

Femoral and tibial fixations



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Disclosures





The menu



- Transcondylar cross pins
- Suture post
- Button
- Fixed loop
- Adjustable loop
- Staple
- Interference fixation
 - Metal
 - Biocomposite
 - PEEK







Goal of fixation? Get the graft to heal

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Tendon-Healing in a Bone Tunnel

A BIOMECHANICAL AND HISTOLOGICAL STUDY IN THE DOG*†

BY SCOTT A. RODEO, M.D.‡, STEVEN P. ARNOCZKY, D.V.M.§, PETER A. TORZILLI, PH.D.‡, CHISA HIDAKA, B.A.‡, AND RUSSELL F. WARREN, M.D.‡, NEW YORK, N.Y.

Investigation performed at The Laboratory for Comparative Orthopaedic Research and The Laboratory for Soft Tissue Research, The Hospital for Special Surgery, New York City

- Serial histological analysis
- Layer of cellular, fibrous tissue matures over time
- collagen-fiber continuity between the bone and the tendon
- Collagen fibers resemble Sharpey fibers
- Strength of the interface increases over time



Suspensory fixation

- Can be used for bony or soft tissue grafts
- Allows for maximum graft contact with bone tunnel
- Relies on strength of sutures, suspensory device, and stitching into graft
- Less concern about blowing out the back wall
- Easier to revise
- Graft toggle in tunnel





Suspensory fixation - old school



Screw suture post
Easy to use
Easily available
Inexpensive
Works great!



Suspensory fixation - trans pin







Continuous loop - history



Knee Surg Sports Traumatol Arthrosc. 1999;7(4):215-9. doi: 10.1007/s001670050151.

Hamstring graft motion in the femoral bone tunnel when using titanium button/polyester tape fixation

J Höher ¹, G A Livesay, C B Ma, J D Withrow, F H Fu, S L Woo

The shorter the loop the better... later continuous loop was created



Bone tunnel enlargement



	Article					
16	Bone tunnel enlargement after anterior cruciate ligament	<u>Höher, J., Möller, H.D.,</u>	Knee Surgery, Sports 1998	<u>369</u>		
	reconstruction: Fact or fiction?	<u>Fu, F.H.</u>	<u>Traumatology</u> ,			
			<u>Arthroscopy</u>			
			, 6(4), pp. 231–240			
	Show abstract 🗸 🕞 FIND@GU 🧵 Entitled full text 🤉	Related documents				

Windshield wiper effect Bungee cord effect



Suspensory fixation - femoral side



• Fixed loop

- Button suspension over lateral cortex
- Can increase button size if concerned about tunnel
- Must measure your tunnel length to determine how much graft to place in tunnel
- No concern for loosening of loop



Continuous loop better than knots



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Continuous-Loop Tape Technique Has Greater Stiffness and Less Elongation Compared With Tied-Suture Fixation of Full-Thickness All–Soft Tissue Quadriceps Tendon Autografts

Christopher M. Gibbs, MD^{†,*}, Philipp W. Winkler, MD^{†,‡}, Robert T. Tisherman, MD[†], Calvin K. Chan, MS[§], Theresa A. Diermeier, MD^{†,‡}, Richard E. Debski, PhD^{†,§}, and Volker Musahl, MD^{†,§}



Suspensory fixation - femoral side



- Button suspension over lateral cortex
- Can increase button size if concerned about tunnel
- Tunnel depth you drill determines how much graft is in the tunnel
- Can re-tension graft after femoral fixation
- Don't need to measure tunnel length
- Some concern for loosening of adjustable loop



Suspensory fixation - femoral or tibial side



• Staple

- Good for "over-the-top" technique
- Useful for revisions with poor femoral bone stock
- Useful for pediatric cases stay out of the physis
- Requires another lateral incision
- Hardware can be symptomatic



Zsiadi, Musahl, Arthroscopy Techniques 2022

Suspensory fixation - tibial side



- Cortical button
 - Easy to use
 - Low profile
- Bone bridge
 - Easy to use
 - No hardware irritation
 - Free!
- Both rely on your knot-tying quality!





Peez, Kittl, OJSM 2023

No tibial fixation?

Use what God gave you!
Harvest hamstrings, leave attached to tibia



Marcacci, Zaffagnini KSSTA 1998

No femoral fixation?



- Over the top technique for skeletally immature
- Take Hamstring (or strip of IT band)
- Loop around lateral condyle
- Suture to tibia



Marcacci, Zaffagnini KSSTA 1998

Interference fixation - old school



• Press fit

- Chambat Technique, 1989
- Outside-in
- Excellent bony contact
- Makes "killer turn"



Interference fixation - old school

KNEE



DOI 10.1007/s00167-004-0606-5

Knee Surg Sports Traumatol Arthrosc

P. Hertel H. Behrend T. Cierpinski V. Musahl

(2005) 13: 248-255

G. Widjaja

ACL reconstruction using bone-patellar tendon-bone press-fit fixation: 10-year clinical results

95 patients
10 yr outcome
KT-1000: 1.8 mm



Interference fixation - the revolution

- Generates compression good for bony grafts
- Strong time zero fixation
- Less toggle between graft and tunnel
- Screws can shred your soft tissue graft
- Less contact between graft and tunnel
- Can't put this across the physis
- Worry more about back wall
 blowout



Masahiro Kurosaka мд Orthopedic Surgery Kobe Shi, Hyogo, Japan



Interference fixation



- Reliable fixation
- They feel great going in!
- They feel terrible if you have to take them out...
- Artifact on MRI





Interference fixation



- Good time zero fixation
- Less concern for graft injury
- Easier to revise
- Incorporates and replaced by bone over time
- Little MRI artifact
- Can break during insertion
- Can lead to severe tunnel widening and cystic changes





Bioabsorbable screw

Case Reports > Arthroscopy. 2001 Jan;17(1):73-6. doi: 10.1053/jars.2001.7797.

The fate of the poly-L-lactic acid interference screw after anterior cruciate ligament reconstruction

V Martinek ¹, R Seil, C Lattermann, S C Watkins, F H Fu

Affiliations + expand PMID: 11154372 DOI: 10.1053/jars.2001.7797

 persistence of a poly-L-lactic acid (PLLA) interference screw 2.5 years after anterior cruciate ligament (ACL) reconstruction



Bio IFS increase "direct insertion" healing



Weiler A, Peine R, Pashmineh-Azar A, Abel C, Südkamp NP, Hoffmann RF.

Arthroscopy. 2002 Feb;18(2):113-23. doi: 10.1053/jars.2002.30656.

Tendon healing in a bone tunnel. Part II: Histologic analysis after biodegradable interference fit fixation in a model of **anterior cruciate ligament** reconstruction in sheep.

Weiler A, Hoffmann RF, Bail HJ, Rehm O, Südkamp NP.

Arthroscopy. 2002 Feb;18(2):124-35. doi: 10.1053/jars.2002.30657.

Interference fixation

• PEEK screws

- Reliable fixation
- Easy to see on imaging, but without artifact
- Excellent biocompatibility
- Can be difficult to revise?





Does it matter what you use?



- Stick to your guns
- Technique matters... rather than devices
- They all work well
- "Never let portal or device dictate surgery. You are in charge!" Russell Warren



My evolution



In My Training	What Freddie Used	Junior Attending	Today
'98 Berlin Press fit	BTB: metal interference screw HS: cross pin	HS: CL button and post QT (Since 2012): CL + IFS	Femur: fixed loop button Tibia: PEEK screw

Top Reasons for ACL Failure

1. Poor technique

- malpositioned tunnels did you really see the back wall?
- Too anterior or too vertical
- Wrong graft choice
- 2. Trauma graft ruptures, fixation doesn't fail
- 3. Anatomy at risk need to check the slope
- 4. Improper rehab return to sport too early
- 5. Biology issue





Does it matter what you use?

- Bio-screw vs endobutton
 No difference in clinical outcome
- Bio-screw vs metallic screw
 - No difference in clinical outcome

• Cortical suspensory button vs interference screw

• No difference in clinical outcomes

Comparative Study > Arthroscopy. 2004 Feb;20(2):122-8. doi: 10.1016/j.arthro.2003.11.007.

Hamstring anterior cruciate ligament reconstruction: a comparison of bioabsorbable interference screw and endobutton-post fixation

C Benjamin Ma ¹, Kimberly Francis, Jeffrey Towers, Jay Irrgang, Freddie H Fu, Christopher H Harner

Review > Arthroscopy. 2010 May;26(5):705-13. doi: 10.1016/j.arthro.2009.12.011.

Bioabsorbable versus metallic interference screw fixation in anterior cruciate ligament reconstruction: a meta-analysis of randomized controlled trials

Chao Shen ¹, Sheng-Dan Jiang, Lei-Sheng Jiang, Li-Yang Dai

Randomized Controlled Trial> Arthroscopy. 2015 Sep;31(9):1733-9.doi: 10.1016/j.arthro.2015.03.006. Epub 2015 Apr 22.

Cortical Suspensory Button Versus Aperture Interference Screw Fixation for Knee Anterior Cruciate Ligament Soft-Tissue Allograft: A Prospective, Randomized Controlled Trial

James H Lubowitz ¹, Randy Schwartzberg ², Pat Smith ³



Tips for Success





Anatomic Individualized Value Based

Thank You!





art you can get into