ACL reconstruction using the ST4-TLS technique: what is the impact of interference screw type on clinical outcomes?
Comparative prospective study in 521 patients

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Conflicts of Interest statement

- Nicolas Lefevre : consultant Websurvey

- S Klouche: consultant FH-Orthopedics

- E Lefevre, Y Bohu, A Gerometta, S Herman and R Chevallier: none

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Introduction - Technique

• France: about 45,000 ACL reconstruction in 2016 (www.scansante.fr)
• USA: 250,000 per year (Kim, JBJS 2011)
• 4 bundles = short graft
• ST4 technique: 1 hamstring tendon semitendinosus
  › Less morbidity and loss of strength
  › Preserve the gracilis tendon
• TLS (Tape Locking Screw), FH
  › Small diameter (4.5mm) bone tunnels made by outside-in aiming on the tibia and femur
  › Anchoring tape
  › Dedicated interference screw
Problematic

• Interference screw:
  › titanium (A),
  › PEEK(B)
  › or bioabsorbable (C)

• Advantage/disadvantage of the different screws

<table>
<thead>
<tr>
<th></th>
<th>Titanium</th>
<th>PEEK</th>
<th>Bioabsorbable</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>No fracture</td>
<td>Artfact</td>
<td>Inert</td>
<td>Screw fracture</td>
</tr>
<tr>
<td>Inert</td>
<td>Difficult ablation</td>
<td>Strong fixation</td>
<td>Allergy</td>
</tr>
<tr>
<td>Durable fixation</td>
<td>Metallosion</td>
<td>?</td>
<td>Costly</td>
</tr>
<tr>
<td>Low cost</td>
<td>Infection?</td>
<td></td>
<td>Osteolysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cyst</td>
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</tbody>
</table>

• Which screw to use? Need clinical arguments to guide the surgeon in his choice
• To assess the impact of the 3 types of screws (Ti, PEEK, bioabsorbable) on clinical outcomes at 2-year minimum follow-up
  › Efficacy, safety
• Comparative study, retrospective analysis of data collected prospectively (French prospective Acl STudy or FAST cohort)
  › NCT02511158
• Non inferiority study
• Inclusion criteria: continuous series of patients, aged over 15.5, operated in 2012-2015 for primary ACL reconstruction, using the DT4-TLS technique.
• Exclusion criteria: associated rupture of the posterior cruciate ligament and patient refusal
Surgical technique

1, 2: Harvesting of the ST
3: 4 bundles, fixation of the tapes, traction
4: outside-to-inside femoral targeting
5: outside-to-inside tibial targeting
6: drilling the tunnels
7: retrograde reaming of the cavities
8: passing the graft and tapes
9: fixing the graft by crews
Design and methodology (2)

• 3 groups according to the type of screw
  › Titanium
  › PEEK
  › or bioabsorbable

• Primary endpoint: the occurrence of an adverse event during the first 2 years
  › hematoma, haemarthrosis, septic arthritis, phlebitis, cyclops syndrome, algodystrophy and re-rupture

• Secondary criteria
  › return to sport, functional scores (IKDC, KOOS, ACL-RSI) at 2-year FU

• Statistical analysis
  › Number of subjects required for a non-inferiority study: 36/group
  › ANOVA, Khi2, Mc Nemar tests
Results: Number and description of patients

Primary reconstruction by ST4-TLS
N=521

- TITANE
  n₁=229 (44%)
- BIOABSORBABLE
  n₂=222 (42.6%)
- PEEK
  n₃=70 (13.4%)

- Ratio M / F : 344 men / 177 women
- Mean age : 30.1 ± 9.3 years
- 507 athletes (97.3%) whom 205 (39.4%) competitors
- No significant difference between groups at inclusion (age, sex, functional scores, level of sport practice)
### Results: data at inclusion and peroperatively

<table>
<thead>
<tr>
<th></th>
<th>Ti (N=229)</th>
<th>Bioabsorbable (N=222)</th>
<th>PEEK (N=70)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>30.7±9.1</td>
<td>29.2±9.2</td>
<td>30.6±10.1</td>
<td>0.17</td>
</tr>
<tr>
<td><strong>Sexe</strong></td>
<td>M 156/ F 73</td>
<td>M 145/ F 77</td>
<td>M 43/ F 27</td>
<td>0.56</td>
</tr>
<tr>
<td><strong>IKDC subjective</strong></td>
<td>55.5±18.5</td>
<td>59.3±17.3</td>
<td>58.6±17.7</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Extra-articular tenodesis</strong></td>
<td>15 (6.5%)</td>
<td>28 (12.6%)</td>
<td>17 (24.3%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Chondropathy</strong></td>
<td>71 (31%)</td>
<td>49 (22.1%)</td>
<td>15 (21.4%)</td>
<td>0.06</td>
</tr>
<tr>
<td><strong>Medial meniscal lesion</strong></td>
<td>83 (36.2%)</td>
<td>77 (34.7%)</td>
<td>25 (35.7%)</td>
<td>0.93</td>
</tr>
<tr>
<td><strong>Lateral meniscal lesion</strong></td>
<td>80 (34.9%)</td>
<td>75 (33.8%)</td>
<td>21 (30%)</td>
<td>0.73</td>
</tr>
<tr>
<td><strong>Graft length (mm)</strong></td>
<td>52.7±7.1</td>
<td>52.9±4.2</td>
<td>53.2±3.8</td>
<td>0.81</td>
</tr>
<tr>
<td><strong>Graft diameter (mm)</strong></td>
<td>8±0.7</td>
<td>8±0.7</td>
<td>8.1±0.8</td>
<td>0.85</td>
</tr>
</tbody>
</table>
Results: adverse events – return to sport 2y

- No statistically significant difference between groups on the occurrence of adverse events (p=0.85)
- Including re-ruptures (p=0.96),
- 1 patient presented an intra-osseous tibial cyst with a bioabsorbable screw.

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<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athletes who responded</td>
<td>171</td>
<td>175</td>
<td>52</td>
<td>--</td>
</tr>
<tr>
<td>Return to race</td>
<td>128 (74.9%)</td>
<td>123 (70.3%)</td>
<td>40 (76.9%)</td>
<td>0.44</td>
</tr>
<tr>
<td>Usual sport</td>
<td>102 (59.6%)</td>
<td>99 (56.6%)</td>
<td>23 (44.2%)</td>
<td>0.15</td>
</tr>
</tbody>
</table>
## Functional scores at 2-year FU

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<th>p</th>
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<tbody>
<tr>
<td>Subjective IKDC</td>
<td>83.4±15.4</td>
<td>85.4±12.8</td>
<td>84.3±12.5</td>
<td>0.03</td>
</tr>
<tr>
<td>KOOS symptoms</td>
<td>84.7±14</td>
<td>86.6±12</td>
<td>87.9±12.3</td>
<td>0.19</td>
</tr>
<tr>
<td>KOOS pain</td>
<td>90.8±11.6</td>
<td>92.5±8.7</td>
<td>92.4±7.8</td>
<td>0.0001</td>
</tr>
<tr>
<td>KOOS daily living</td>
<td>95.8±7.7</td>
<td>96.7±7.6</td>
<td>97.7±5.3</td>
<td>0.21</td>
</tr>
<tr>
<td>KOOS sport</td>
<td>81.2±20.9</td>
<td>82.2±19.8</td>
<td>82.3±20.2</td>
<td>0.86</td>
</tr>
<tr>
<td>KOOS QoL</td>
<td>74.2±24.3</td>
<td>75.1±23.1</td>
<td>73.1±20.7</td>
<td>0.84</td>
</tr>
<tr>
<td>ACL-RSI</td>
<td>66.5±25.8</td>
<td>65.6±24.2</td>
<td>65.1±24.7</td>
<td>0.91</td>
</tr>
</tbody>
</table>
Conclusion

In this prospective comparative study, after the reconstruction of an isolated ACL tear according to the DT4-TLS technique, the type of interference screw has no impact on the occurrence of adverse events and clinical outcomes at 2 years of follow-up.
References


6. Chevallier R et al. Bioabsorbable screws, whatever the composition, can result in symptomatic intra-osseous tibial tunnel cysts after ACL reconstruction. KSSTA. 2019 Jan;27(1):76-85.