Association between bone tunnel enlargement and posterior knee laxity after posterior cruciate ligament reconstruction

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I have no financial conflicts to disclose.
Introduction

Posterior Cruciate Ligament (PCL) Injuries

The indication of operative treatment increased recently because of the advances of surgical technique.

Transtibial technique

most commonly used reconstruction method

the clinical outcome of this reconstructive procedure is??

Enlargement of bone tunnel??

Purpose

Analysis of the relationship between bone tunnel enlargement after PCL reconstruction and posterior knee stability.

Patients & Method

Patient:
PCL reconstruction at our department
single bundle
remnant preservation
using autogenous semitendinosus and gracilis tendons

20 knees
Sex: Male 17, female 3
Mean age: 38
Period: November 2011 — March 2016
Operative Procedure

Graft: Semitendinosus and gracilis tendons
Portal: Anterolateral portal + Anteromedial portal
⇒ Posteromedial portal was created using a guide system

A femoral bone tunnel:
distal portion of the femoral attachment of anterolateral bundle.
Operative Procedure

A tibial bone tunnel
Director PCL tibial Aimer
at 60° of guide angle.

After the graft passed the tunnel, one EndoButton was flipped outside of the femur and the other was fixed with double spike staples at the tibia in anterior drawer.

Measurement procedure

The cross sectional area of bone tunnels was evaluated using CT imaging 5mm inside from the bone tunnel opening.

**Timing**
- at early postoperative period: less than one month after surgery
- at middle period: around one year after surgery

The posterior laxity
- the radiographic gravity sag view
- posterior stress radiography
- the Kneelax-3 at one year after surgery.

**Clinical outcome**: Lysholm score
### Result

The cross-sectional area
- **femoral bone tunnel**: significantly expanded
- **tibial bone tunnel**: no significant difference

<table>
<thead>
<tr>
<th>Bone Tunnel</th>
<th>Postoperative Period</th>
<th>Early (mm²)</th>
<th>Middle (mm²)</th>
<th>Enlargement Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femoral</td>
<td></td>
<td>78.5</td>
<td>94.5</td>
<td>20.66 ± 8.8</td>
</tr>
<tr>
<td>Tibial</td>
<td></td>
<td>99.9</td>
<td>107.4</td>
<td>10.79 ± 5.2</td>
</tr>
</tbody>
</table>

P < 0.05

The graph shows the cross-sectional area of the bone tunnel over the postoperative period (early vs. middle). The femoral bone tunnel shows a significantly expanded area compared to the tibial bone tunnel, which shows no significant difference.

*Significant difference.*
degree of the expansion of the bone tunnel posterior knee instability.

no significant relationship
Result

<table>
<thead>
<tr>
<th></th>
<th>Pre operation</th>
<th>Post operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysholm score</td>
<td>73.7</td>
<td>91.5</td>
</tr>
</tbody>
</table>

degree of the expansion of the bone tunnel Lysholm score

no significant relationship

$r = -0.101$

$P = 0.72$
Discussion

- The overall mean tunnel difference between 1 week postoperatively and the final follow-up was 12.0% for the femoral tunnel and 10.6% for the tibial tunnel.
  (Jae Ho Kwon M.D., Arthroscopy, 2014)

- In the case that bone tunnel expansion is seen in X-rays, backward instability increases.

- Bone tunnel expansion in the X-rays image is an osteoplasty process and not accompanied by the real volume expansion

骨隧道擴張 ≠ 向後不穩定性
Discussion

The residual laxity after PCL reconstruction

**Killer turn** is agreed as the main course

(Yasumitsu Ohkoshi M.D., Ph.D., Shinya Nagasaki M.D et al. Ar

**BUT...**

In this study, bone tunnel enlargement was not found on the tibial side, but found on the femoral side.

**an increased signal intensity at the femoral side.**

**the true killer turn in PCL reconstruction is located at the femoral tunnel entrance**

(Fujimoto E et al. Orthop Traumatol Surg Res. 2014)

**IN ADDITION**

The remnants might have beneficial effects on maturation at the proximal and middle zones
Conclusions

bone tunnel enlargement was confirmed on the femoral side after PCL reconstruction.

The bone tunnel enlargement was not associated with the posterior knee laxity.

References

Tunnel Volume Enlargement After Posterior Cruciate Ligament Reconstruction: Comparison of Achilles Allograft With Mixed Autograft/Allograft—A Prospective Computed Tomography Study (Jae Ho Kwon M.D., Arthroscopy, 2014)


Serial magnetic resonance imaging study of posterior cruciate ligament reconstruction or augmentation using hamstring tendons (Fujimoto E et al. Orthop Traumatol Surg Res. 2014)