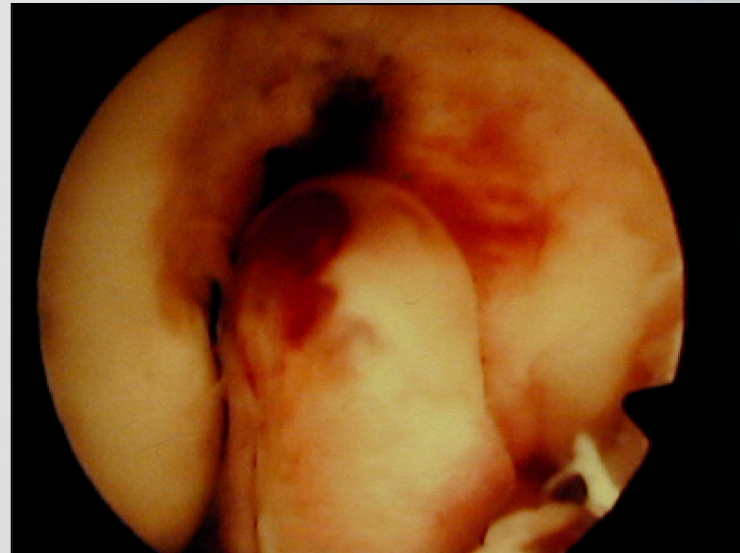


HTO + lateral tenodesis in Arthritic ACL deficient knee



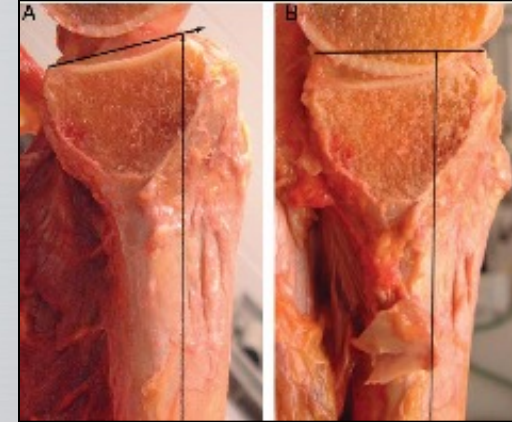
François Kelberine, Jean Philippe Vivona, Gaspard Fournier

Aix en Provence France

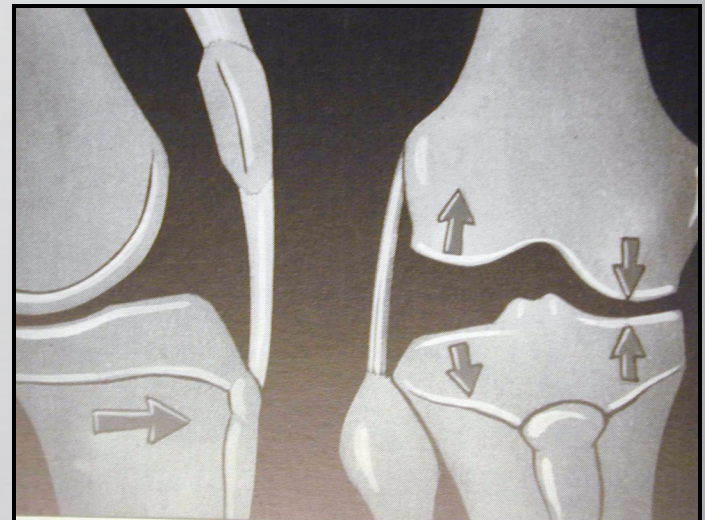


Detrimental factors / arthritis

- Morphotype (varus & tibial slope)
- Previous medial DJD
 - double varus
- Secondary collateral ligament injuries
 - Triple varus



Dejour & Bonnin *JBJS* 1994
William *Am J Sport Med* 2000



ACL deficient knee with Arthritis

Isolated ACL-R

- **Detrimental / arthritis**

Daniel *Am J Sport Med* 1994

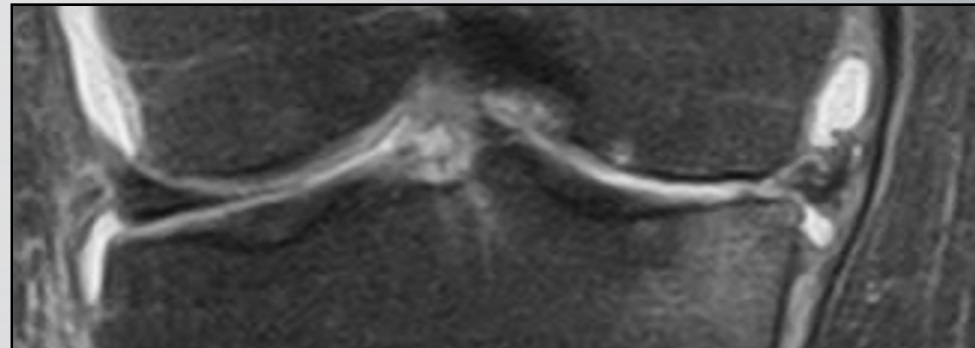
Dejour H *Rev Chir Orthop* 1988

Healy *Am J Knee Surg* 1990

Williams *Am J Sports med* 2000

- **Doubtful (... 37%)**

Selva *Rev Chir Orthop* 1997



- **Beneficial for low grade arthritis in one compartment**

Jarvela *Int Orthop* 1999

Shelbourne *Am J Sport Med* 2000

Ericksson *J Bone Joint Surg Br* 2001

ACL deficient knee with Arthritis

HTO alone

can stabilize partially the ACL deficiency

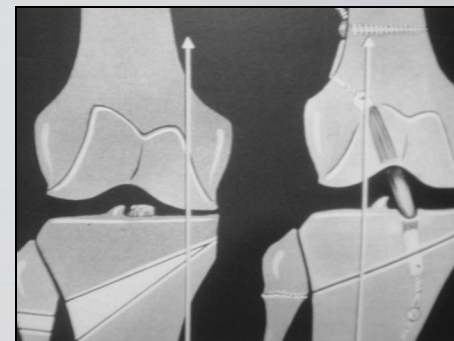
- HTO technique is of importance
 - Lateral closing wedge trends to reduce the slope
 - Medial open wedge trends to augment the slope

Dejour H *in Instability and osteoarthritis of the knee 1994*

Hohman *Operative Techniques in Orthop 2007*

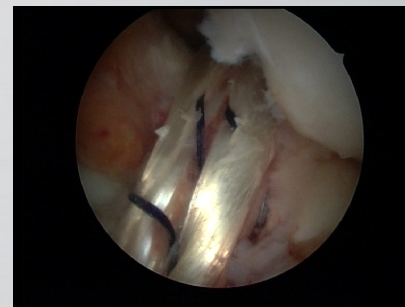
Combined procedures

When symptomatic, both pathologies need to be treated



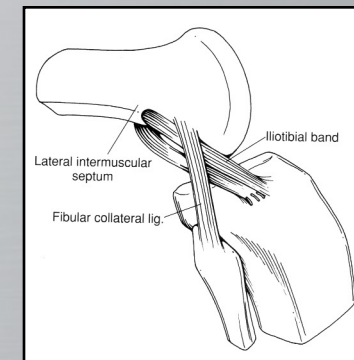
- **Medial arthritis with HTO**

- Medial open wedge
- Lateral closing wedge



- **Instability with ACL repair**

- Hamstring
- BTB
- Anterolateral extra articular tenodesis



Our technical choice / HTO



- **Pb with opening wedge**

- **Trend to flexion**

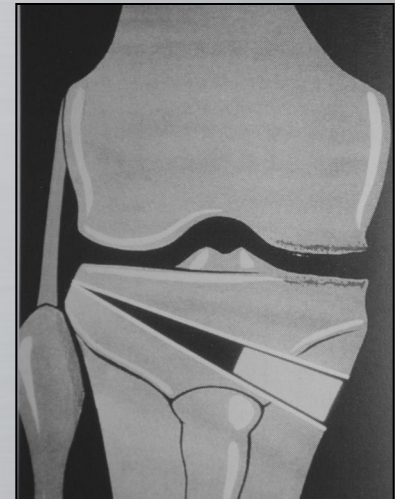
Rodner Am J Sport Med 2006

- **Hardware interference with tibial track**

Hinterwimmer Op Orthopaedie und traum 2014

- **Graft fixation at a bony gap level**

Imhoff Techn knee Surg 2002



Our technical choice / HTO

- **Closing wedge**
- **Automatic trend to extension**
- **L - shape plate posteriorly located**
- **No bony gap, immediate weight bearing**

Lerat Rev Chir Orthop 1993



Our technical choice / ACL

- **Extra articular tenodesis**

- Same approach
- Rotatory control

Galway *J Bone Joint Surg Br* 1972

Lemaire *Rev Chir orthop* 1980

Suero *KSSTA* 2013

- **Control of secondary lateral laxity**

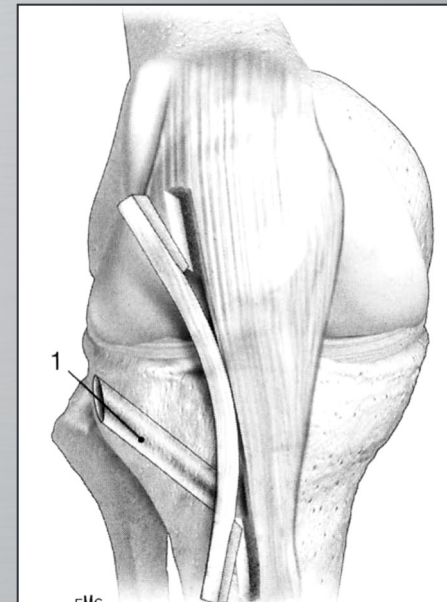
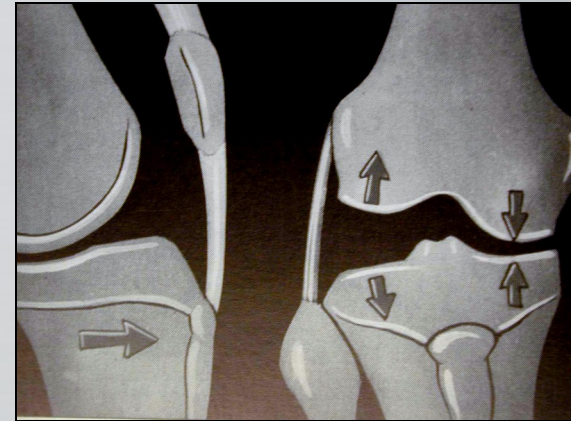
Lerat *Rev Chir Orthop* 1993

Suero *KSSTA* 2013

- **No intra articular overload**

- **Graft = BTB**

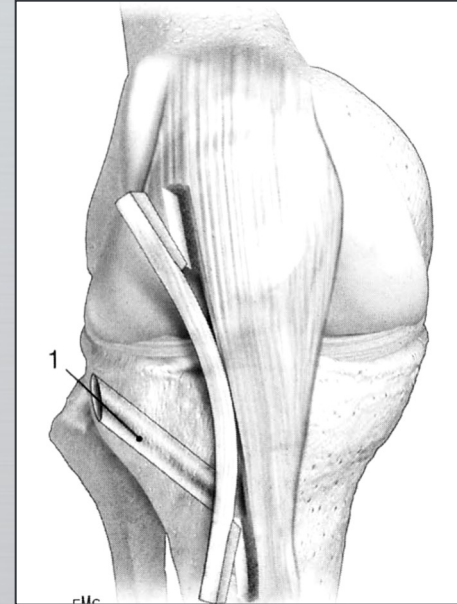
Imbert & Kelberine *Techn Chir EMC 2000 Elsevier*



Technique

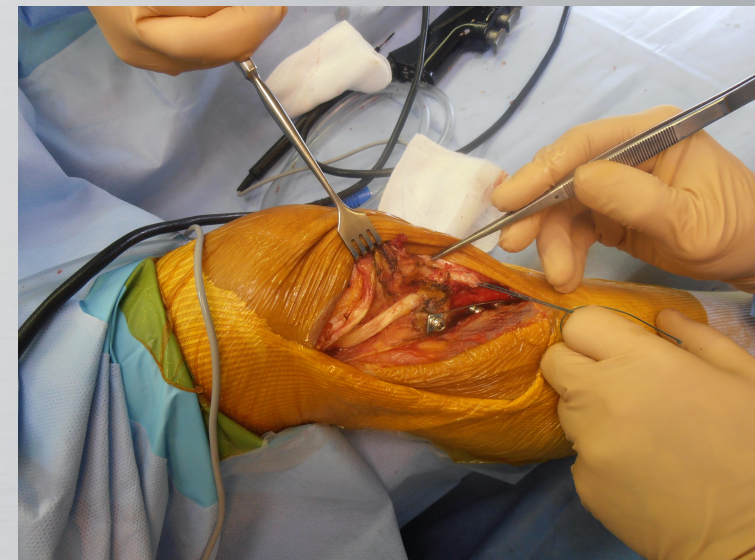
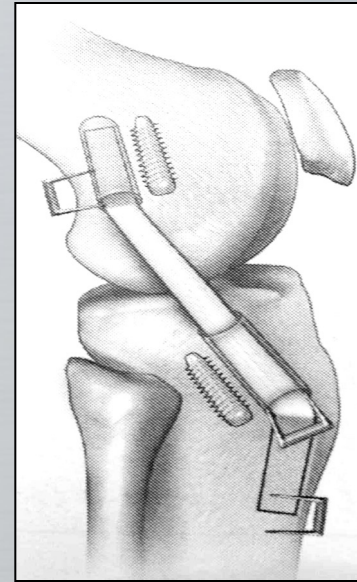
Imbert, Kelberine *Techn Chir EMC 2000 Elsevier Ed 44-791*

- **Harvesting BTB lateral quarter**
 - two 7mm bone blocks
 - with 1 cm of quad tendon
- **Lateral close wedge HTO**
- **Medial hinge with intact medial cortex**
Kessler COOR 2002
- **Supple plate fixation**



Technique

- Tunnels (Gerdy & femur = Lemaire technique)
- Isometry
- Interference screw fixation
- Reconstruction of deep layer of ITB (AL Lig)
Kaplan J Bone Joint Surg A 1958
- Arthroscopy useless
- Post operative course
 - Full weight bearing with rigid brace
 - CPM



Material and method

- **37 patients (1997-2010) 17 males / 20 females**
- **29 y to 53 years old**
- **Sport practice**
 - **31 before ACL rupture**
 - **Still active pre operatively : 2 competitive, 10 recreational**
- **59 previous surgical procedures**
- **41 med menisci, 9 lat menisci, 9 ACL repairs (3 artificial)**
 - **7 arthro debridements, 2 HTO, 1 tibial tubercle transfer**
- **Delay to surgery / ACL rupture = 17,5 y (9 to 22)**



Material and method

- **Clinical signs**
 - Functional instability **100%**
 - Pivot shift **100%**
- Ant drawer = + 8 mm (5 to 11)
(telos or KT1000)
- Medial pain **100%**
- X-Rays
 - 11 grade B, 22 stage C, 4 stage D
 - Varus alignment 5° to 15°



Anatomical results

- **Pivot shift (95%)**

- 24 negative
- 11 sliding
- 2 frank



- **Ant Laxity (KT 1000) = 2mm (1 to 7mm) !!**

- **6 radiological DJD worsening (4,6,6,7,10,10 y)**

- **3 TKA @ 4,9&10 y**

Functional results

9 years FU (3 y- 16 y)

- no complication
- 5 failures with 4 resurgery
 - 1 Hamstring intraarticular repair
 - 3 TKA (@ 4, 9 & 10 y)
- Subjective assessment : 32 satisfied (86%)
- 27 (73%) resume to sport activities > pre-op
 - 3 competitive, 22 recreational, 2 occasional
 - Lower level or changing sport/ preinjury (83%)
 - Especially former athletes

Literature

	Population	HTO	IA ACLR	ExA P	
Kelberine 2012 (NP)	37/37 pts y	39	CW	none	BTB
O'Neil 1992 (CORR)	10/10 pts y	32	CW	BTB	
Noyes 1993 & 2000 (AJSM)	23/41 pts y	31	CW	Both (2 steps)	33%
Lerat 1993 (RCO)	28/53 pts 37y		Both	Both	NP
Dejour 1993 (CORR)	44/50 pts y	29	Both	BTB	77%
Neuschwander 1992 (Orth)	5/5 pts	27 y	CW	BTB	
Boss 1995 (KSSTA)	27/34 pts y	36	CW	BTB/Art	
Latterman 1996 (KSSTA)	16/16 pts y	32	Both	STG (1/2 w/o)	
Williams 2003 (J Knee S)	13/13 pts y	33	CW	BTB	
Bonnin 2004 (Knee)	30/40 pts	30	CW	BTB	85%

Literature

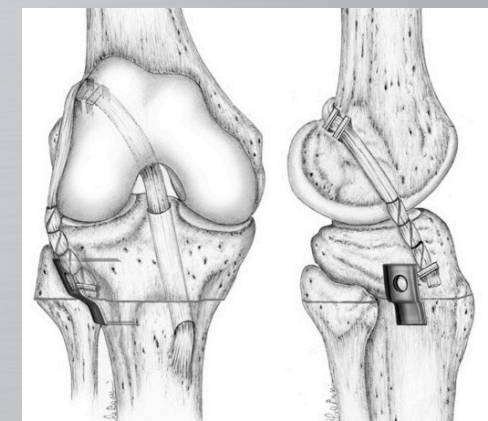
	FU	Laxity	OA worsening	Re-surgery
Kelberine 2012 (NP)	9 years	6%	16%	9%
O'Neil 1992 (CORR)	3 years			
Noyes 1993 & 2000 (AJSM)	4 years	22%	22%	
Lerat 1993 (RCO)	4 years	22%		
Dejour 1993 (CORR)	3,6 years	NP	Improvement	
Neuschwander 1992 (Orth)	2,5 years	20%		
Boss 1995 (KSSTA)	6,5 years	33%	11%	
Latterman 1996 (KSSTA)	6 years	45%	100%	
Williams 2003 (J Knee S)	3 years	15%		
Bonnin 2004 (Knee)	12 years	10%	20% M, 73% L	
Graveleau 2008 (JBJS)	2 years			
Akamatsu 2010 (Knee)	2 years	0%	0%	75% cyclop
Roussignol 2012 (ORTS)	5 years		10%	
Zaffagnini 2013 (KSSTA)	6,5 years	6%	22%	0%
Trojani 2014 (ORTS)	6 years	20%	14%	

Literature

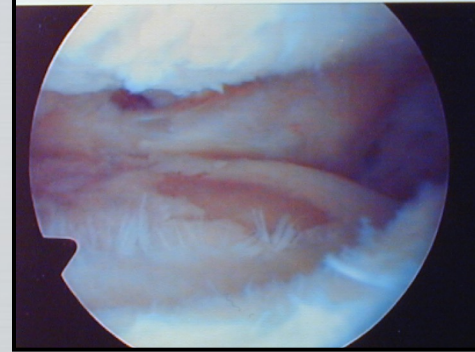
	FU	Satisf %	Function	RTS
Kelberine 2012 (NP)	9 years	86%	75% A & B	73% (10%C)
O'Neil 1992 (CORR)	3 years		66% A & B	
Noyes 1993 & 2000 (AJSM)	4 years	88%		66%
Lerat 1993 (RCO)	4 years	100%		68% (18%C)
Dejour 1993 (CORR)	3,6 years	91%		61%
Neuschwander 1992 (Orth)	2,5 years			
Boss 1995 (KSSTA)	6,5 years	75%	66% A & B	79%
Latterman 1996 (KSSTA)	6 years	92%		
Williams 2003 (J Knee S)	3 years			92% (16%C) ?
Bonnin 2004 (Knee)	12 years	Score 78	63% A & B	84% (1%C)
Graveleau 2008 (JBJS)	2 years	100%		75%
Akamatsu 2010 (Knee)	2 years			Recreational
Roussignol 2012 (ORTS)	5 years	85%	80% A & B	55% (5%C)
Zaffagnini 2013 (KSSTA)	6,5years	Score 72		62% Recr
Trojani 2014 (ORTS)	6 years		70% A & B	80% (44%C)

Literature

	Special comments
O'Neil 1992 (CORR)	
Noyes 1993 & 2000 (AJSM)	Recommand HTO + ACLR
Lerat 1993 (RCO)	
Dejour 1993 (CORR)	
Neuschwander 1992 (Orth)	
Boss 1995 (KSSTA)	Stable with time
Latterman 1996 (KSSTA)	Recommand HTO (ACL 2 nd ...)
Williams 2003 (J Knee S)	Recommand HTO + ACLR
Bonnin 2004 (Knee)	OA / other compartments
Graveleau 2008 (JBJS)	tibial slope 10°
Akamatsu 2010 (Knee)	Recommand notchplasty (cyclop)
Roussignol 2012 (ORTS)	tibial slope 12°, long preop onset
Zaffagnini 2013 (KSSTA)	
Trojani 2014 (ORTS)	tibial slope 10°



Conclusions



- **Simple technique allowing weight bearing**
- **Subjective results similar / HTO + IA ACLR**
- **Restore knee stability & keep intact agonists of ACL**
- **Control rotational laxity but anterior drawer too!**
- **Prevent OA worsening & Protect medial aspect (overload & valgus)**
- **Return to « modified » sport (type and level)**



Conservative procedure in young athletes