Laximetry

from X ray to new devices

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Rationale

- ✓Science
- ✓Diagnostic support
- ✓Clinical relevance = pre / post op

Measurements

- ✓Global Anterior translation
  - ✓Lateral and medial compartments

Lerat JBJS 1980, Franklin JBJS 195
Dejour JBJS 1994, Bercovy 1995

- ✓Internal Rotation

X-Rays to navigation

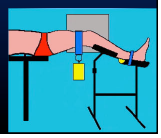
X-rays lateral views

- ✓True lateral, 20 ° of flexion
  - ✓Stress = weight bearing

HooperJBJS 1986
Torzilli JBJS1991
Edung Skel Radiol 199
Dejour JBJS 1994

- ✓Radiological lachman test
  - ✓measurement of ≠ translations for each compartment

Lerat JBJS 1980



- ✓Not enought accurate, large SD

Telos

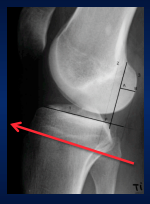
- ✓Comparative stress X rays

Paessler Sport & Med 1986
Staubli Acta Ortho Scand 199

- ✓6 criteriae of reliability (fluoroscopy)
- ✓ Stress (150 N) & landmarks

Telos

- ✓Precises measurements ++
  - ✓150 N / cut-off 8.5 mm
  - ✓Side to side difference ++
  - ✓cut-off 2 mm



- ✓Contraction of the hamstring muscles ?

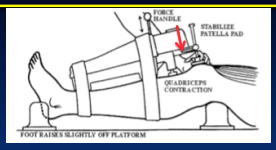
(28 % false negatives)

Radio stereometry RSA

- ✓Measurement of femorotibial micro mobility in the lab > implantation of tantalum beads
- ✓Post op follow-up of operated knee without pre-op data
- ✓Invasive technique
- ✓No controlateral reference

Mechanical devices

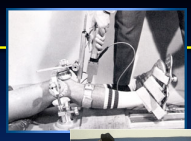
- ✓Numerous



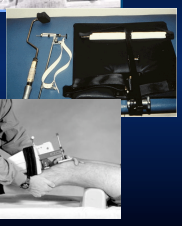
- ✓Precise and reproducible constrain
- ✓Measurement of the anterior displacement of tibia in respect of the patella : joint line marked

The different models

- ✓Precursor Markolf 1978



- ✓Stryker® knee laxity tester
- ✓Genucom® knee tester



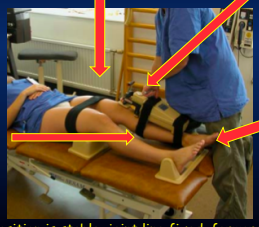
- ✓Medmetric ®KT 1000 (2000)
- ✓Rolimeter
- ✓Genurob

The KT-1000 (2000) Daniel AJSM 1985

Patient lies supine
slight hip flexion
20° knee flexion
Fully relaxed

hip ER can be restricted by a midthigh strap

The frontal dial is adjusted to a neutral position by multiple AP mouvements



secured to the tibia with Velcro straps

Tibial position is maintained by placing the subject's feet between two vertical supports that prevent the feet from ER

Once the starting position is stable, joint line fixed, forward direct passive loads are applied through the handle

The KT-1000 (2000)

- ✓ Simple, precise to 1 mm
- ✓ Progressive increased load (34, 67, 89N & manual maximal (sounds)
- ✓ Excellent Intra observer & Poor Inter observer reproducibility

The Rolimeter (R.Jakob)

Manually anterior pull
Displacement measured by increments / 2 mm

User-friendly and cost-effective, small, portable, sterilizable

Knee's position is not standard
No test at a variety of force levels
Precise to 2 mm
Direct measurement by the examiner

Genu RoB

Robert, Rev Chir Ortho 2009

- ✓Simple, non-invasive, painless
- ✓Precise to 0.1 mm,
- ✓Consider hamstring muscle co-contraction (sensors)
- ✓Reading and recording on a remote PC
- ✓Sensitivity and specificity > 90 %
- ✓Reproducibility ++ interobserver (even beginners)

Comparison of devices

Device	Repeatability/reliability	References
KT-1000 or KT-2000	Anterior: ±3.99 mm, ±3.89 mm, ±3.74 mm[a] Posterior: ±2.95 mm, ±2.53 mm, ±3.27 mm	Huber et al. (1997)
	Anterior: 0.87[b] Posterior: 0.79	Highgenboten et al. (1989)
	0%, 82%[c] 0%, 75%[c]	Anderson et al. (1992) Anderson and Lipscomb (1989)
Genucom	Anterior: 0.96[b] Posterior: 0.86	Highgenboten et al. (1989)
	23%, 76%[c] 10%, 70%[c]	Anderson et al. (1992) Anderson and Lipscomb (1989)
Rolimeter	Anterior between three testers: r(P1 vs. P2) = 0.96 r(P1 vs. P3) = 0.55 r(P2 vs. P3) = 0.57	Papandreou et al. (2005)
Stryker ligament tester	Anterior: 0.74[b] Posterior: 0.87 Anterior/posterior: 0.83	Highgenboten et al. (1989) Jorn et al. (1998)
	0%, 82%[c] 10%, 75%[c] 4.4 mm, 8.0 mm[d]	Anderson et al. (1992) Anderson and Lipscomb (1989) Jorn et al. (1998)

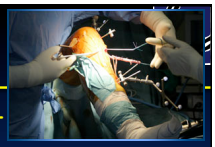
Kupper J clinical Biomechanics 2007

Weak points of the devices

- ✓Inter tester poor reliability
- ✓Dominance hand is a significant item
- ✓Prices
- ✓How frequent they are used??

Sernet Knee Surg Trauma Arthro 2007
Robert Rv Chir Ortho 2009

Navigation



- ✓Peroperative 3-D measurement
  - ✓Translation
  - ✓Rotation

Song Knee Surg Trauma Arthro 2009
Colombet CORR 2006

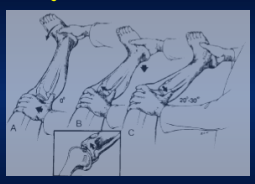
- ✓Use of rigid bodies fixed into the tibia and femur
- ✓Usefull to control the efficacy of ACL repair
- ✓Useless in follow up

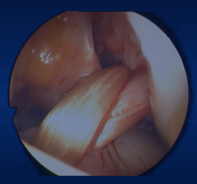
Monaco Knee Surg Trauma Arthro 2009
Lorbach Knee Surg Trauma Arthro 2009

✓ = KT 1000 or Rotameter

And tibial rotation ?

- ✓Objective measured assessment of Pivot-Shift





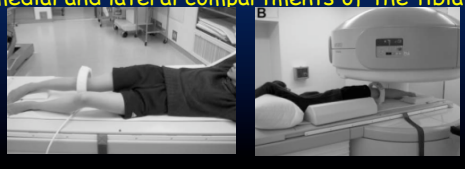
- ✓Step of Research +++

Tibial rotation : MRI

- ✓Open MRI

Osaki AJSM 2007

- ✓Slocum anterolateral rotatory instability test
- ✓Measurement of anterior displacement of both medial and lateral compartments of the tibia



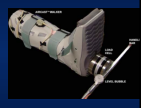
Tibial rotation : electromagnetic

- ✓In vivo measurement applied for quantitative evaluation of the dynamic instability during the pivot-shift test.
- ✓Reliability of the load and observers ?

Tibial rotation : electromagnetic

Mushal Knee Surg Trauma Arthro 2007

- ✓A load sensor is attached to a boot with a handle bar for application ofrotation moments about the knee



- ✓Another sensor record rotational mouvement of the tibia in ragad of the femur

- ✓Simple, reliable

Tibial rotation : Mechanical

Lorbah Knee Surg Trauma Arthro 2009

Rotameter

Next lecture by Romain Seil