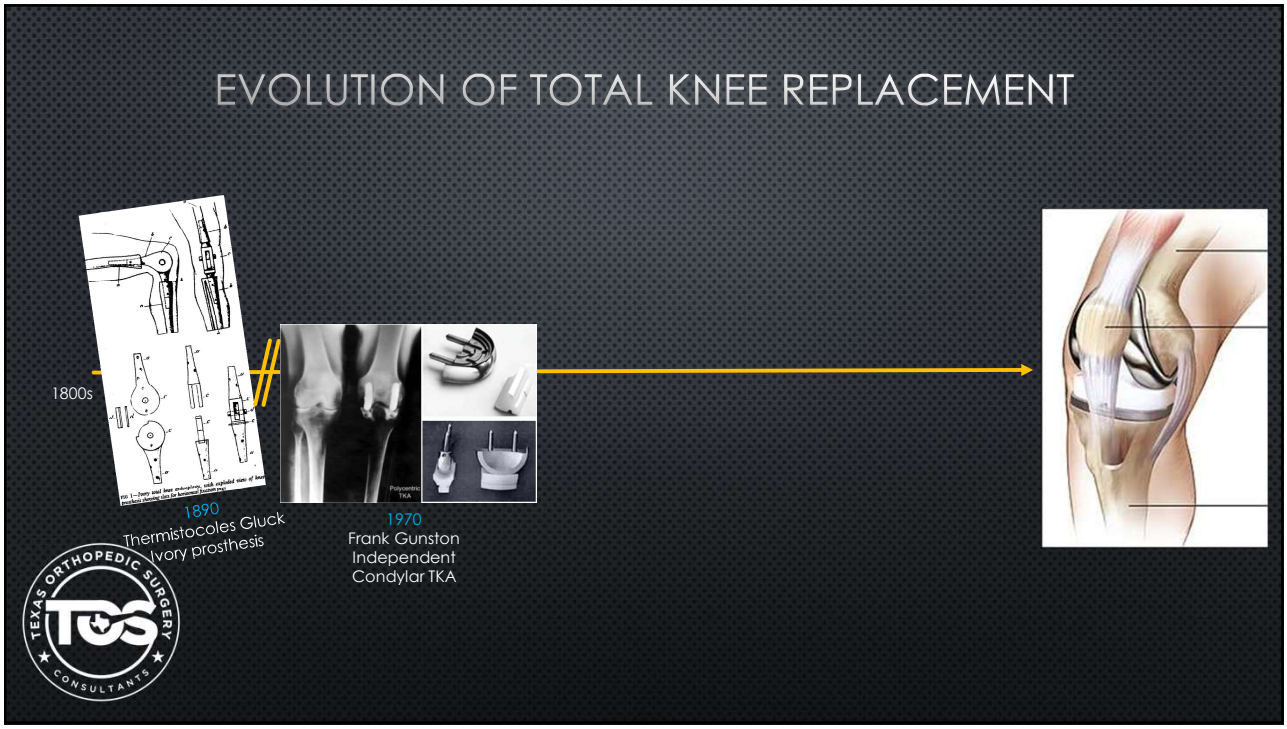
THE KNEE



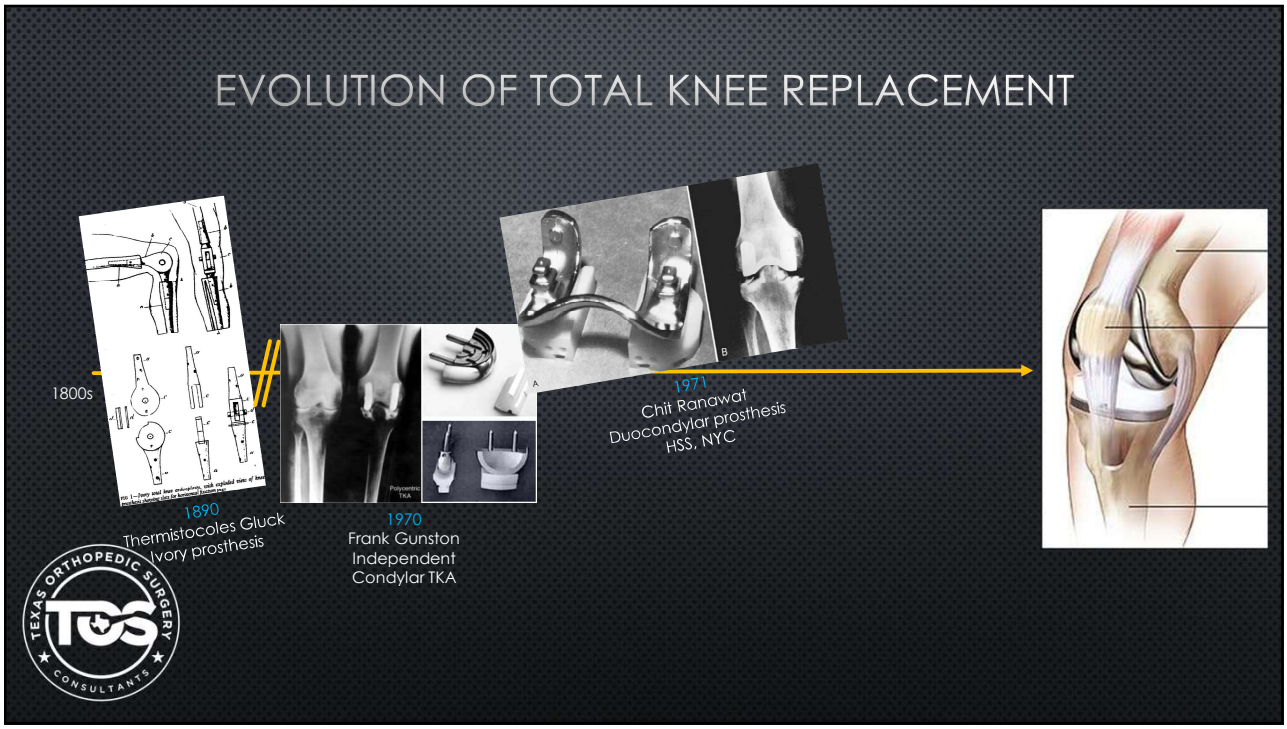
56


EVOLUTION OF TOTAL KNEE REPLACEMENT
1962
1800s
1890
Thermistocoles Gluck
Ivory prosthesis
TEXAS ORTHOPEDIC SURGERY
TOS
CONSULTANTS

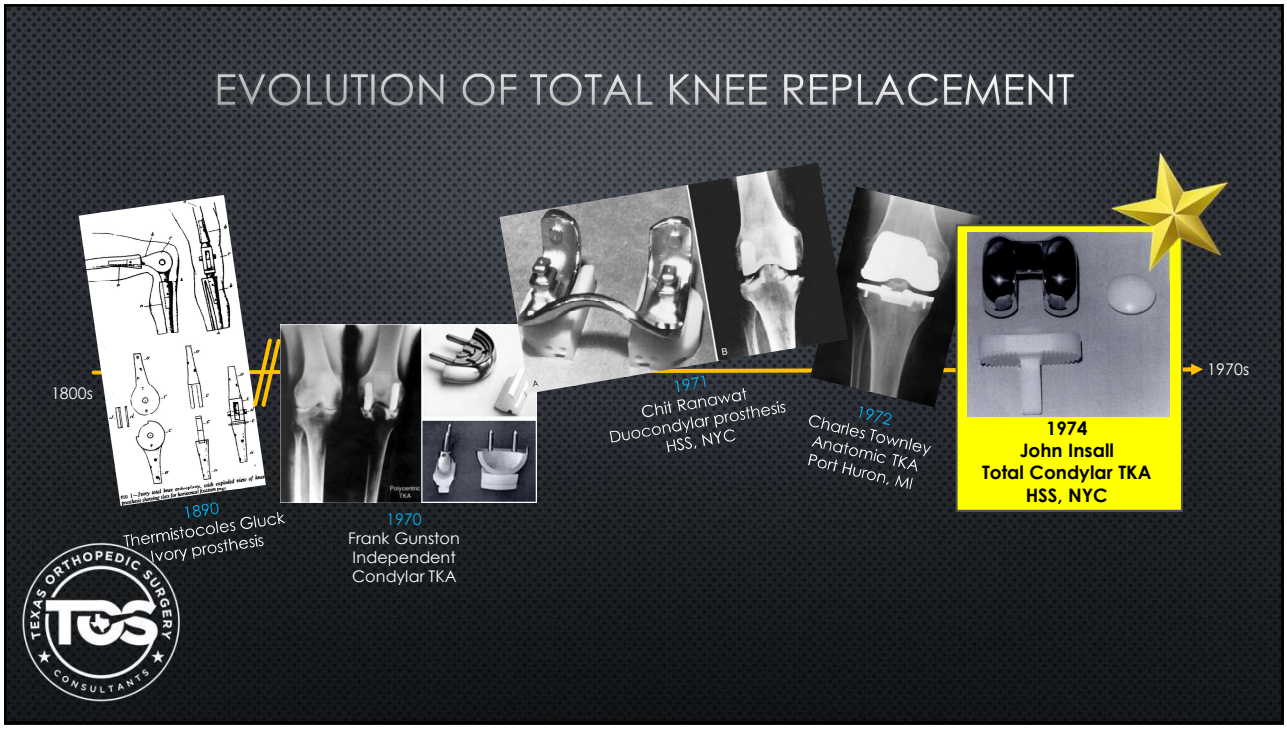
57


EVOLUTION OF TOTAL KNEE REPLACEMENT
1800s
1890
Thermistocoles Gluck
Ivory prosthesis
1970
Frank Gunston
Independent
Condylar TKA
TEXAS ORTHOPEDIC SURGERY
TOS
CONSULTANTS

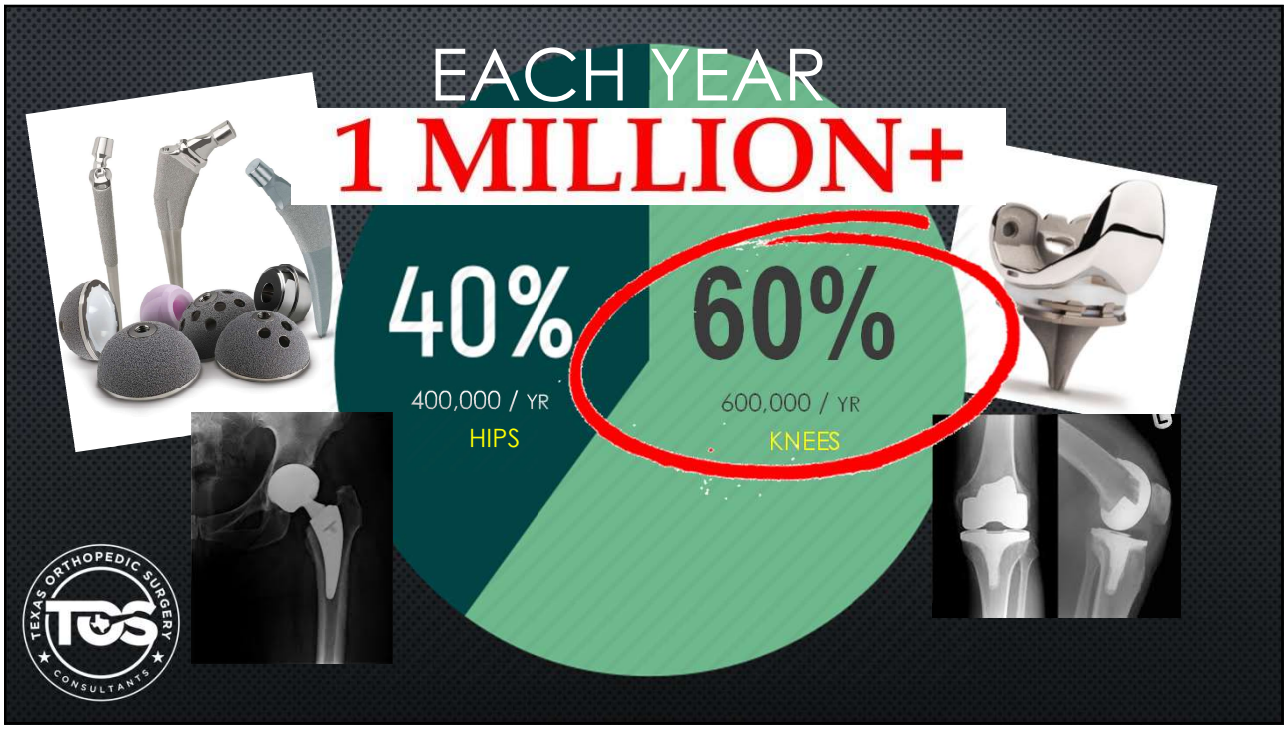
58


EVOLUTION OF TOTAL KNEE REPLACEMENT
1800s
1890
Thermistocoles Gluck
Ivory prosthesis
1970
Frank Gunston
Independent
Condylar TKA
1971
Chit Ranawat
Duocondylar prosthesis
HSS, NYC
TEXAS ORTHOPEDIC SURGERY CONSULTANTS

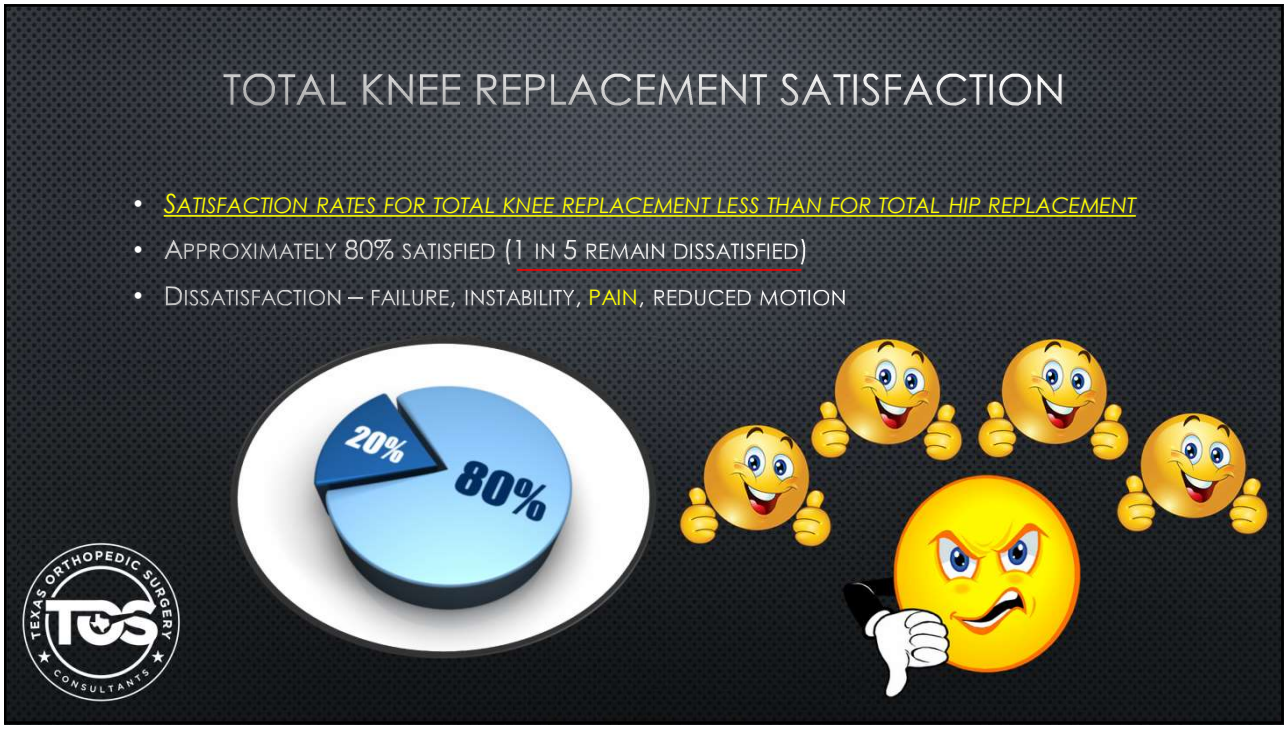
59


EVOLUTION OF TOTAL KNEE REPLACEMENT
1800s
1890
Thermistocoles Gluck
Ivory prosthesis
1970
Frank Gunston
Independent
Condylar TKA
1971
Chit Ranawat
Duocondylar prosthesis
HSS, NYC
1972
Charles Townley
Anatomic TKA
Port Huron, MI
1974
John Insall
Total Condylar TKA
HSS, NYC
1970s
TEXAS ORTHOPEDIC SURGERY CONSULTANTS

60

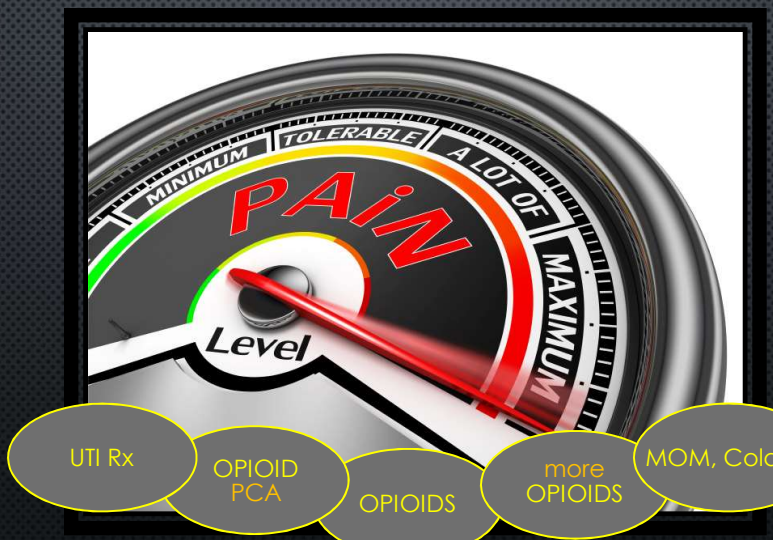

EACH YEAR
1 MILLION+
40%
400,000 / YR
HIPS
60%
600,000 / YR
KNEES
TEXAS ORTHOPEDIC SURGERY CONSULTANTS
TOS

61


TOTAL KNEE REPLACEMENT SATISFACTION
• SATISFACTION RATES FOR TOTAL KNEE REPLACEMENT LESS THAN FOR TOTAL HIP REPLACEMENT
• APPROXIMATELY 80% SATISFIED (1 IN 5 REMAIN DISSATISFIED)
• DISSATISFACTION – FAILURE, INSTABILITY, PAIN, REDUCED MOTION
20%
80%
TEXAS ORTHOPEDIC SURGERY CONSULTANTS
TOS

62

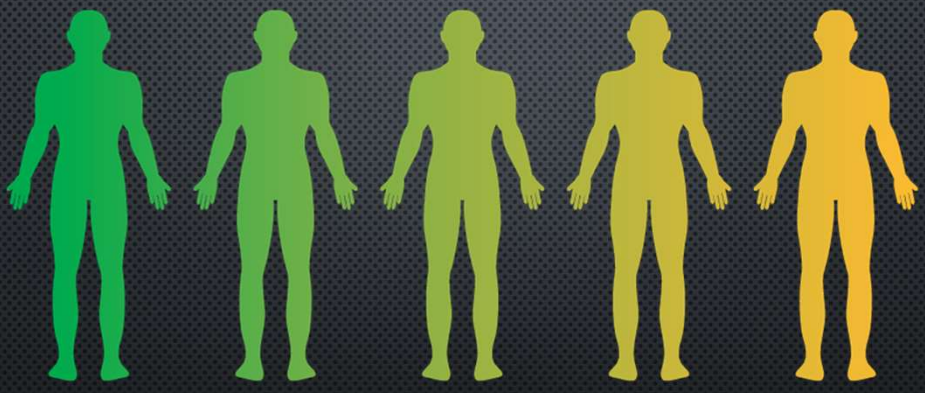
TOTAL KNEE REPLACEMENT SATISFACTION



UTI Rx | OPIOID PCA | OPIOIDS | more OPIOIDS | MOM, Colace

63

TOTAL KNEE REPLACEMENT SATISFACTION



FIRST TIME OPIOID USER — OPIOID DEPENDENT

OPIOID USE OVER TIME

64

TOTAL KNEE REPLACEMENT SATISFACTION

Nerve Blocks | Local Injection | OPIOIDS | Non-Narcotic | Alternative

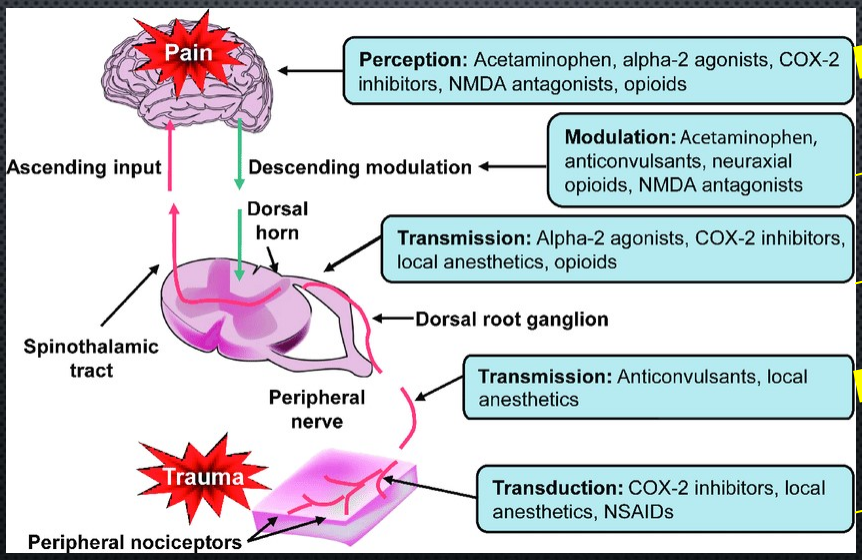
65

TOTAL KNEE REPLACEMENT SATISFACTION

"MULTIMODAL" PAIN THERAPY

66

TOTAL KNEE REPLACEMENT SATISFACTION



APAP 1g TID ATC

Gaba 100 TID

Oxycontin 5-15 Q 4-6 prn

L I A - Ranawat

Celebrex 200 QD

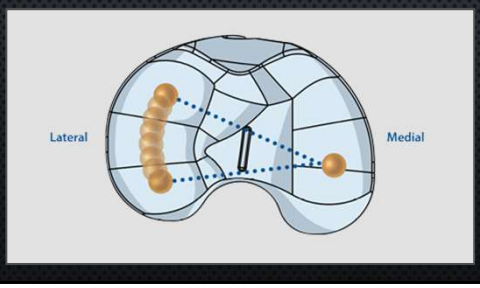
67

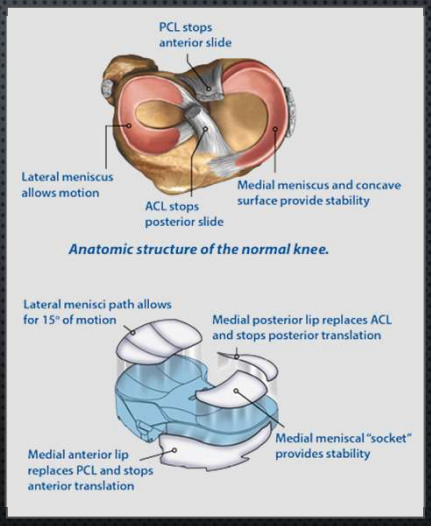
TOTAL KNEE REPLACEMENT SATISFACTION

68

TOTAL KNEE REPLACEMENT SATISFACTION

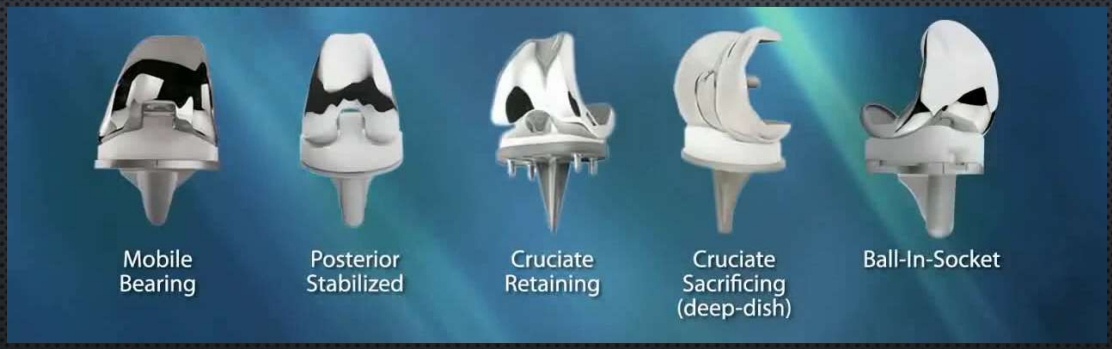
- MULTIPLE MOTION PLANES (F/E, ROLLBACK, TRANSLATION, PIVOT)
- MULTIPLE KNEE DESIGNS FOR OVERCOMING VARIOUS SHORTCOMINGS
- "MEASURED RESECTION" VS "GAP BALANCING" IN TOTAL KNEE REPLACEMENT
- CRUCIATE RETAINING VS CRUCIATE SACRIFICING (CR VS PS)
- NO "ONE SIZE FITS ALL"





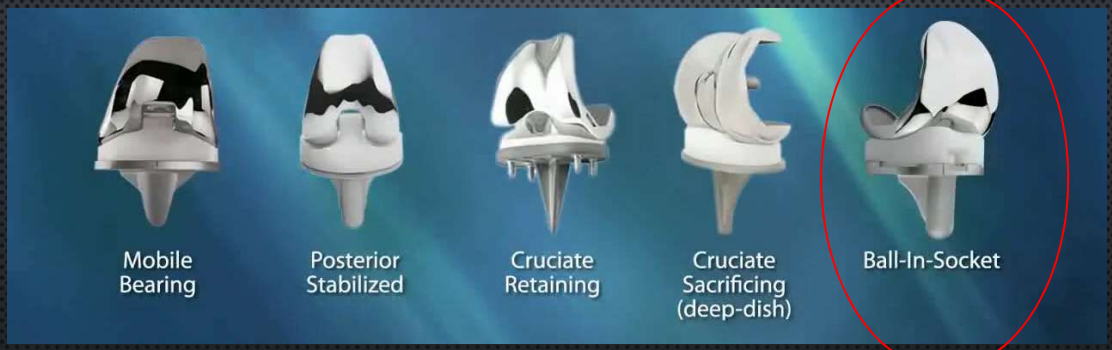
69

EVOLUTION OF TOTAL KNEE REPLACEMENT



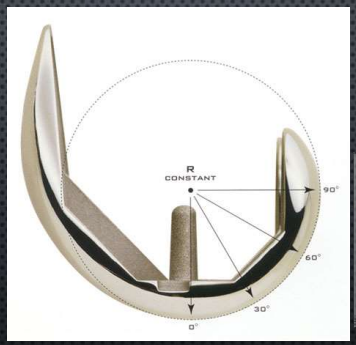
70

EVOLUTION OF TOTAL KNEE REPLACEMENT



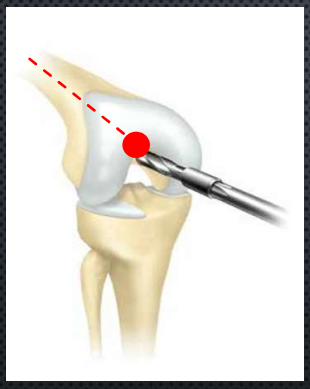
71

EVOLUTION OF TOTAL KNEE REPLACEMENT

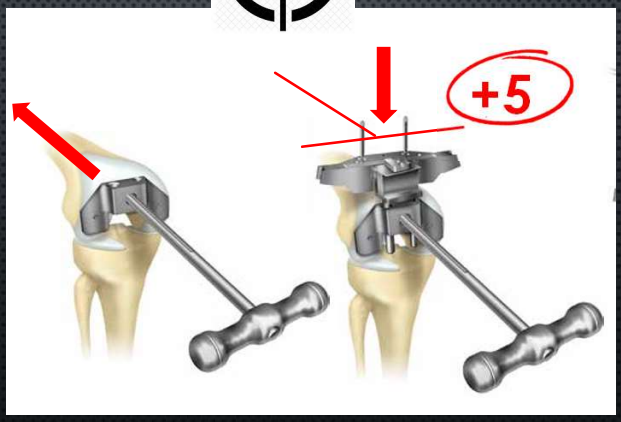


72

TRADITIONAL INSTRUMENTATION FOR TKA



Accuracy Critical



- V A R I A B I L I T Y -

73

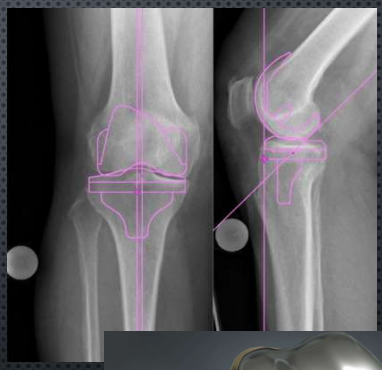
ADVANCES IN IMAGING

1895
Wilhelm Roentgen

Digital X-Ray

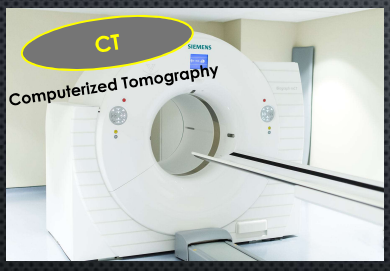
74

PATIENT-SPECIFIC FOCUS REDUCES VARIABILITY



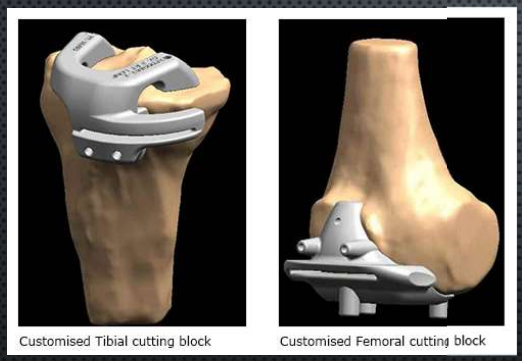
75

PATIENT-SPECIFIC FOCUS REDUCES VARIABILITY



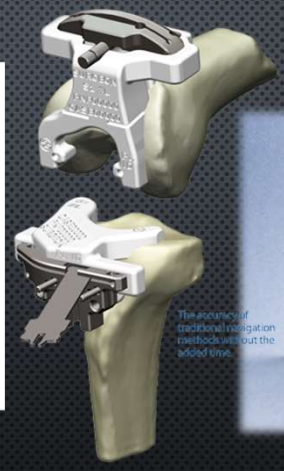
76

PATIENT-SPECIFIC FOCUS REDUCES VARIABILITY



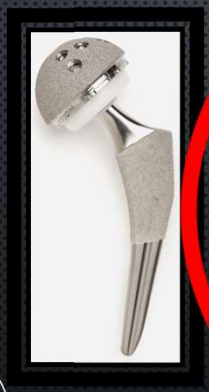
Customised Tibial cutting block

Customised Femoral cutting block



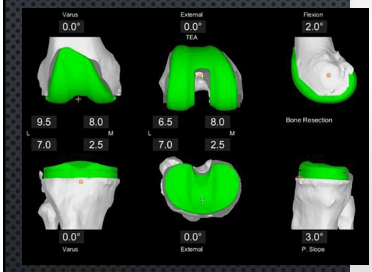
77

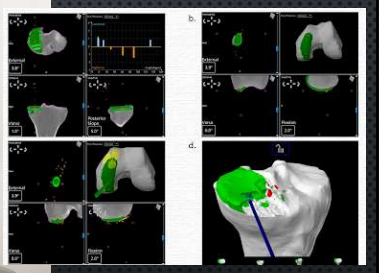
ROBOT-ASSISTED KNEE REPLACEMENT



78

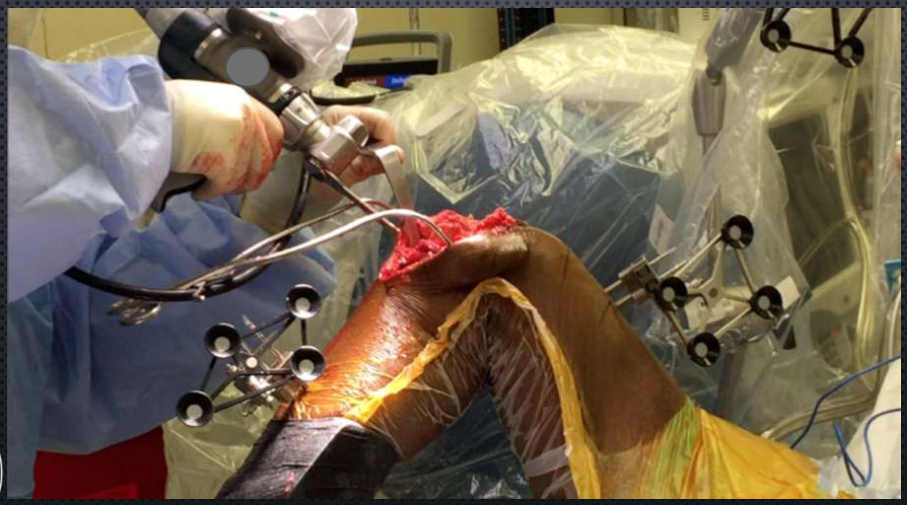
ROBOT-ASSISTED KNEE REPLACEMENT





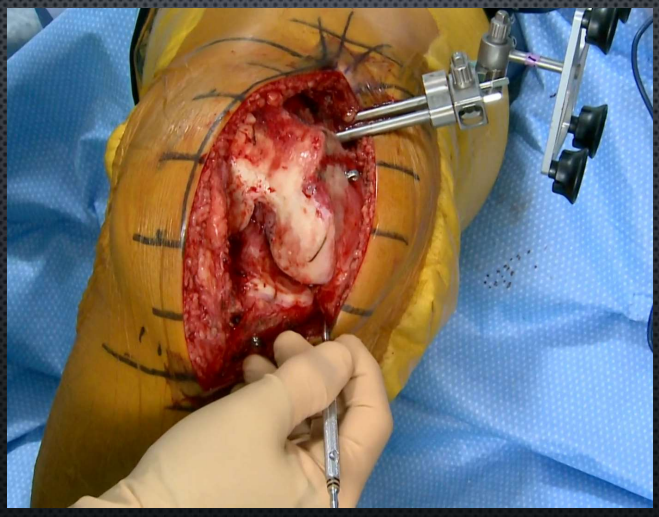
79

ROBOT-ASSISTED KNEE REPLACEMENT



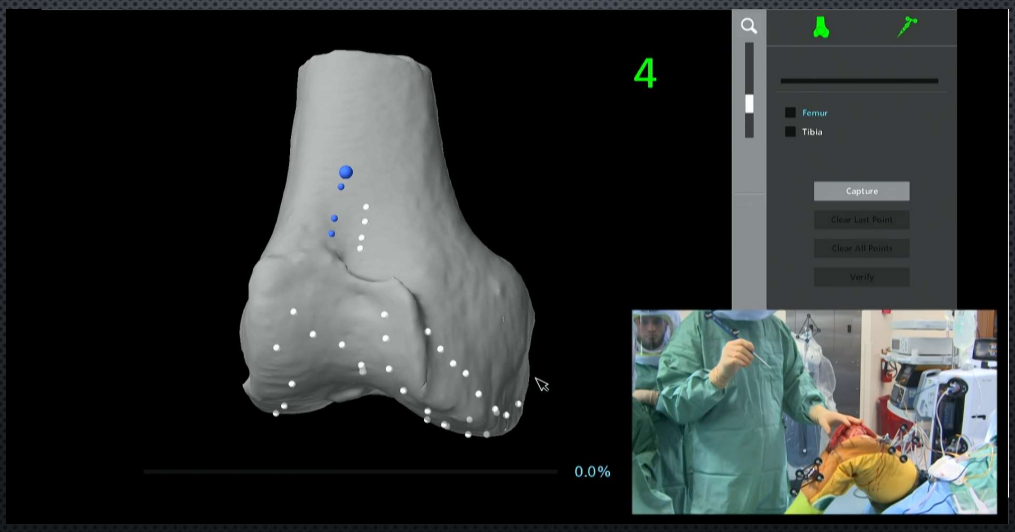
80

ROBOT-ASSISTED KNEE REPLACEMENT



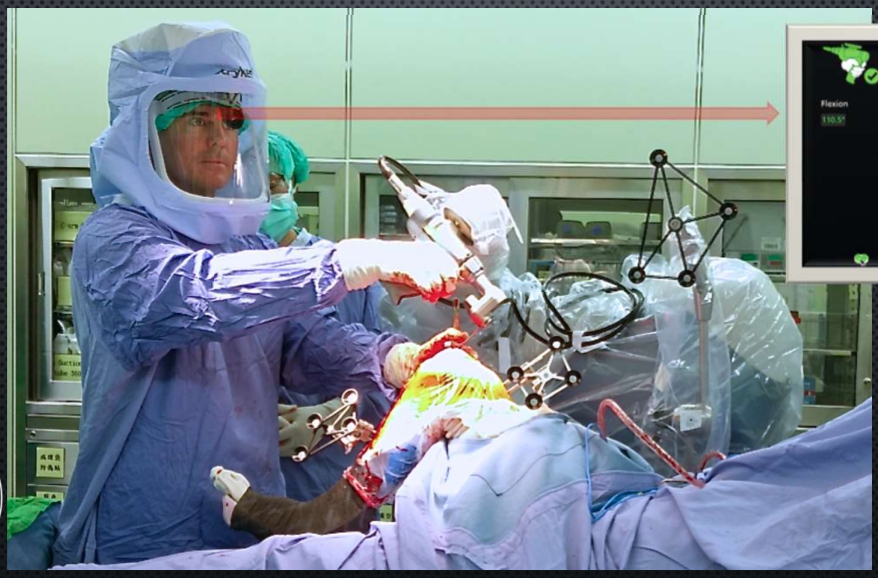
81

ROBOT-ASSISTED KNEE REPLACEMENT



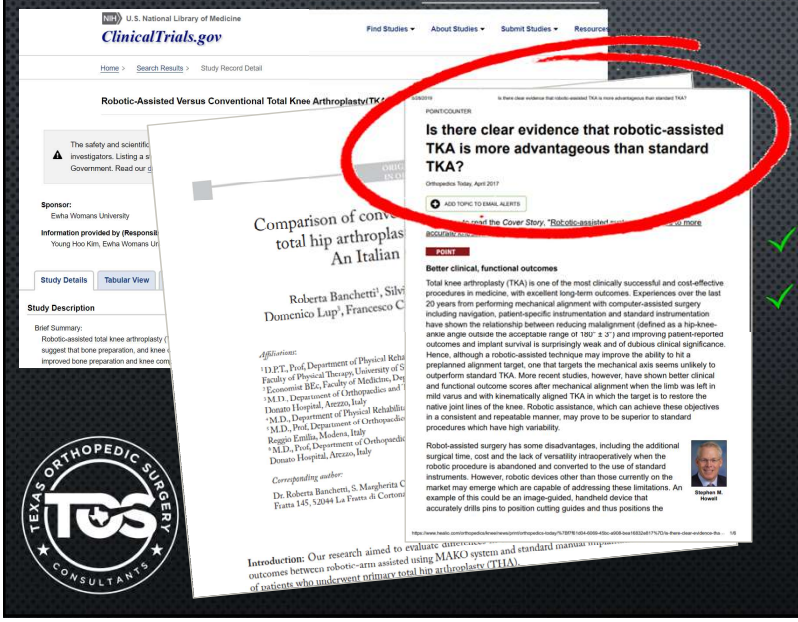
82

ROBOT-ASSISTED KNEE REPLACEMENT



83

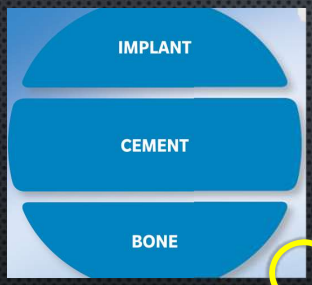
ROBOT-ASSISTED KNEE REPLACEMENT

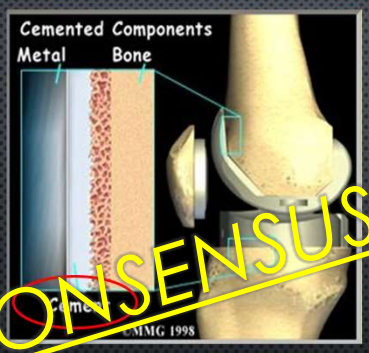


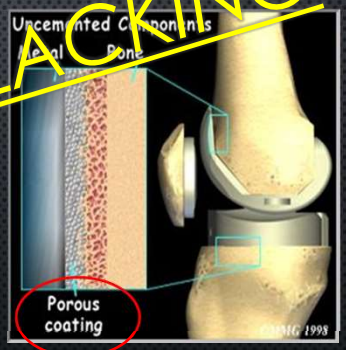
- ✓ Improved component placement
- ✓ Shorter hospital stay
- ✗ No translation to long term postop clinical benefit
- ✗ Further evaluation regarding functional outcomes

84

CEMENTED VS UNCEMENTED TKA







CONSENSUS LACKING

85

TOTAL KNEE REPLACEMENT : AN ELECTIVE PROCEDURE

- NO SMOKING, NO NARCOTICS X 3 MONTHS PREOP
- PATIENT-SPECIFIC SURGICAL SYSTEMS (CT/MRI)
- HIBICLENS PREOP
- MUPIROCIN NASAL SWABS
- MULTIMODAL ANALGESIA BEGINS IN PREOP HOLDING AREA
- REGIONAL ANESTHESIA
- USE OF TRANEXAMIC ACID (TXA) HELPS MITIGATE BLOOD LOSS
- STANDARD PARAPATELLAR SURGICAL APPROACH
- LIA (LOCAL INFILTRATIVE ANALGESIA) PLUS FEMORAL CANAL BLOCK IN PACU
- B/L KNEE-HIGH TED HOSE IN PACU PLUS POLAR CARE, MOBILIZE DAY OF SURGERY

86

AFTERCARE FOR TOTAL KNEE REPLACEMENT

IMMEDIATE POST-OP → UP AND WALKING THE AFTERNOON OF SURGERY (WALKER, PT)

MULTIMODAL PAIN THERAPY CONTINUES

POD 2 , 3 → DISCHARGE TO HOME, RXS FOR PAIN AND BLOOD CLOT PROPHYLAXIS

WEEKLY OUTPATIENT PHYSICAL THERAPY (PT) CONTINUES UNTIL RECHECK

1-2 WEEKS AFTER → REMOVE SURGICAL BANDAGE

TRANSITION FROM WALKER TO CANE PER PT DIRECTION

6 WEEKS AFTER → FOLLOW UP WITH SURGEON

87

AFTERCARE FOR TOTAL HIP OR KNEE REPLACEMENT

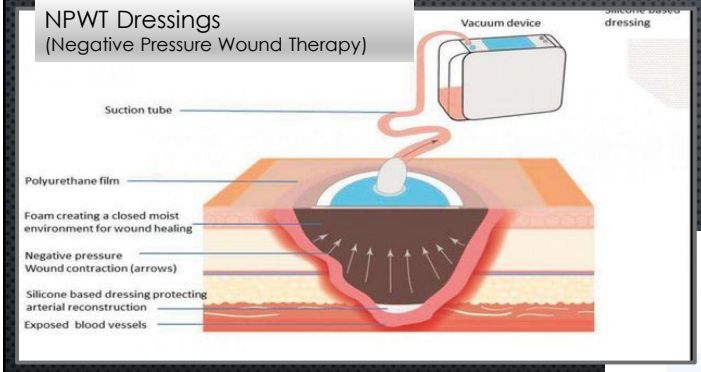
Postoperative dressing
TKA, circa 2000

Ice / Cold Packs
Cryotherapy

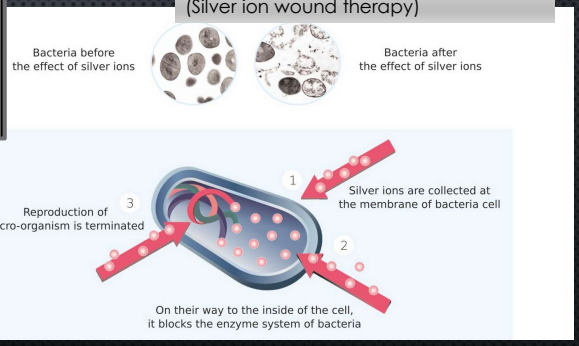
88

AFTERCARE FOR TOTAL HIP OR KNEE REPLACEMENT

NPWT Dressings
(Negative Pressure Wound Therapy)



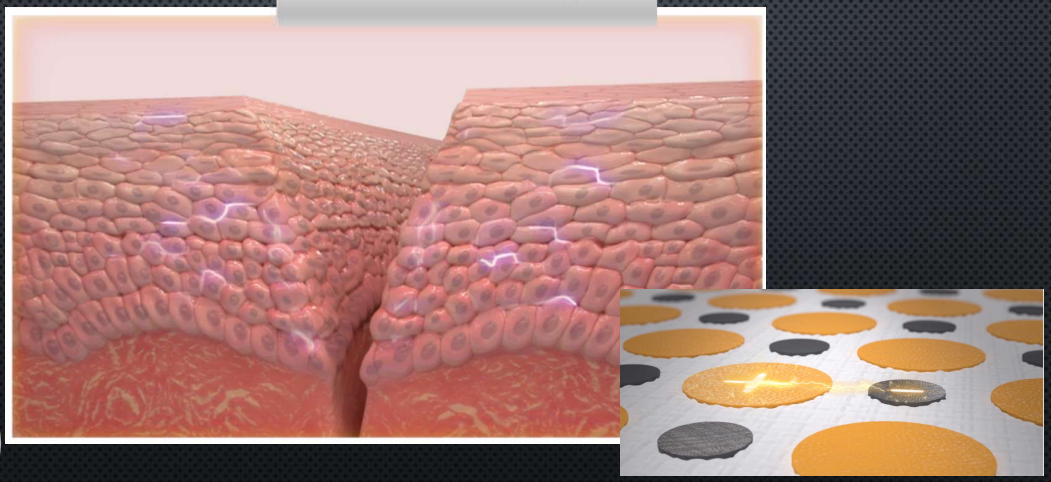
Silver Dressings
(Silver ion wound therapy)



89

AFTERCARE FOR TOTAL HIP OR KNEE REPLACEMENT

Microcurrent Technology

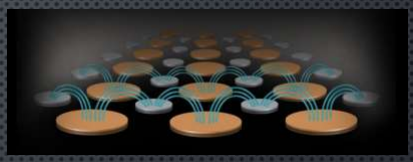


90

AFTERCARE FOR TOTAL HIP OR KNEE REPLACEMENT

91

AFTERCARE FOR TOTAL HIP OR KNEE REPLACEMENT

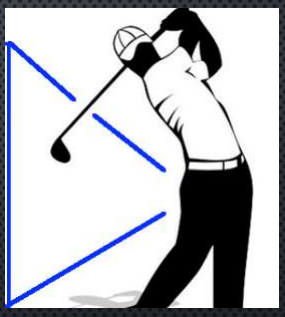


92

RESULTS

80% satisfaction

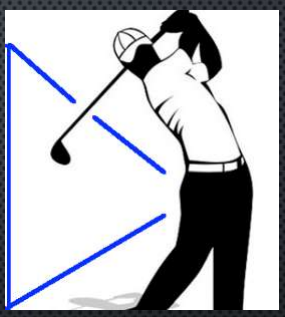
85-93% satisfaction



93

RESULTS

- SATISFACTION RATES REMAIN HIGH FOR HIP OR KNEE REPLACEMENT
  - RIGHT SURGERY, RIGHT PATIENT
- PAIN CONTROL MUCH IMPROVED OVER EARLY EFFORTS
- BLOOD TRANSFUSION VERY RARE
- HOSPITALIZATION NO LONGER MEASURED IN WEEKS
- FOCUS IS ON MOBILIZATION – EARLY AND OFTEN
- IMPROVED IMAGING = IMPROVED ACCURACY FOR COMPONENT FIT AND PLACEMENT
- INDIVIDUAL, PERSONALIZED FOCUS PROMISES IMPROVED PATIENT OUTCOMES



94

95

TEXAS ORTHOPEDIC SURGERY
TOS
CONSULTANTS

www.MyNewKnee.net

THANK YOU

972-235-5633 / 972-235-KNEE

96