Εμβιομηχανικά Δεδομένα και Κλινικά Αποτελέσματα από τη χρήση του Buttonhole Soffix

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ACL Tear : A Silent Epidemic

ACL Tear Incidence (USA)
30/100,000/year = 75,000/year

ACL Reconstructions (USA)
105,000/year

Success Rate 85%
15,000 failures/year
Graft Options

- **Autograft** — BPTB, QHT, Quadriceps
- **Allograft** — BPTB, Achilles Tendon
- **Xenograft** — Bovine
- **Synthetic Grafts** — Prosthetic Ligament, Ligament Augmentation Device, Scaffold
- **Tissue Engineering** — Future of ACL reconstruction
Hamstrings vs BPTB

✓ 7 prospective studies comparing BPTB and QHT grafts

✓ 4 have found similar laxity values and functional results between the two types of graft tissues

✓ 3 found statistically tighter instrument measured values with the BPTB graft that did not correlate with functional outcome
Buttonhole Soffix

1 2 3

4 5 6
Forces on the Cruciate Ligaments During Activities of Daily Living

<table>
<thead>
<tr>
<th>Activities</th>
<th>ACL (N)</th>
<th>PCL (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level walking</td>
<td>169</td>
<td>352</td>
</tr>
<tr>
<td>Ascending stairs</td>
<td>67</td>
<td>641</td>
</tr>
<tr>
<td>Descending stairs</td>
<td>445</td>
<td>262</td>
</tr>
<tr>
<td>Descending ramp</td>
<td>93</td>
<td>449</td>
</tr>
<tr>
<td>Ascending ramp</td>
<td>27</td>
<td>1215</td>
</tr>
</tbody>
</table>
Reconstruction of the ACL in a Porcine Knee using a Equine Tendon-Soffix Graft and an Over the Top Route

Mean UTL = 1360 N
Structural Stiffness = 34 N/mm
* Mean UTL of Soffix = 1229 N
* Mean UTL of 4 strand STG-Soffix = 1186 N
Cyclic Loading Results

- No Failures of construct after 3000 cycles
- Mean Elongation after 3000 cycles = 4.9 mm
- Minimal elongation after initial 250 cycles
Buttonhole Soffix: Biomechanical Properties
Polysulphone Bollards
Polysulphone Bollards

A. Amis et al. JBJS, 1987
The Buttonhole Soffix Surgical Technique

- Primary ACL Reconstruction
- Revision ACL Reconstruction
Surgical Technique

1. Hamstring tendon graft harvesting and preparation

1. Tibial Tunnel drilling
Surgical Technique

1. Over the Top Femoral Route

4. Tibial Tunnel Drilling

5. Graft Passage

6. Fixation
Harvesting of Semitendinosus-Gracilis Tendons
The Buttonhole Soffix Surgical Technique
Tibial tunnel drilling
Tibial Tunnel Placement

Moderate impingement
Lateral femoral skin incision to locate the “over the top” route
Posterior capsule penetration and groove fashioning at the “over the top” position
Graft passage
Graft-S offix Complex Preconditioning

1. Pre-implantation Preconditioning
   (300 N Maximum Manual Pulling Force)

2. Intraoperative Preconditioning

3. Fixation under tension
Purpose

1. Evaluate the efficacy of ACL Reconstruction using the BH Soffix Surgical Technique

1. Present the Midterm Results
Study Population

127 patients operated between 1998-2002

112 (88.1%) assessed

103 men (92%)

9 (8%) women

Mean age at operation 26±7 years (19-46 years)
Methods

✓ Prospective Study
✓ No Control Group (Level IV)
✓ Chronic ACL injuries
✓ Unilateral Hamstring ACL reconstruction using the BH Soffix
Mechanism of Injury

- Contact: 33.9%
- Noncontact: 66.1%
Mechanism of Injury

- Sports: 63
- Work: 21
- RTA: 16
- Fall: 7
- Other: 5
Episodes of giving way
Surgical Technique

- Quadrupled Hamstring Tendon Autograft
- Buttonhole Soffix Fixation Device
- Tibial tunnel = graft size
- Over-the-Top Femoral Fixation
Rehabilitation

- Brace Wearing in Full Extension for 1 week
- Early Full Weight Bearing
- Closed Chain Exercises for 3 months
- Jogging > 4 months
- Return to full activity, cutting & contact sports after 1 year
Graft Position

Tibia
48 ± 3%

Harner, 1994
Postoperative Knee Radiograph

67 degrees

78 degrees
• One deep infection (washout and graft preservation)

• No neurovascular complications

• No graft fixation failure (bollard or loop)
9 patients underwent arthroscopic evaluation due to secondary meniscal injuries.

The graft failed in 8 patients due to:

- a new injury (4 cases)
- graft loosening (2 cases)
- biological failure (2 cases)
Tibial site bollard prominence
✓ No significant tunnel expansion

✓ Mean Increase in Tunnel Cross Sectional Area = 33%
Accompanying Injuries: Menisci

- Medial Meniscus: 45 (35.4%)
- Lateral Meniscus: 33 (25.9%)
- Both Menisci: 11 (8.6%)
## Accompanying Injuries: Cartilage

<table>
<thead>
<tr>
<th>Injury</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFC</td>
<td>34</td>
<td>(26.7%)</td>
</tr>
<tr>
<td>LFC</td>
<td>19</td>
<td>(14.9%)</td>
</tr>
<tr>
<td>Both FC</td>
<td>8</td>
<td>(6.2%)</td>
</tr>
<tr>
<td>Patella</td>
<td>52</td>
<td>(40.9%)</td>
</tr>
</tbody>
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Articular Cartilage Injuries of the Femoral Condyles (after Outerbridge)
Outcome Assessment

- Independent Examiner in a dedicated Research Clinic
- History & Physical Examination
- KT-2000 arthrometric SSD
- IKDC Score
- Lysholm Score
- Tegner Activity Scale
Results

✓ Time from injury to reconstruction was 26±7 months (9-62 months)

✓ Follow up for 3-5 years (mean 47±11 months)
Subjective Satisfaction

Most patients (106, 94.6%) would have had the same operation again if it were necessary.

The 10-point VAS score was 8.4 (range, 4-10; SD, 1.2)
Range of Knee Motion

- Loss of flexion $>10$  3 patients
- Loss of extension $>5$  1 patient
Tegner Activity Score

- Pre-Injury: 7.10
- Pre-OP: 4.90
- Post-OP: 6.80
The KT-2000 SSD measurement improved from 8.56±2.3 mm (range 5.3-12.1) preoperatively to 1.7±0.9 mm (range -1.4-5.3) postoperatively.
The SSD on maximum manual testing was

- <3 mm in 95 patients (84.8%)
- 3-5 mm in 14 patients (12.5%)
- > 5 mm in 3 patients (2.7%)
Most patients had less than 3 mm SSD at the last follow-up.
The pivot shift test was regarded as:

- **normal** in 85 patients (76%)
- **glide** (+) in 23 (20.5%)
- **clunk** (+++) in 3 (2.6%)
- **gross** (++++) in 1 (0.9%)
Pivot Shift

- NORMAL: 85
- GLIDE: 23
- CLUNK: 3
- GROSS: 1
Donor Site Morbidity

✓ 4 patients complained of anterior knee pain, but kneeling was restricted in just 2

✓ Kneeling pain 12 patients

✓ No local tenderness

✓ Harvest site morbidity

  7 patients nearly normal and 105 normal

✓ 2 cases of temporary saphenous neuralgia
Second look arthroscopy 4 years after the index operation.
* BH Soffix is an effective means of ACL Reconstruction
* The technique provides excellent stability and good functional results
ACL BH Soffix Reconstruction

- Low complication rate
- Most patients were IKDC A and B
The success of ACL reconstruction depends on:

1. Patient choice
2. Chronicity of the injury
3. Graft type
4. Graft fixation
5. Surgical Technique
6. Accompanying injuries
Discussion

High incidence of secondary injuries may lead to secondary osteoarthritis and pain compromising the results of the reconstruction.
Over the Top Route
The OTT route is recommended

- in ACL revision surgery
  (when the posterior femoral wall is deficient)
- in children with open physes and
- in double bundle ACL reconstructions

Nevertheless, almost all arthroscopic techniques using a femoral tunnel reference the OTT site.
An in vitro comparison of over-the-top and femoral tunnel through-the-condyle ACL reconstructions failed to show any statistical differences in the joint kinematics when either reconstruction was compared.

A main advantage of the OTT technique is that it is highly reproducible and does not rely on locating an ‘isometric’ point.

The cruciate ligaments are not isometric and the isometric patterns of their fibres vary.
In all published clinical studies the OTT femoral route provided at least equal results with other surgical techniques.


Comparison of our study with other published series

The major finding is the similarity in the final outcome between our study and most published series using both a hamstring and BPTB autograft.
Summary and Conclusions

The Soffix Technique for ACL reconstruction:

- Is a reproducible technique with over the top routing
- Quick learning curve
- Dedicated instrumentation allows impingement free siting
- Soffix and frame facilitates construction of hamstring graft and allows good fixation
- High initial UTL with biomechanical testing
- Good results for primary and revision reconstruction
Thank You