Can the proximal phalangeal head remodel after stretching exercise or surgical treatment in patients with camptodactyly?

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Introduction

Camptodactyly
- Non-traumatic painless flexion deformities of proximal interphalangeal joint (PIPJ) of the digit except that of thumb
- Rare congenital anomalies of the hand
  - Clinical manifestation of some other syndromes
  - Disease of its own right
- Very difficult to get satisfactory results

Radiographic changes of camptodactyly
- Typical changes are found in true lateral finger radiographs
  - Head of the proximal phalanx loses its rounded articular convex contour
  - Flattening at the base of the middle phalanx articulation
  - “Beaked” appearance at the head of proximal phalanx
  - Reversal potential of deformed bone
  - If these deformities are corrected to appropriate anatomical position, proximal phalangeal head would regain spherical shape of head

Purpose of study
- To verify the remodeling patterns of proximal phalangeal head after conservative and/or surgical intervention in patients with camptodactyly using true plane lateral radiographs
- To propose the proper reproducible radiographic measurement indices

Materials & Methods

Inclusion criteria
- Patients who performed conservative and/or surgical interventions of camptodactyly with over 2 year follow up

Exclusion criteria
- Other combined hand anomalies
- Neuromuscular disease

Radiographic evaluation
- Two radiographic parameter were proposed
  - Beak triangle ratio
  - Beak angle
- Both parameters were measured at two time point using finger true lateral radiographs
  - Pre-intervention & Post-intervention after 1 year
  - The congruency of proximal phalangeal head evaluated by consensus of two experienced orthopedic surgeons

Definition of Beak triangle ratio
- Find the three inflection point
  - Between dorsal cortex and proximal phalanx beak
  - Most superior point of proximal phalanx head
  - Most anterior point of volar beak
  - Draw a triangle connecting three points
  - The ratio between base and height of the triangle (b/a)

Definition of Beak angle
- Draw an extension line of dorsal cortex of proximal phalanx shaft (=E1)
  - Find a inflection point between dorsal cortex and proximal phalanx beak (= i) and most superior point of a proximal phalanx head (= s)
  - Draw a extension line connecting i and s (=E2)
  - Measure the acute angle between E1 and E2 (= α)

Measurement of Clinical outcomes
- Preoperative work-up
  - Careful physical examination and Hand and finger both X-ray series

Results

- Post-intervention follow up
  - Two weeks, six weeks, six months, one year after initial intervention
  - The extent of PIPJ contracture on passive functioning at wrist neutral position was before and one year after initial intervention

Patients demographic data

<table>
<thead>
<tr>
<th>Number of digits involved</th>
<th>Index</th>
<th>Middle</th>
<th>Ring</th>
<th>Little</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 (13.3%)</td>
<td>16 (35.6%)</td>
<td>11 (24.4%)</td>
<td>12 (26.7%)</td>
<td>13 (61.9%)</td>
<td>8 (38.1%)</td>
</tr>
<tr>
<td>Average age at initial diagnosed</td>
<td>15.11 ± 14.22 (0-39) mos</td>
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Number of digits classified as treatment method

<table>
<thead>
<tr>
<th>Conservative manner</th>
<th>Operative manner</th>
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<tbody>
<tr>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>11</td>
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The mean measured parameters and extent of PIPJ contracture

<table>
<thead>
<tr>
<th>Beak triangle ratio</th>
<th>Beak angle</th>
<th>PIPJ contracture</th>
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<tbody>
<tr>
<td>Before intervention</td>
<td>0.327 ± 0.052</td>
<td>56.65 ± 5.19</td>
</tr>
<tr>
<td>1yr after intervention</td>
<td>0.367 ± 0.053**</td>
<td>50.31 ± 6.21**</td>
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Correlations among degree of PIPJ contracture and radiographic indices

<table>
<thead>
<tr>
<th>Beak triangle ratio</th>
<th>Beak angle</th>
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<tbody>
<tr>
<td></td>
<td>-0.322**</td>
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Discussion & Conclusions

Discussion
- If the congruency proximal phalangeal head were improved, the beak triangle ratio would be increased and beak angle would be decreased
- There might be reformed potential in a proximal phalangeal head

Conclusion
- Remodeling of proximal phalangeal head with camptodactyly after conservative and/or surgical intervention were confirmed
- Early intervention would be recommended to correct the deformities in patients with large growth potentials

Reference