Swan Neck & Boutonniere deformities

Simon Tilley

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Swan Neck Deformity

Hyperextension of PIP Joint w/ flexion of DIP joint
- deformity may start at PIPJ or DIPJ
  - Obligatory attenuation of the volar plate @ PIPJ
  - At DIPJ elongation or rupture of attachment of the extensor tendon to the base of the distal phalanx

Results in:
- mallet deformity of DIPJ
- extensor tendon imbalance leading to hyperextension deformity at PIPJ
summation of pathology

- Stretching of the volar plate at PIP joint
- Intrinsic tightness
- Collateral ligament contracture
- DIP laxity
Causes

- In contrast to the boutonniere deformity, swan neck deformities may begin at MP, PIP and DIP joints
MP joint pathology:

- Intrinsic and central tendon tightness leads to MP joint subluxation.
- Even before MPJ subluxation develops, intrinsic tendon tightness may lead to PIP hyperextension deformity.
- Once the MPJ subluxation develops (flexion deformity), there will be a secondary PIP hyperextension deformity as a result of altered balance.
PIP joint pathology

- PIP Joint hyperextension from lax volar capsule secondary to synovitis
- FDS rupture
- Complete excision of the FDS
DIP joint pathology:

- Mallet deformity (common cause)
  - In rheumatoid arthritis, there may be stretching or disruption of the distal extensor mechanism resulting in mallet deformity
  - As a result of the mallet deformity, there will be eventual PIP hyperextension deformity (DIP will therefore show more advanced deformity than the PIPJ)
Swan neck following excision of FDS

Tight repair of FDP or free tendon grafting

Intrinsic contracture has the effect of causing PIP hyperextension which eventually causes volar plate attenuation
<table>
<thead>
<tr>
<th>Nalebuff Type</th>
<th>Description</th>
<th>Cause</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PIPJ flexible</td>
<td>DIPJ mallet</td>
<td>Cannot extend DIPJ with PIPJ passively flexed</td>
<td>Fuse DIPJ</td>
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<td></td>
<td></td>
<td>PIPJ volar plate / FDS insufficient</td>
<td>Can extend DIPJ with PIPJ passively flexed</td>
<td>Extension block splint</td>
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<tr>
<td>2</td>
<td>Limited PIPJ Flexion</td>
<td>Tight intrinsics</td>
<td>Can flex PIPJ with MCPJ flexed (Bunnell Test)</td>
<td>FDS tenodesis</td>
</tr>
<tr>
<td>3</td>
<td>Stiff PIPJ Joint preserved</td>
<td>Tight intrinsics</td>
<td>Normal X-ray</td>
<td>MUA or dorsal soft tissue release</td>
</tr>
<tr>
<td>4</td>
<td>Stiff PIPJ Joint changes</td>
<td>Tight intrinsics</td>
<td>X-ray: articular changes</td>
<td>Arthrodesis</td>
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Boutonniere deformity

- Acquired lesion of the extensor mechanism
- PIPJ develops flexion deformity
- DIPJ develops extension deformity
Pathology

- Balance between the extensors over the dorsal PIP joint and the flexors volarly is upset.

- As deformity progresses, the now dominant FDS creates constant flexion at the PIP joint.

- Initially, the DIP joint exhibits an extensor lag.

- As lumbricals and interosseii lose their insertion into the middle phalanx due to the incompetent central slip, their force of action is diverted entirely through the lateral bands. Over time, these lateral bands migrate palmarly and contract. Accompanied by shortening of the oblique retinacular ligaments. Together, these changes cause hyperextension at the DIPJ.
Normal lateral band location, dorsal to the axis of rotation of the proximal interphalangeal joint.

After central slip disruption, lateral bands migrate volar to the axis of rotation of the proximal interphalangeal joint.
Aetiology

- Trauma
- RA and other inflammatory arthritides
- Burns and infections.
Several mechanisms:

- A laceration over the joint may involve the central slip.
- Axial loading with PIP in extension can cause closed disruption of the central slip.
- Volar dislocation of the PIPJ can cause avulsion of the central slip.
Trauma

- Digit held in semiflexed position
- Active motion, esp PIPJ extension and DIPJ flexion decreased.
- Full extension can be achieved passively (except late presenters).
- Typically misdiagnosed or undertreated on first presentation.
- Common splinting techniques with the PIP joint partially flexed serve to accentuate the deformity.
- Dorsal avulsion fractures or any fractures involving the base of the middle phalanx are at high risk for developing a BD.

Maintain high index of suspicion!
Imaging Studies

- Standard radiographs of the hand and digit usually suffice. If no bony abnormalities are found & high clinical suspicion consider:
  - Flexion and extension views
  - Stress views
  - Fluoroscopic examination
Other Tests

2 specific tests can aid in the early recognition of acute injuries to the central slip and extensor mechanism:

- A ≥20° loss of active extension of the PIPJ, with wrist and MP fully flexed
- Extravasation of intraarticular dye dorsal and distal to the PIP joint

- Haines-Zancolli test may aid in the decision to treat with splinting or surgery.
  - Negative test if passive flexion of the DIP is still possible with the PIP maintained in extension.
  - Positive if flexion of the DIP is not possible with PIP in extension.
  - Less chance of successful conservative treatment exists with a positive Haines-Zancolli test result.
Burns

- Full-thickness burns may disrupt the central slip.
  - Most commonly, BD occurs from secondary infection.
Management 1 - Nonoperative

- Splinting. Variety of techniques have described. All need 4-6/52 immobilization in extension to be effective.
- Safety pin splint is most practical for digits with <40° flexion contracture. Isolates the PIPJ in extension and allows for movement of the DIP joint.
- Dynamic spring splints may be helpful for contractures >40°
- For severe established contractures, serial digital casts are extremely valuable
Management 2 - Surgical

- **Preoperative:** Minimum of 1 month of splinting prior to surgical intervention
  - Surgical results are highly dependent on the pre-op degree of contracture.
  - Stiff joint must be corrected with therapy or surgery before tendon repair

- **Intraoperative:** When central slip is avulsed with bone fragment, fragment should be either fixed or excised, and the tendon reattached. The PIP then is held in extension with a K-wire

  - Stack has described use of FDS to reconstruct the central slip and balance the forces across the PIP.
  - Matev used lateral band on one side to reconstruct the central slip, on the other side it is elongated to make use of a single lateral band.
Rheumatoid Boutonniere

- Up to 50% of patients with RA are estimated to develop a BD in at least one digit.
- Rupture of central slip of ext tendon due to synovitis of PIPJ
- Lateral bands dislocate in palmar direction, being converted from extensors to flexors
- Non surgical treatment of little benefit and can reduce function
# Management of Rheumatoid BD

<table>
<thead>
<tr>
<th>Deformity</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Mild (10-15 deg)</td>
<td>Extensor tenotomy over centre of middle phalynx</td>
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<tr>
<td>Moderate (30-40 degrees)</td>
<td>Soft tissue procedures (variable results, low threshold for arthrodesis)</td>
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<tr>
<td>Severe (fixed)</td>
<td>Arthrodesis – position ranging from 20 deg (index) to 45 deg (little finger)</td>
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</tbody>
</table>
Outcome and prognosis

- Good in acute injuries & in reconstruction of stage I and most stage II rheumatoid deformities.
- With stage III RA, extensive burns, irreversible contractures & extensive soft tissue losses, salvage procedures may be only reasonable options.
- Rarely, contracture & pain result in amputation of the digit or ray.
Thank you