Emerging Options for Enhancing Stress Fracture Healing in Athletes

Immobilization and extended rest are often impractical for elite athletes.

Modern strategies can ensure the quickest return to full activity.

High-risk fractures:
- Femoral neck superior cortex
- Patella
- Tibial diaphysis anterior cortex
- Medial malleolus
- Talus
- Tarsal navicular
- Fifth metatarsal proximal metadiaphysis
- Great toe sesamoids

The Kaeding-Miller Classification System

<table>
<thead>
<tr>
<th>Grade</th>
<th>Pain</th>
<th>Radiographic findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>✔</td>
<td>Imaging evidence of stress injury</td>
</tr>
<tr>
<td>II</td>
<td>✔</td>
<td>No fracture line</td>
</tr>
<tr>
<td>III</td>
<td>✔</td>
<td>Nondisplaced fracture line</td>
</tr>
<tr>
<td>IV</td>
<td>✔</td>
<td>Displaced fracture (≥2 mm)</td>
</tr>
<tr>
<td>V</td>
<td>✔</td>
<td>Nonunion</td>
</tr>
</tbody>
</table>

Stress fracture diagnosed and risk-stratified based on history, physical examination, and imaging.

- Optimize biomechanics, mental health, and loading exposures
- Assess nutritional and hormonal status

Nutrition/hormonal status optimized?

No
- Vitamin D supplementation
- Nutrition consultation
- Sex hormone supplementation
- Incomplete healing or recurrence?
  - 1. Concentrated bone marrow aspirate
  - 2. Autologous platelet solutions
  - 3. Injectable bone graft substitutes

Yes
- Consider external simulation

Low-risk sites
- Direct injectable modalities
  - Systemic: Pulsed PTH
  - Topical: 1. Electrical osseous stimulation 2. ESWT

High-risk sites
- Indirect stimulating treatments
- Consider internal fixation with biologic augmentation

Multiple Sites?
- Yes
- No