Background

- Anterior cruciate ligament (ACL) injuries are one of the most common knee injuries in female soccer players that require reconstruction and rehabilitation.¹
- The incidence rate of autogenous ACL reconstruction (ACLR) complications during surgery are reported as low as 0.2% to 1.7%.²,³
- There is insufficient information on the most effective rehabilitation protocol for patients with complications during surgery.
- Many rehabilitation protocols fail to include programs for patients who have general joint laxity.
- No known studies have reported on the most effective treatment for a patient with generalized laxity and an autograft rupture during surgery.

Patient Description

- The patient was a 25-year-old female soccer player referred to outpatient PT by her orthopedic surgeon following a left ACLR.
- A bone-patella tendon-bone autograft, which was harvested successfully, tore in the mid portion while under tension during the operation and had to be repaired during the surgery.
- The graft was removed and repaired by the placement of a Krackow stitch (Figure 1) using a #2 FiberWire (Arthrex Inc, Naples, FL) starting at the distal end of the graft tissue, up and over the proximal end, and then down the opposite side to the distal end.⁴
- Due to this rare complication a slower approach of an ACLR protocol was utilized.
- The patient also presented with generalized knee laxity (Beighton Score: 7/9 suggesting hypermobility).⁵,⁶

Interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Traditional Rehab Protocol</th>
<th>Delayed Rehab Protocol</th>
<th>Rationale for Delayed Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immobilizer Use</td>
<td>Wean from immobilizer after 1 week</td>
<td>Immobilizer 0-45° until week 6</td>
<td>Due to decreased quad control during gait and to protect integrity of the graft</td>
</tr>
<tr>
<td>Increase knee ROM to 0-100°</td>
<td>Start week 2</td>
<td>Start week 3</td>
<td>Decrease tensile forces on repaired graft</td>
</tr>
<tr>
<td>Recumbent Bike</td>
<td>Start week 2</td>
<td>Start week 3</td>
<td>Decrease ROM &lt; 100° to protect the graft</td>
</tr>
<tr>
<td>Lower Extremity Alignment Training During Functional Activities</td>
<td>Start week 2</td>
<td>Start week 2</td>
<td>Knee, foot, hip alignment training due to generalized hypermobility and to decrease stresses on the graft</td>
</tr>
<tr>
<td>Jogging Program</td>
<td>Start week 14</td>
<td>Start week 20</td>
<td>Due to quad control and lower extremity alignment</td>
</tr>
<tr>
<td>Hopping Program</td>
<td>Start week 14 to 16</td>
<td>Expected start week 26</td>
<td>To protect the graft and avoid tensile forces prior to return to sport</td>
</tr>
</tbody>
</table>

Timeline

- Initial Injury: Injury occurred during a women’s soccer league game 3 years and 4 months prior to ACLR
- Subsequent Injuries: Three injuries within 2-3 months during soccer, falling, and a fall while walking her dog
- Initial Evaluation: Knee ROM 140/140, LEFS 80/80, and NPRS 0/10
- ACLR Reconstructive Surgery: Bone-patella tendon-bone autograft rupture during ACLR

- Initial Evaluation: Knee ROM 140/140, LEFS 80/80, and NPRS 0/10
- 4 weeks following surgery: LEFS 47/80 and NPRS 0/10, and left knee ROM 140 degrees
- 10 weeks after surgery: LEFS 61/80, NPRS 0/10, and left knee ROM 140 degrees
- 15 weeks after reconstruction: LEFS 62/80, NPRS 0/10, and left knee ROM 140 degrees

Outcomes

- LEFS (%): 10 weeks after surgery 61/80, 15 weeks after surgery 77/80
- NPRS (0-10/10): Initial Evaluation 4/10, 10 weeks after surgery 6/10, 15 weeks after surgery 7/10

Conclusion

- A graft’s strength following an ACLR may not increase due to a longer protection time post-operatively, however, weaker grafts are more likely to fail and need the prolonged protection phase in order to remodel appropriately.⁷
- A delayed ACLR protocol including therapeutic exercise, balance and proprioceptive exercise, neuromuscular re-education, taping, and manual therapy appeared to have been beneficial in improving outcome measures.
- Further research is necessary to understand the best rehabilitation approach for patients with surgical complications, repaired grafts, and hypermobility.

Acknowledgements

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References

- Rolene Yousefyan, BS, SPT
- University of New England, Doctor of Physical Therapy Program, Portland, Maine

- ¹, ², ³, ⁵, ⁶, ⁷

- Figure 1: ACL reconstruction and repair using the Krackow stitch.
- Figure 2: Recumbent Bike
- Figure 3: Mini-Ball
- Figure 4: Balance Board