

Treatment of Meniscus Tears with ACL Reconstruction

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History

- Been in practice since 1982
- Specialized orthopaedic practice – see only knee problems
- Dedicated staff for research to determine track patient outcomes
- All of the data presented today is from years of continual research follow-up of patients' outcomes (not opinion)

Factors to consider

- ACL intact or ACL deficient knee (today we will talk about ACL-deficient knee)
- From our research, most “repairable” meniscus tears are those that are asymptomatic
- Patients with symptomatic tears have flap or displaceable degenerative tears that are not amenable to repair
- “Save all menisci” is a good idea BUT
- Reality is most symptomatic tears that are repaired, even if they don't cause symptoms, may not function well

Factors to consider

- Medial versus Lateral
- Degenerative versus Nondegenerative
- Stable versus Unstable
- Treatment choices
 - Remove
 - Repair
 - Leave alone
- Postoperative Rehabilitation – does it matter?

History of treatment

- Before arthroscopy was available, most of the meniscus tears associated with ACL instability were not observed or treated
- In 1982-83 before using arthroscopy consistently with ACL reconstruction—35% had either a LMT or MMT
- When we started using arthroscopy, we found that 67% of patients had MTs with more being lateral
- Expected patients to return because of meniscal symptoms at some time after ACL reconstruction – didn't happen!

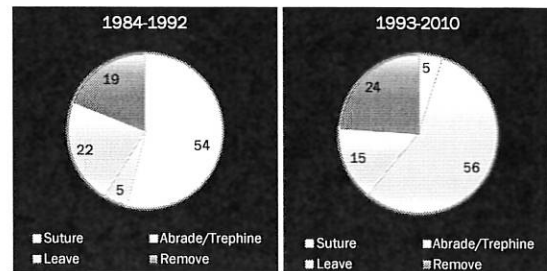
History of treatment

- When arthroscopy was used (from 1984 on), many more meniscus tears were observed
- Felt compelled to either repair or remove the tears even though the tears were not symptomatic
- Leaving the tear alone was not considered

Trends for Tears

- Acute vs. chronic instability
 - Medial tears
 - 44% of acute injuries had tears versus 54% of chronics
 - Lateral tears
 - 55% of acute injuries had tears versus 47% of chronics
- What does this mean?
 - Simply – Most lateral meniscus tears seen with acute injury heal

Trend for Treatment of All Meniscus Tears



Why change treatment?

- The change in treatment occurred for several reasons
- All changes were made because of observation and analysis of follow-up results of patients

How to determine treatment

- Can we identify which meniscus tears are symptomatic?
- Other than the obvious degenerative stuck bucket-handle tears, it can be difficult
- Studied correlation of joint line tenderness and actual meniscus tears in acute and chronic injuries

Meniscus Tears with Acute ACL Injuries

- Prospective evaluation of joint line tenderness and meniscus tears
- 2-year period of time
- 173 patients seen for acute injury
- Evaluated for joint line tenderness at initial exam
- Recorded meniscus tears seen at time of surgery

Shelbourne et al., AJSM 1995

Meniscus Tears with Acute ACL Injuries

- Presence or absence of joint line tenderness has no correlation with meniscal tears in patients with acute ACL tears

Meniscus Tears with Acute ACL Injuries

- Now that we delay ACL surgery until the patient has a quiet knee with full ROM, what happens to joint line tenderness?
- On the day of surgery, few patients have pre-op joint line tenderness
- But >50% have meniscus tears

Meniscus Tears with Subacute and Chronic ACL Injuries

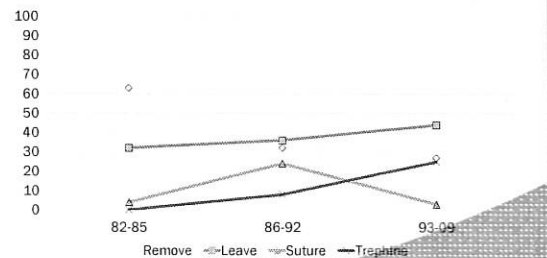
- Evaluated correlation of JLT to meniscus tears in patients with subacute or chronic ACL injuries
- Subacute = patient has delayed surgery after injury but did not have another ACL instability episode
- Chronic = Had another ACL instability episode after initial injury

Shelbourne KD, Benner RW. J Knee Surg 2009

Meniscus Tears with Subacute and Chronic ACL Injuries

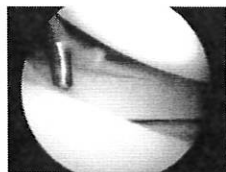
- Same study design as study of acute injuries
- 3531 patients
- Same finding - JLT was about 50% sensitive, specific, or accurate for detecting a medial or lateral meniscus tear

Lateral Meniscus Tears: Treatment Trend



Lateral Meniscus Tears with ACL Surgery

- Repairing posterior third LMT with an inside-out technique is difficult



Lateral Meniscus Tears with ACL Surgery

- It is rare to have a patient with an intact ACL have a symptomatic posterior third LMT
- We began repairing less LMTs by leaving the posterior third tears in situ
- Then we followed the patients' results

Lateral Meniscus Tears

- 1146 ACL reconstructions between 1982 and 1991
- 598 LMTs identified
 - 256 Partial excision
 - 135 Meniscus repairs
 - 207 left in situ
- Results – None of the patients had a subsequent removal of LMT

FitzGibbons and Shelbourne, AJSM 1995

Lateral Meniscus Tears: Leave Alone Tears

- Isolated LMT left alone, no MMT or CM
 - PHA LMT (70)
 - Radial flap tears (50)
 - Peripheral post tears (212)
- Mean 7 years f/u
- 96% had IKDC objective rating of normal or nearly normal
- Of 332 tears, only 8 required subsequent surgery (2.4%)

Shelbourne KD, Heinrich J. Arthroscopy 2004

Lateral Meniscus Tears: Treatment and Failure Rates

Treatment	82-85 (n=228)	86-92 (n=1197)	93-09 (n=3898)
Removal %	63	32	27
Leave (failure) %	32 (0)	36 (4)	44 (3)
Suture (failure) %	5 (0)	24 (10)	3 (12)
Trephine (failure) %	0	8 (4)	26 (4)

Lateral Meniscus Tears Left Alone: Conclusions

- Most LMTs seen at ACL reconstruction are asymptomatic and can remain left in situ
- Vertical tears posterior to the popliteus tendon do not become unstable bucket-handle tears if left in situ

Meniscus Tears with ACL Reconstruction

- When meniscus repair techniques were developed, I started performing more meniscus repairs
- Did not know what the success rate would be

Meniscus Tears with ACL Reconstruction

- Complication developed
- In chronic ACL injuries where patients had a locked bucket-handle tear with bad extension going into surgery, I had an increase in rate of arthrofibrosis with combined ACL reconstruction and repair

Meniscus Tears with ACL Reconstruction

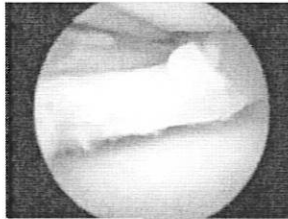
- Began performing staged procedures –
 - Treat locked meniscus
 - Return later, if needed, for ACL reconstruction
- Rationale
 - Did not want to do anything to cause ROM problems
 - Patients with locked meniscus tears sought treatment for the tears; had been dealing with ACL deficiency for awhile

Meniscus Tears with ACL Reconstruction

- Did a scope and performed repair regardless of how bad the meniscus looked
- Knew that I would be back later for ACL reconstruction and could remove the tear at that time if needed
- Rehabilitation was not restricted
 - Full ROM and weightbearing was encouraged

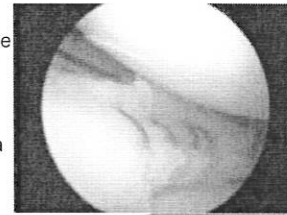
Bucket-Handle Medial Meniscus Repair

- Used a rasp and multiple needle sticks to stimulate bleeding
- Left the posterior section in situ because we know these tears can heal



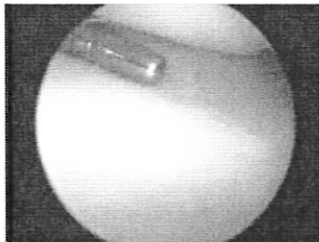
Bucket-Handle Medial Meniscus Repair

- Began using 4-6 sutures in the anterior half of the meniscus
- Basically converted an unstable tear to a stable tear



6 Weeks after Repair

- Follow-up at the time of ACL reconstruction



Meniscus Tears with ACL Reconstruction

- What I learned by doing 2-stage meniscus repair and ACL reconstruction
 - Could allow weightbearing as tolerated and the meniscus can heal
 - Found the more sutures placed fostered better healing; however, sutures would not be present at 2nd look arthroscopy
 - Determined that placing the needle through the meniscus stimulated healing
 - Believe trephination with many needle sticks is all that is necessary with most types of repairable meniscus tears

Bucket-Handle Meniscus Tears

- Have found that many BH tears, even in the white/white zone, can heal with repair
- Major question – But do they function?

Bucket-Handle Tears- Repair or Remove?

- Does the repaired BH meniscus tear function well enough to provide joint protection?
- Study* compared results of 155 BHMMT
 - 56 repair vs. 99 partial meniscectomy
 - Mean modified Noyes score = 90.8 points for both groups 8 years post-op
 - Repaired group:
 - 30 Non-degenerative tears: 93.9 points
 - 26 Degenerative tears: 87.1** points
 - No difference in radiographic grades between repair and removal groups at a mean of 7 years post-op

*Shelbourne/Carr AJSM 2003** statistically significantly lower

Bucket-Handle Tears- Repair or Remove?

- Post-op surgery:
 - 6 patients had subsequent surgery for MMT
 - Mean time – 3.8 years after ACL reconstruction
 - 5 of 6 tears were degenerative tears at the time of ACL reconstruction

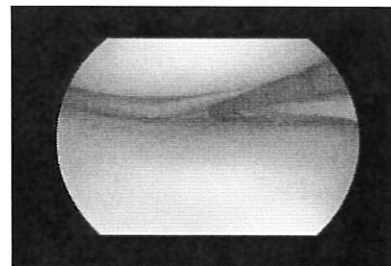
Bucket-Handle Tears- Repair or Remove?

- If purpose of meniscus repair is to save the meniscus and have it function, we have to look at more than just whether the repaired meniscus causes symptoms requiring further surgery
- Need to show that the repaired meniscus functions as a normal meniscus
- Subjective results indicate that repair of degenerative tears do not function as normal
- We now remove degenerative MMTs

Bucket-Handle Tears- Repair or Remove?

- Concluded that repaired degenerative BHMMT may not function normally or provide advantage over partial meniscectomy
- Also, although healing was present at follow-up arthroscopy, many patients returned later because of subsequent meniscus tear
- Now, remove degenerative white/white tears

Bucket-Handle Tears- Repair or Remove?



Bucket-Handle Tears

- Remove degenerative BH tears that can be pulled into the notch

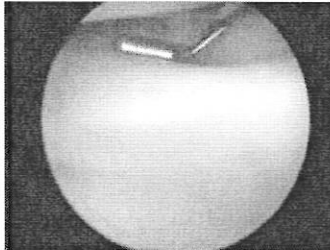


Medial Meniscus Tears

- Other types of medial meniscus tears seen with ACL reconstruction can be treated
 - Trephination
 - Left in situ
 - Suture repair

Peripheral Stable Medial Meniscus Tear

- Common meniscus tear seen with acute ACL injury
- Can easily be missed
- Once recognized, need a treatment plan that works



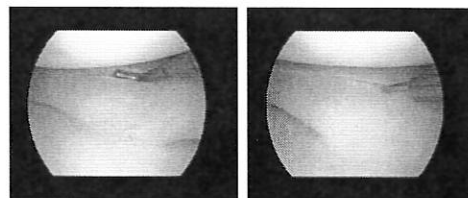
Current Study

- Began treating peripheral nondegenerative MMTs with trephination alone
- Purpose
 - To evaluate outcome of peripheral nondegenerative MMTs, at least 1 cm in length, treated with trephination alone at time of ACL reconstruction
 - Compare to control group of patients without meniscus tears

Methods

- Between 1997-2010, 419 patients met inclusion criteria
 - Peripheral nondegen MMT at least 1 cm length
 - As long as tear could not be displaced with a probe into the notch, it was treated with trephination alone
 - No lateral meniscus tears
 - No arthritic changes on radiographs
 - No revision ACL surgery
 - No bilateral involvement
- Control group, 462 patients same as study group but also had no medial meniscus tears

Peripheral Nondegenerative MMT



Methods

- IKDC Radiographic rating
- IKDC objective testing
- IKDC subjective score
- CKRS subjective score
- Subsequent MMT rate requiring treatment

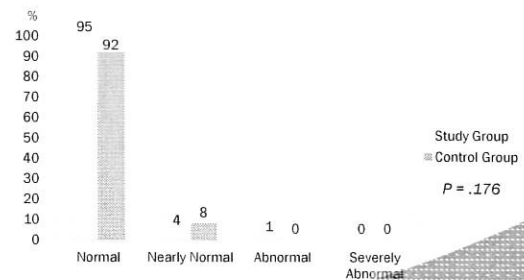
Results

- Minimum 2 yr f/u (range, 2 – 17 years)
- Objective f/u
 - Study group: 191 (46%) at mean 5.6 yrs post-op
 - Control group: 200 (43%) at mean 5.9 yrs post-op
- Subjective f/u
 - Study group: 312 at mean 7.0 yrs post-op
 - Control group: 343 at mean 7.1 yrs post-op

Results: Subjective Surveys

Survey	Study Group Mean ± SD	Control Group Mean ± SD	P-value
IKDC	86.5 ± 15.8	86.7 ± 16.3	.81
CKRS	91.8 ± 13.3	92.3 ± 10.9	.27

Results: IKDC Radiographic Rating



Results: IKDC Objective

Test	Study Group % of patients	Control Group % of patients	P-value
Effusion present	5.8	3.5	.278
Extension < normal	5.8	2.0	.123
Flexion < normal	5.2	3.5	.545
SLH < normal	10.4	6.8	.401
KT-1000 max/max diff (mm)	1.8 ± 1.7	1.7 ± 1.5	.612
Isokinetic quad strength (inv knee/NI knee, %)	94.6 ± 12.6	96.3 ± 12.9	.282

Results

- Subsequent re-tear requiring removal
 - Study group: 16.3%
 - Control group: 5.8%
 - P-value: < .01
 - Mean time of re-tear was 3.6 years (.5 to 16 years)

Discussion

- Although healing rate with BHMMTs was high, we wanted to find out if "healing" allowed patients better outcome
- Seems like we are repairing many menisci that don't need repaired
- Repaired menisci that don't need another surgery is not the only criteria for a good outcome
 - Don't know objective and subjective results until many years later
 - Results need to be compared to results of patients with normal menisci

Discussion

- Results in this study showed no statistically significant difference in subjective scores or objective results between study patients and control group of patients without meniscus tears
- Subsequent tear rate was 16% in study group compared with 6% in control group
- However, subsequent tear rates are similar to other published reports of medial meniscus repair with less follow-up time

Discussion

- Several studies* report healing rates observed by repeat arthroscopy after ACL reconstruction
- "Satisfactory healing" rates 81-87%
- Our healing rate of repaired displaced BHMMTs prior to ACL surgery was 84%

*Morgan (AJSM 1001); Horibe (Arthroscopy 1996); Asahina (Arthroscopy 1996); Kimura (CORR 1995); Tenuta (AJSM 1994)

Discussion

- Paxton et al – systematic review of MM repairs done with ACL reconstruction
- Showed 12% re-operation rate at 4 years post-op and 17.5% rate at 10 years

Discussion

- I used to treat peripheral nondegenerative MMTs with ACL reconstruction with suture repair
- Previously published reoperation rate of 14% (with 5 -10 year f/u)

Discussion

- One might argue – what's the harm in going ahead and adding a repair?
- Can't hurt?
- There are possible complications associated with repair
 - Damage to articular surfaces
 - Repair device left in meniscus causing symptoms

Treatment Decision

- Not doing “something” is difficult for a surgeon
- We are trained to do procedures when a tear is present because treatment has to be better than leaving it alone
- The treatment should make the patient better than leaving the tear alone

Rehabilitation

- Decisions made for rehabilitation are critical to outcome
- Many programs limit ROM and weight bearing because of fear that the repair will not heal
- Our data show that almost all tears can heal with allowing full ROM and weightbearing

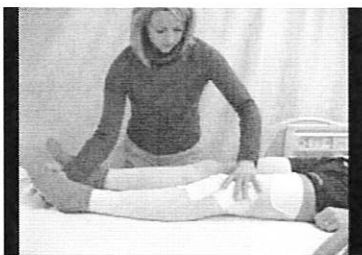
Rehabilitation

- Limitations in ROM and weightbearing are detrimental
 - Limited WB makes the patient hold the knee in bent position
 - Causes ROM problems
- Why is ROM loss important?

Rehabilitation

- Long-term outcome of ACL reconstruction shows that ROM loss causes more symptoms and increases rate of OA
- ROM is compared to the opposite normal to include hyperextension

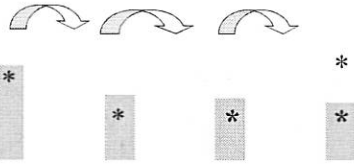
Assessing ROM Passive Extension



Importance of Symmetrical ROM

- Evaluated our long-term outcomes with ROM as one of the variables
- IKDC defines normal ROM to be:
 - Within 2° of extension - to include hyperextension
 - Within 5° of flexion
- ROM loss was most important factor affecting subjective and objective results
- Difference between patients with and without normal ROM was eye-opening!

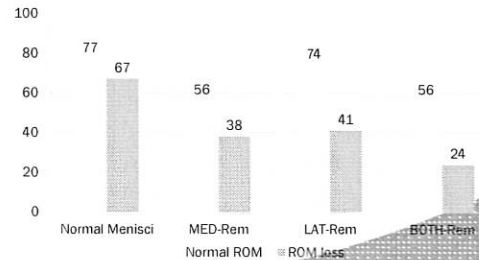
Subjective Scores at 10-20 yr f/u: ROM and Meniscal Status



*Statistically significant lower

Shelbourne KD, Gray T. AJSM 2009

ROM and Radiographs: % of patients with normal radiographs



Rehabilitation Matters!

- Regardless of whether you repair or remove meniscus-
 - You need to ensure patient regains full ROM, especially extension
 - Need to maintain full ROM for rest of their lives

Rehabilitation Matters!

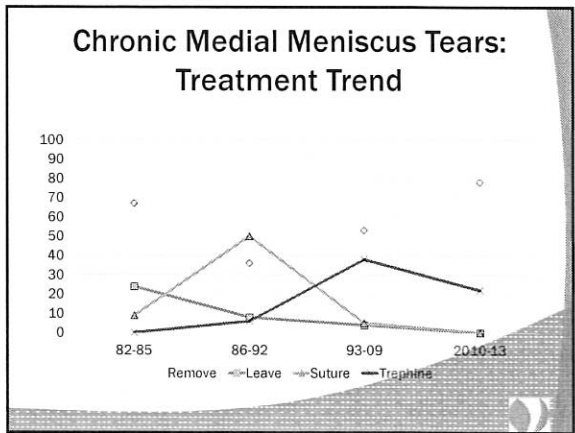
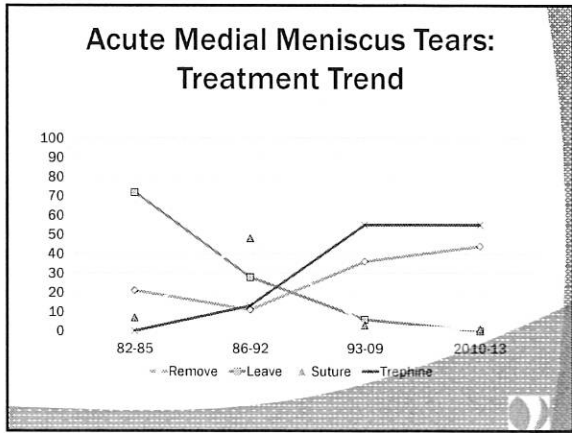
- Widely established that meniscectomy and articular cartilage damage causes more OA in the long-term after ACL
- We found that ROM loss was equally as devastating to the long-term results
- WE have more control over ROM
- Whatever you do, obtain full extension (including hyperextension) and flexion

Rehabilitation Matters!

- Want the knee to feel stable on exam - but many times, it is because knee is stiff and lacks ROM
- Our patients man/max KT1000 average - 1.8 mm
 - 0-3 mm = 92%
 - 4-5 mm = 7%
 - >5 = 1%
 - Patients don't have a negative KT value
- Would rather have a knee that has some play in it with full ROM than a stiff knee
- Stiff knee will cause OA in the long-term

Rehabilitation Matters!

- Do not restrict ROM or WB
- WB promotes healing
- It pushes the meniscus toward the capsule
- It isn't the sutures that matter with repair
- It is the needle going through the meniscus into the capsule that creates the blood channel for healing
- Trephination with WB can be enough for healing



- ### Conclusions: LMTs
- LMTs and MMTs are different
 - Most LMTs can be left in situ
 - The only LMTs I repair now are displaceable vertical peripheral tears that extend anterior to the popliteus
 - I repair only the middle third of the LMT
 - If in doubt with a LMT – leave it alone

- ### Conclusions: MMTs
- Although degenerative BH meniscus tears can heal with repair, re-tear rate is high and they do not function normally
 - Posterior half nondisplaceable peripheral nondegenerative vertical MMTs can be trephined
 - The posterior portion of a non-degenerative bucket handle MMT can be trephined
 - The middle third should be stabilized with sutures

- ### Conclusions
- Rehabilitation
 - Allow full WB as tolerated
 - Emphasize full ROM
 - Patients that do not regain full ROM will have an increased chance of developing OA in the long-term
 - Repair success rate will be just as good (if not better) with unrestricted rehabilitation