Clinical Comparison of the Osteochondral Autograft Transfer System and Subchondral Drilling in Osteochondral Defect of the First Metatarsal Head

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My disclosure is in the Final AOFAS Program Book. I have no potential conflicts with this presentation.
Most isolated lesions of osteochondral defect of the first metatarsal head are originated from trauma. → may lead to degeneration of the first MTP joint.

The first metatarsophalangeal joint mobility is important to allows a normal gait pattern and action of the windlass mechanism, and assists in balance, impact reduction and normal stance.

Therefore, osteochondral defect of the first metatarsal head should be treated properly to perform the daily activities as well as many sports activities and also not to progress in hallux rigidus.

Treatment option of osteochondral lesions

- Marrow inducing reparative procedures: subchondral drilling, curettage, microabrasion, and microfracture.
- Restorative procedures: osteochondral grafting, mosaicplasty, and frozen osteochondral allografts.

However, studies on the osteochondral autograft transfer system for treatment of osteochondral defect of the first metatarsal head have rarely been published.

The aims of this study

1) to investigate the clinical outcomes and postoperative activity levels of the osteochondral autograft transfer system in treatment of osteochondral defect of the first metatarsal head,

2) to compare the outcomes thereof with those of subchondral drilling operation,

3) to identify the prognostic factors associated with the osteochondral defect of the first metatarsal head.
from May 2008 to June 2010

twenty-two consecutive patients (24 feet)
  Group A (14 feet) : subchondral drilling
  Group B (10 feet) : osteochondral autograft transfers

Mean age : 38.9 years (range, 28-56 years)
Mean follow-up period : 25.1 months (range, 22-36 months)
Male : Female = 8 : 14

Evaluation of clinical outcomes
  Visual Analogue Scale (VAS) for pain score
  AOFAS hallux metatarsophalangeal-interphalangeal scale
  Roles and Maudsley score for patient satisfaction
  Tegner activity scale
  Activity Rating Scale (ARS)

Radiologic Evaluation
  AP and lateral weight-bearing radiographs
  : assess the first MTP joint for degenerative arthritis
  MRI
  : measure the size and location of lesions
  : evaluate any associated lesions
     (e.g. subchondral cyst) before the operation

Surgical Technique
  For the osteochondral autograft transfer,
    : OATS instrumentation set (Arthrex Inc., Naples, FL) was used
  For subchondral drilling,
    : a 0.9 millimeter-diameter K-wire was used for multiple drillings of subchondral bone
Results

Clinical and Functional Results

<table>
<thead>
<tr>
<th></th>
<th>Group A (Subchondral drilling)</th>
<th>Group B (OATS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preoperative</td>
<td>last follow up</td>
</tr>
<tr>
<td>VAS</td>
<td>6.9 ± 0.9</td>
<td>3.9 ± 1.3</td>
</tr>
<tr>
<td>AOFAS*</td>
<td>62.9 ± 5.8</td>
<td>73.2 ± 8.2</td>
</tr>
<tr>
<td>Tegner scale*</td>
<td>3.4 ± 0.9</td>
<td>4.6 ± 0.7</td>
</tr>
<tr>
<td>Activity rating scale*</td>
<td>8.9 ± 1.9</td>
<td>8.7 ± 1.7</td>
</tr>
<tr>
<td>R &amp; M score*</td>
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<td></td>
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<tr>
<td>Excellent</td>
<td>0</td>
<td>1 (7%)</td>
</tr>
<tr>
<td>Good</td>
<td>0</td>
<td>4 (29%)</td>
</tr>
<tr>
<td>Fair</td>
<td>6 (43%)</td>
<td>6 (43%)</td>
</tr>
<tr>
<td>Poor</td>
<td>8 (57%)</td>
<td>3 (21%)</td>
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</tbody>
</table>

*Statistically significantly differences are observed between the groups, $p < 0.05$.

Radiological assessment

Degenerative arthritis of the first MTP joint was observed in six cases in group A and one case in group B.

Large defect size ($\geq 50 \text{ mm}^2$) and the existence of subchondral cyst were significantly associated with the development of degenerative arthritis of the first MTP joint in group A ($p = 0.011$, $p = 0.037$, respectively), but no association was found between location of the defect area and degenerative arthritis of the first metatarsophalangeal joint in group A ($p = 0.133$).
Association between Defect Size and Clinical Outcome

**Results**

**Group A**
- $R^2 = 0.937$ ($p < 0.05$)

**Group B**
- $R^2 = 0.127$ ($p = 0.312$)

- $R^2 = 0.935$ ($p < 0.05$)

- $R^2 = 0.007$ ($p = 0.814$)
## Associations Between Satisfaction of Clinical Result and Variables of Osteochondral Defect

<table>
<thead>
<tr>
<th></th>
<th>Group A (Subchondral drilling)</th>
<th>Group B (OATS)</th>
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<tbody>
<tr>
<td></td>
<td>S&lt;sup&gt;b&lt;/sup&gt;</td>
<td>U&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Defect size</td>
<td></td>
<td></td>
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<tr>
<td>Large (≥ 50 mm&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1 5</td>
<td></td>
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<tr>
<td>Small (&lt; 50 mm&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>6 2</td>
<td></td>
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<tr>
<td>Location of defect</td>
<td></td>
<td></td>
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<tr>
<td>Central&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2 4</td>
<td></td>
</tr>
<tr>
<td>Peripheral&lt;sup&gt;d&lt;/sup&gt;</td>
<td>5 3</td>
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<tr>
<td>(dorsal or plantar)</td>
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<tr>
<td>Existence of subchondral cyst&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1 6</td>
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<td></td>
<td>(0.001-0.555)</td>
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Considering a VAS < 4 points, AOFAS score > 80 and good or excellent Role and Maudsley score at last follow-up as a satisfactory clinical outcome.

<sup>a</sup> OATS, osteochondral autograft transfer system; OR, odds ratio; CI, confidence interval.

<sup>b</sup> S, satisfactory clinical result.

<sup>c</sup> U, unsatisfactory clinical result.

<sup>d</sup> The values are given as number.

Large defect size (≥ 50 mm<sup>2</sup>) and existence of subchondral cyst were significant predictors of unsatisfactory clinical outcomes, with an OR of 0.067 (95% CI: 0.005-0.970) and 0.028 (95% CI: 0.001-0.555), respectively, compared to small defect size (< 50 mm<sup>2</sup>) and nonexistence of subchondral cyst in group A (P = .047, P = .019, respectively). **These correlations were not** observed in group B. No association was found between location of defect area and clinical outcome in both groups.
## Results

### Patient Characteristics and Clinical Outcome for Groups by Defect Size and Subchondral Cyst

<table>
<thead>
<tr>
<th>Factor</th>
<th>Defect size</th>
<th></th>
<th>Subchondral cyst</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>RR</th>
<th>p</th>
<th></th>
<th></th>
<th>RR</th>
<th>p</th>
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<tbody>
<tr>
<td></td>
<td>&lt; 50mm²</td>
<td>≥ 50mm²</td>
<td>CR</td>
<td>NE</td>
<td>E</td>
<td>CR</td>
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<tr>
<td>Age (years)&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>&lt; 37</td>
<td>4 (26.7)</td>
<td>6 (66.7)</td>
<td>0.12</td>
<td>0.053</td>
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<tr>
<td>≥ 37</td>
<td>11 (73.3)</td>
<td>3 (33.3)</td>
<td>1.94</td>
<td>0.369</td>
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<td>Gender</td>
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<tr>
<td>Male</td>
<td>5 (33.3)</td>
<td>4 (44.4)</td>
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<tr>
<td>Female</td>
<td>10 (66.7)</td>
<td>5 (55.6)</td>
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<tr>
<td>BMI&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>&lt; 26.0</td>
<td>6 (40)</td>
<td>5 (55.6)</td>
<td>0.73</td>
<td>0.693</td>
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<td>≥ 26.0</td>
<td>9 (60)</td>
<td>4 (44.4)</td>
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<tr>
<td>D (weeks)&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
<td>0.51</td>
<td>0.356</td>
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<tr>
<td>&lt; 20</td>
<td>6 (40)</td>
<td>4 (44.4)</td>
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<td>≥ 20</td>
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<td>5 (55.6)</td>
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<sup>a</sup> CR, Cox proportional hazards regression analysis; NE, nonexistence; E, existence; RR, relative risk; D, Duration of symptoms.

<sup>b</sup> The medial values are used as a standard values for dividing the groups.

According to the Cox regression analysis, there were no significant correlations between all prognostic factors and defect size or existence of subchondral cyst. (\( p > 0.05 \), respectively)
In our study, the defect size was a significant predictor of clinical outcome in the subchondral drilling group ($p = 0.047$), but no association was found in the OATS group ($p = 0.748$).

In our study, in the subchondral drilling group, the existence of subchondral cyst significantly worsened the clinical outcomes ($p = 0.019$). However, the clinical outcomes of the OATS group were not influenced by the presence of a subchondral cyst.

The major limitations of our study: small number of cases and the relatively short duration of the follow-up period.

**Conclusion**

The encouraging outcomes of this study suggest that the osteochondral autograft transfer system for the first metatarsal head could potentially be utilized to restore the functionality of a metatarsophalangeal joint. If the osteochondral defect is larger than 50 mm$^2$ or a subchondral cyst exists, the osteochondral autograft transfer system should be considered as the treatment of choice rather than subchondral drilling operation for the treatment of osteochondral defect of the first metatarsal head.
References


