Effects of Autologous Adipose-Derived Regenerative Cells in the Healing and Function of Anterior Cruciate Ligament Reconstruction

ISAKOS 2019
Cancun, Mexico, May 12-16th 2019

Eduard Alentorn-Geli\textsuperscript{1-3}, Roberto Seijas-Vázquez\textsuperscript{1,2,4}, Xavier Cuscó\textsuperscript{1,2}, Gilbert Steinbacher\textsuperscript{1-3}, Pedro Álvarez-Díaz\textsuperscript{1,3,4}, David Barastegui\textsuperscript{1-3}, Jordi Català\textsuperscript{1}, Jordi Navarro\textsuperscript{1,2}, Patricia Laiz\textsuperscript{1,2}, Montserrat García-Balletbó\textsuperscript{1,2}, Ramón Cugat\textsuperscript{1-3}

\textsuperscript{1} Fundación García-Cugat, Barcelona, Spain; \textsuperscript{2} Artroscopia GC, Barcelona, Spain; \textsuperscript{3} Mutualitat Catalana de Futbolistas, Barcelona, Spain; \textsuperscript{4} Universidad Internacional de Cataluña, Sant Cugat del Vallès, Spain.
CONFLICT OF INTEREST

Eduard Alentorn-Geli, Roberto Seijas-Vázquez, Xavier Cuscó, Gilbert Steinbacher, Pedro Álvarez-Díaz, David Barastegui, Jordi Català, Jordi Navarro, Patricia Laiz, Montserrat García-Balletbó, Ramón Cugat have no financial conflicts to disclose
To compare the healing and clinical outcomes of anterior cruciate ligament (ACL) reconstruction between patients with or without intraoperative administration of adipose-derived regenerative stem cells (ADRC).
METHODS
Procedures

• Between June 2013 and June 2014, 20 soccer players undergoing ACL reconstruction received additional ADRC intra-operative administration (experimental group)
• Inclusion criteria:
  • Aged 18 years old or older
  • Primary ACL tear and reconstruction
  • Consented to participate in the study
• Healing and clinical outcomes after ACL reconstruction of the experimental group were compared to a historical cohort of 19 soccer players undergoing ACL reconstruction alone.
### METHODS
#### Patients

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>EXPERIMENTAL GROUP</th>
<th>CONTROL GROUP</th>
<th>P-VALUE</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td>24.7 (4.7)</td>
<td>31.1 (8.4)</td>
<td>0.005</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>77.9 (10.5)</td>
<td>78.6 (11.8)</td>
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<td>Height (m)</td>
<td>1.7 (0.07)</td>
<td>1.7 (0.06)</td>
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<tr>
<td>BMI</td>
<td>24.7 (3)</td>
<td>25.6 (3.9)</td>
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<tr>
<td>Tegner Activity Scale</td>
<td>9 (9-10)</td>
<td>7 (4-8)</td>
<td>&lt;0.001</td>
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</tbody>
</table>
The ADRC extraction, preparation and administration protocol was used following Celution® System (Cytori Therapeutics, San Diego, USA).

Liposuction was performed in the abdomen and inner thigh to obtain a sample of 360ml of fat.

A final preparation of 5ml of ADRC was obtained and infiltrated within the ACL graft under direct dry-arthroscopy visualization.
METHODS

Outcomes

- Visual Analogue Scale for pain: obtained at 2, 4, 6, and 12 months after surgery.
- Lequeste Index, Tegner activity scale, IKDC subjective evaluation form: obtained at baseline, 6 and 12 months after surgery.
- MRI obtained at 2, 4, 6, and 12 months to evaluate remodeling of the ACL graft.
## RESULTS
Clinical outcomes

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>ADRC</th>
<th>CONTROL</th>
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<tbody>
<tr>
<td>IKDC</td>
<td>93</td>
<td>84</td>
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<tr>
<td>LYSHOLM</td>
<td>95</td>
<td>93</td>
<td>0.5</td>
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<tr>
<td>LEQUESNE</td>
<td>0.4</td>
<td>0.9</td>
<td>0.3</td>
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<tr>
<td>VAS</td>
<td>0.2</td>
<td>0.6</td>
<td>0.3</td>
</tr>
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</table>

At 12 months
# RESULTS  
Clinical outcomes

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>ADRC</th>
<th>CONTROL</th>
<th>P-VALUE</th>
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<tbody>
<tr>
<td>IKDC</td>
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<td>0.03</td>
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<tr>
<td>LYSHOLM</td>
<td>28</td>
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<tr>
<td>LEQUESNE</td>
<td>5.6</td>
<td>4.5</td>
<td>0.4</td>
</tr>
<tr>
<td>VAS</td>
<td>1.4</td>
<td>1.6</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Pre-Post difference
RESULTS
MRI

• MRI improved across time in all patients.
• Both groups significantly improved graft remodelling at 12 months compared to 2 months after surgery, but there were no significant between-group differences in this improvement.
DISCUSSION

• Animal studies have demonstrated that the use of ADRC in ACL reconstruction provides early graft healing and better biomechanical outcomes compared to the control group, but these improvements are no longer maintained over time in sheep and rabbits (1-3).

• In humans, the use of bone marrow-derived stem cells applied at the graft and tendon-to-bone interphase after ACL reconstruction using hamstring tendons autograft demonstrated no significant differences in MRI-based healing evaluation nor in vascularity, cellular and collagen content on histological examination (4).
CONCLUSIONS

Overall, the addition of ADRC at ACL reconstruction does not provide a significant benefit on pain scores, knee function, activity level, and MRI-based graft maturation compared to ACL reconstruction alone.

