CTS & MARTIN-GRUBER ANASTOMOSIS
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MARTIN-GRUBER ANASTOMOSIS

MEDIAN – ULNAR ANASTOMOSIS
MARTIN-GRUBER ANASTOMOSIS & CTS

- Normal Median CMAP

CTS EDX FINDINGS

- Wrist CMAP
  - Prolonged DML Latency
  - Normal Or Small Amplitude
  - Initial Negative Deflection

- Elbow CMAP
  - Initial Positive Deflection
  - Larger CMAP Than At Wrist
  - Abnormally Fast NCV or Negative NCV
MARTIN-GRUBER ANASTOMOSIS & CTS

R MEDIAN - APB

<table>
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<tr>
<th>Sites</th>
<th>Latency (ms)</th>
<th>Amplitude (mV)</th>
<th>Duration (ms)</th>
<th>Area (mm²)</th>
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<tbody>
<tr>
<td>1</td>
<td>4.65</td>
<td>8.8</td>
<td>5.85</td>
<td>30.1</td>
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<td>2</td>
<td>7.03</td>
<td>9.4</td>
<td>7.45</td>
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Segments

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<tr>
<th>Distance (cm)</th>
<th>Lat. Diff. (ms)</th>
<th>Velocity (m/s)</th>
<th>Temp (°C)</th>
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<td>4.65</td>
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<tr>
<td>2: 1</td>
<td>17.5</td>
<td>2.25</td>
<td>74.5</td>
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MARTIN-GRUBER ANASTOMOSIS

MEDIAN - ULNAR ANASTOMOSIS

ULNAR - MEDIAN
MARTIN-GRUBER ELECTRPHYSIOLOGIC VARIATIONS

- Important To Recognize M-G Variations
  - Identify Them Correctly
  - Teach Us About Anatomy/Physiology

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- Smaller Amplitude Proximally
ULNAR NERVE: MARTIN-GRUBER & CTS

- C8/T1 Fibers From Median Join The Ulnar Nerve Distal To The Elbow But Proximal To The Wrist
- Therefore: More Ulnar Fibers Respond To Stimulation At The Wrist Compared To The Elbow
- Possible Confusion With “Conduction Block” In The Forearm: Not That Common A Finding
ULNAR NERVE: MARTIN-GRUBER & NO CTS

Median Nerve

Ulnar Nerve
What If Wrist Stimulation Produces An Initial Positive Deflection

Do Not Immediately Conclude E-1 Is “Off” The Motor Point
  This Could Lead To A “Wild Goose Chase”

Instead, Stimulate The Median Nerve At The Elbow
  1) No Positive Deflection
  2) Positive Deflection
WRIST CMAP INITIAL POSITIVE DEFLECTION

- Instead, Stimulate The Median Nerve At The Elbow
  - 1) No Positive Deflection
  - 2) Positive Deflection

- No Positive Deflection
  - Then Not Off Motor Point And No Martin-Gruber Anastomosis
    - If Move The Electrode Then For Sure Off The Motor Point: Wild Goose Chase
  - Re-Stimulate The Median Nerve At The Wrist BUT
    - Reduce Current Intensity Until Positive Deflection Goes Away
    - Move The Cathode Just Lateral To The FCR Tendon
    - In Some Person Can Get Rid Of The Positive Deflection But May Never Be Supramaximal Because From A Current/Volume Conductor Standpoint The Median And Ulnar Nerves Are Too Close Together And Can't Solely Activate The Median Nerve Without Co-activation To Some Degree Of The Ulnar With CMAP Co-contamination
CMAP INITIAL POSITIVE DEFLECTION

- Instead, Stimulate The Median Nerve At The Elbow
  - 1) No Positive Deflection
  - 2) Positive Deflection

- Positive Deflection
  - On Motor Point But Have Martin-Gruber Anastomosis
    - If Sensory CTS Present; Be Suspicious For MGA
    - Reduce Current At Wrist
      - If No Positive Deflection Then On Motor Point; Go Back To Elbow To Determine If MGA Present
      - If No Positive Deflection At Elbow Stimulation Then On Motor Point And No MGA
      - If No Positive Deflection At Wrist But Positive Deflection At Elbow Then MGA
  - Off Motor-Point
    - Reduce Current At Wrist But Positive Deflection Persists; Move Electrode To Motor Point
    - If Get Negative Deflection; Then Stimulate At Elbow And If Positive Deflection Then MGA Present

WRIST CMAP INITIAL POSITIVE DEFLECTION

- Instead, Stimulate The Median Nerve At The Elbow
  - 1) No Positive Deflection
  - 2) Positive Deflection

- Positive Deflection
  - On Motor Point But Have Martin-Gruber Anastomosis
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      - If No Positive Deflection At Wrist But Positive Deflection At Elbow Then MGA
  - Off Motor-Point
    - Reduce Current At Wrist But Positive Deflection Persists; Move Electrode To Motor Point
    - If Get Negative Deflection; Then Stimulate At Elbow And If Positive Deflection Then MGA Present
CTS DML/NCV MISCONCEPTIONS

- Assume A Sensory CTS Exists
- DML/NCV
  - Prolonged DML/Normal Forearm NCV
  - Prolonged DML/Slowed Forearm NCV
  - Normal DML/Slowed Forearm NCV
  - Normal DML/Proximal CMAP With Initial Positive Deflection
- False Assumption: Fastest Conducting Forearm Fibers Have Shortest DML

CTS/DML/NCV

- Prolonged DML/Normal NCV
CTS/DML/NCV

- Prolonged DML/Normal NCV
  - Wrist Stimulation: DML
  - Elbow Stimulation: PML = FML + DML
  - NCV = Segmental Dist/Segmental T
  - NCV = Forearm Dist/\{(FML + DML) – DML\}
  - DML Common To Both & Subtracted Out
  - NCV = Feararm Dist/Forearm Time
CTS/DML/NCV

- Prolonged DML And Slowed Forearm NCV

- Previous Explanation Of Elimination Of Common DML Doesn’t Work

- Expl: The Fastest Fibers Can’t Get Through
  - Conduction Block
  - Axonal Loss

- If The Fastest Fibers Are Never Recorded They Can’t Contribute To The Measured Velocity
CTS/DML/NCV

- Prolonged DML And Slowed Forearm NCV

CTS/DML/NCV

- Normal DML/Slowed Forearm NCV
CTS/DML/NCV

- Normal DML/Slowed Forearm NCV
- DML May Be Within Reference Population Norms, But Is Prolonged For Pt (3.2 ➔ 3.8)
- Conduction Block or Axonal Loss Of Fastest Fibers
- We Erroneously Assume Fastest Forearm Fibers Are Associated With The Shortest DML

DML & FOREARM NCV

![Graph showing correlation between DML and NCV measurements]