Arthroscopically Assisted Intra-Articular Corrective Osteotomy For Tibial Plateau Malunion

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Introduction
Tibial plateau fractures comprise only 1% of all fractures.
- It is still challenge to orthopaedic doctors.

Treatment objects for primary Tibial plateau fractures
- Normal joint congruity
- 30° Flexion
- Early ROM
- Avoiding all concurrent lesions

Surgery for Tibial plateau fracture
Conventional Open Reduction and Internal Fixation
- Knee arthroscopy
- Extensive soft tissue dissection
- High complication rate (50%)

Arthroscopic Reduction and Internal Fixation (ARIF)
- Minimal soft tissue dissection
- Precise joint surface reduction
- Concomitant lesion repair
- ACL/PCL/Patellar Tear

Malunion after Tibial plateau fracture
- Malunion may caused by
  - Severe comminution fracture
  - Unstable fixation
  - Inadequate Bone graft
  - Implant failure
  - Infection

Management of Tibial plateau malunion
To achieve good result, surgeon should
- Preserve native Knee joint
- Restore anatomical alignment
- Restore stability
- Restore joint surface congruence

Corrective osteotomy is the choice of treatment
- Difficulties
  - Osteotomy site determination
  - Reduction accuracy
  - Extensive soft tissue dissection

- Avoid total knee arthroplasty
- Young patient
- Long time complications
Hypothesis
Arthroscopic Assisted Corrective Osteotomy (AACO) can treat Tibial plateau fracture malunion
- Easier determined osteotomy site
- Better reduction accuracy
- Less soft tissue dissection
- Avoid radiation exposure (C-arm)

Definition of Malunion
- Angular deformity exceeding 5 degrees (compared to intact Knee)
- Articular surface step-off more than 3 mm
- Tibial condylar widening greater than 5 mm

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<th>2</th>
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<th>4</th>
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<td>4</td>
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Surgical technique
- All patient put in supine position without leg holder
- A pneumatic tourniquet was applied
- Arthroscopic fluid inflow was achieved with gravity
- Prevent swelling and compartment syndrome
- Standard arthroscopic portals were created. The tibial incision was made along the previous wound

Evaluation
- Clinical and radiologic outcomes were scored by the modified Rasmussen Scoring system
- Knee alignment was measured from standing scanogram
- The degree of articular depression was measured from the opposite remaining articular surface

Case Presentation
53 y/o male after TA

Received ORIF Initially
4 months later in our Clinic

Standing Scanogram

Pre-OP 3D CT

Arthroscopic Assisted Corrective Osteotomy

6 months later
RESULTS

Clinical Assessment

- Rasmussen clinical score
  - Before AACO: 20.7 (range: 15 to 24)
  - After AACO: 27.3 (range: 24 to 29) \( (p = 0) \)

- Satisfactory rate

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<thead>
<tr>
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<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
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<tr>
<td>Before AACO</td>
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<td>0</td>
<td>5</td>
</tr>
<tr>
<td>After AACO</td>
<td>0</td>
<td>5</td>
<td>12</td>
<td>11</td>
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- Knee ROM
  - Before AACO: 98 degrees (range: 30 to 135 degrees)
  - After AACO: 133 degrees (range: 120 to 135 degrees) \( (p = 0) \)

Radiologic Assessment

- Joint line depression
  - Before AACO: 13.2 mm (4 to 30 mm)
  - After AACO: 1.4 mm (0 to 4 mm) \( (p = 0) \)

- Rasmussen radiologic score
  - Before AACO: 5 (range: 4 - 7)
  - After AACO: 7.8 (range: 6 - 9) \( (p = 0) \)

- Knee joint alignment (> 5 degrees varus/valgus change from uninjured knee)

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<th>Group</th>
<th>Varus/Valgus</th>
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<td>Before AACO</td>
<td>15.8 degrees (6.3)</td>
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<tr>
<td>After AACO</td>
<td>7 degrees (6-9)</td>
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Associated Injuries

- 11 patients (46%) had associated intra-articular injuries
  - 1 ACL tear
  - 1 PCL tear
  - 2 ACL insertion fractures
  - 5 meniscus injuries (3 medial and 2 lateral meniscus)
  - One patient had a common peroneal nerve injury before AACO

Complications

- No major complication
  - No neurovascular injury due to AACO
  - No infection
  - No DVT

- No patients shifted to total knee arthroplasty at final f/u
  - One patient had wound stitch abscess and treated with oral antibiotics

DISCUSSION
**Tibial plateau fracture malunion**

To perform the corrective osteotomy, knowing the deformed bony structure is essential.

- **3D CT** was highly recommended.
- Difficult to apply the 3D image to real-time operation.
- Some metal artifacts may influence image quality.

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**Benefit of Arthroscopic Assisted Corrective Osteotomy**

- Directly visualize the intra-articular malunion and determine the appropriate osteotomy site.
- Osteotomy can be performed easily and precisely without arthrotomy.
- The malunited fragments can be reduced more accurately.

- To treat intra-articular soft tissue lesions simultaneously.
- Decrease unnecessary radiation exposure.
- Limited intra-operatively C-arm system.

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**Knee arthroplasty for tibial plateau fracture malunion**

- Saleh KJ, JBJS A, 2001
- 15 cases received TKA after failure of ORIF for tibial plateau fracture.
- Function score all Pain improved
- Technique demand
  - High failure rate 33%
  - Infection rate 20%

- Weiss NG, JBJS A, 2003
- 62 patients received TKA after tibial plateau fracture.
- Poor soft tissue condition led to multiple surgeries.
- Reoperation rate 21%
- Infection rate 6.4%

**3D print PSI for osteotomy**

- Patient Specific Instrument
- Designed based on 3D CT
- Improved accuracy of osteotomy.

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**Conclusion**

- AACO provides precise reduction, correct alignment, minimal soft tissue stripping, few complications, and adequate treatment in a single-stage surgery.
- The use of this procedure will allow orthopaedic surgeons to maintain the native knee joint and help young patients to avoid the long-term complications associated with total knee arthroplasty.
- 3D print PSI maybe the next step for corrective osteotomy.
- Concomitant arthroscopic examination is still suggested to check soft tissue injuries.

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**Thanks for attention!**