Clinical Outcomes of Arthroscopic Transmalleolar Fixation using Cortical Bone Pegs Combined with Retrograde Autologous Cancellous Bone Grafting for Chronic Osteochondral Lesion of the Talus

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COI disclosure
Kenji Takahashi

I have no personal or financial interest to declare
The treatment of a primary osteochondral lesion of the talus is a therapeutic challenge.\(^1\)

The advantage of a fixation for OLT is that it facilitates bony healing, restores the natural congruency of the subchondral bone plate, and preserves the hyaline cartilage.\(^2\)

The clinical efficacy of fixation techniques have reported good to excellent functional outcomes.\(^3\),\(^4\)

Both acute and chronic lesions are indicated for fixation and can be considered in the following cases: (1) an intact osteochondral fragment larger than 10 mm in diameter and (2) a bony fragment of at least 3 mm in thickness.\(^5\)

Fixation of a lesion is indicated in a skeletally immature patient when it can be performed without violation of the growth plate and no medial malleolar osteotomy is required.\(^5\)

Chronic lesions may require bone grafting in cases where debridement of sclerotic and poorly vascularized bone tissue yields a bone void not conducive to accepting the osteochondral fragment. Lesions that have minimal defect, no cyst, and bleeding bone do not require bone grafting.\(^5\)
1. Cortical and cancellous bone were harvested from the proximal tibial metaphysis and a few bone pegs in 2.5 mm diameter and 15 - 20 mm length were made from the cortex.

2. Under fluoroscopic device, the 7 mm of bone tunnel was made by retrograde drilling beneath the OLT to perforate the sclerotic margin and autologous cancellous bone transplantation was performed.

3. After that, the 3 mm of bone tunnel was made on the medial malleolus, and the OLT was penetrated using the 2.5 mm of drill and was fixed with the 2 or 3 bone pegs through the transmalleolar bone tunnel.
Postoperative Rehabilitation

<table>
<thead>
<tr>
<th></th>
<th>~1w</th>
<th>~6w</th>
<th>~8w</th>
<th>~10w</th>
<th>~4m</th>
<th>~6m</th>
<th>6m~</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB</td>
<td>WB</td>
<td>NWB</td>
<td>1/3</td>
<td>2/3</td>
<td>FWB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROM ex.</td>
<td>×</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Brace</td>
<td>SLB splint</td>
<td>PTB brace</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Crutches</td>
<td>ADL</td>
<td>Jog</td>
<td>RTP</td>
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</table>

Purpose

- To investigate the clinical outcomes of ATFRB for chronic OLTs retrospectively and examine the appropriate factor of fragment healing for ATFRB.

Material

ATFRB (1 surgeon) / Aug. 2012~Aug. 2017 / FU ≥6m

| 21 feet (21 cases) |

Age(avg.) : 15.2±3.0 y.o. (12-24)    Gender : M11 F10
F/U periods(avg.) : 2y1m (6m-5y11m)  Activity : Basketball, Baseball, Tennis 4/ Badminton 3
Field Athletic, no activity 2 / Soccer, Volleyball 1
Evaluation

- Healing rate (using CT and MRI)
- Return to activity
- Clinical Outcome: AOFAS hindfoot score
- Comparison between healing group (H) and non-healing group (N)
  - Clinical outcome at final evaluation:
    AOFAS score / Self-Administered Foot Evaluation Questionnaire (SAFE-Q)\(^6\)
  - Preoperative OLT: Morphology (using CT): "solitary" or "separated"
    The intensity (in T2W MRI image): "iso-" or "low-"

Preoperative classification CT/MRI(T2W)

- Solitary/iso
- Solitary/low
- Separated/iso
- Healed
- Non-union

Statistical analysis: Fisher exact test, Paired t-test, Student t-test
Results

- **Healed**: 15 feet (71.4%) → RTS 13, no activity 2
- **non-healed**: 6 feet (28.6%) → RTS 4
  
  re-ope (OATS) 1, drop-out 1 (pain was remained)

- **AOFAS hindfoot score**: 79.8 pts → 94.0 pts (p<0.01)

- **Comparison with group H & N**

<table>
<thead>
<tr>
<th></th>
<th>Group H (15)</th>
<th>Group N* (4)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOFAS score</td>
<td>96.7</td>
<td>90.5</td>
<td>0.155</td>
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<tr>
<td>SAFE-Q:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pain</td>
<td>90.9</td>
<td>82.6</td>
<td>0.276</td>
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<tr>
<td>Physical function/ADL</td>
<td>94.6</td>
<td>93.3</td>
<td>0.807</td>
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<tr>
<td>Social function</td>
<td>95.9</td>
<td>97.0</td>
<td>0.850</td>
</tr>
<tr>
<td>General Health</td>
<td>97.6</td>
<td>91.8</td>
<td>0.532</td>
</tr>
<tr>
<td>Shoe-rerated</td>
<td>89.3</td>
<td>96.3</td>
<td>0.441</td>
</tr>
<tr>
<td>Sports</td>
<td>93.1</td>
<td>85.5</td>
<td>0.406</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Group H (15)</th>
<th>Group N (6)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphology (CT):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solitary (17)</td>
<td>14</td>
<td>3</td>
<td>0.053</td>
</tr>
<tr>
<td>Separated (4)</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Intensity (T2W MRI):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso (12)</td>
<td>12</td>
<td>0</td>
<td>0.002</td>
</tr>
<tr>
<td>Low (9)</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

- All OLT with iso intensity healed. The 3 of 9 OLT with low intensity healed as well.

(* Two failure cases were excluded in clinical outcome evaluation)

→ Clinical outcome was not significant difference between both groups.
Case presentation

**Case 1** ″Solitary/iso″
15yo M, Baseball

The isorated fragment with iso intensity of T2W

**Case 2** ″Separated/iso″
13yo F, Badminton

Separated and atrophic bony fragment with iso intensity of T2W

Healed!
Case presentation

Case 3: "Solitary/low" 14yo M Basketball
The isolated fragment with low intensity of T2W became into the iso. Healed!

Case 4: "Solitary/low" 14yo F Tennis
Non-union Healed!

T2W pre post4m post6m post7m post1Y post2Y
Discussion

[The healing rate of fixation for OLT]

▶ Fixation with bone pegs after malleolar osteotomy:
  24/27 (88.9%) by X-ray evaluation (Kumai T, JBJS-Br2002)\(^3\)

▶ Arthroscopic lift, drill, fill and fix procedure with an absorbable bio-compression screw(s) (LDFF):
  9/14 (64.3%) by CT evaluation (Reilingh ML, KSSTA 2018)\(^4\)

▶ ATFRB (In our study):
  15/21 (71.4%) by CT evaluation → Clinical outcome was satisfied in 19/21 (90.5%)

[Predictive factor of healing after the fixation of OLT]

▶ No report is found.

▶ In our study after ATFRB ...
  ➢ The iso intensity of T2W in preoperative MRI (p<0.01)
    ✓ Isolated lesion is likely to heal more than separated lesion in preoperative CT image.
Indication of fixation:
- Both acute and chronic lesions / an intact OCL > 10 mm in diameter and 3 mm in thickness.
- Contraindication: Generalized osteoarthritis / a purely cartilaginous lesion.

Technical demands:
- For a skeletally immature pts.: no violation of the growth plate and no medial malleolar osteotomy is required.
- Adequate debridement of sclerotic bone and bone marrow stimulation should be performed prior to fixation.
- Bone grafting: Chronic case with sclerotic margin and poorly vascularized bone fragment.
- Optimal method of fixation: At least one bioabsorbable compression screw (maximum of 3-mm screw) and additional bioabsorbable dart(s) or pin(s) to prevent rotation. The alternative fixation is 2.0- or 2.7-mm steel screws or bone pegs (at least 2 fixations in a nonparallel fashion).
- Sealing of the defect is not necessary after fixation.

● ATFRB is one of fixation technique which almost support the above recommendation.
● The retrograde drilling and bone grafting may facilitate healing more than BMS.
Conclusion

- Arthroscopic transmalleolar fixation using cortical bone pegs combined with retrograde autologous cancellous bone grafting (ATFRB) is a low invasive and effective technique even for chronic osteochondral lesion of the talus in immature patients.

- The healing rate was 15 of 21 cases (71.4%), however, the clinical outcome was satisfied in 19/21 (90.5%).

- One of the predictive factor of fragment healing after fixation was suggested the iso intensity lesion of T2W in preoperative MRI. However, the 3 of 9 patients with the low intensity lesion healed performing ATFRB technique.

Limitation

- retrospective case series study
- small number
- single observer for image evaluation


