History of Physical Therapy

- Nursing Profession Sub-specialty U.S. (1920s)

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History of Physical Therapy

- Physical Therapy as its own Profession (1940s)

- Prerequisite:
  - Nursing
  - Physical Education
Physical Therapy Evaluation

- James Cyriax M.D. (1904-1985)

- Tissue Specific

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Examination: Flow of Procedures

1. Initial Observation
2. History
3. Structural
   - Quick tests
   - Screenings
   - 3 Positions
   - (Neuro/Precautionary?)
4. AROM
5. PROM
6. Resisted ROM
   - 3 Positions
7. Palpation
   - 5 steps
8. Neurology
   - Myo/Derm
   - Reflexes
9. Special Tests
10. Mobility/Segmental Testing
11. Diagnostic Testing
12. Correlation/Prognosis

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Orthopedic Assessment
(Guide to Physical Therapy Practice 2001)

- History
  - Demographics
  - MOI/MIV

- Symptoms:
  - Location
  - Type
    - (Pain/Numb/Tingling/weakness)
  - Quality
    - (Burning/Dull/etc)
  - Better/Worse

- Review of Systems
  - Red Flags
  - Yellow Flags
  - Blue Flags

- PMH/Meds
- Family Medical Hx
- Hobbies/ADLs

MAKE A TISSUE PATHOLOGY HYPOTHESIS!

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Examination: Basic Theory

- Continually ask yourself:
  - What is being Stretched?
  - What is being Compressed?
  - Which Muscles Contribute to this Motion?
  - What is the Segmental Innervation?
Screening of Extremities

- Shoulder
- Elbow
- Hand

Quick Tests
- Apleys
- Combined AROM
- Resistive ROM
- Indicated Special Tests

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Screening of Extremities

- Ankle
- Knee
- Hip

- Closed Chain Testing
- Heel/Toe Walking
- Squatting

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Screening of the Cervical Spine

AROM

- Rotation and SB/Extension
- With over pressure (if necessary)

- Precautionary Testing
  - Applicable with trauma and neuro Signs/Sx

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Screening of Lumbar Spine

Disc/Ligament/Facet?
- Sx location
- Time of Day
- Positional

- Posterior Buttock
  - Lumbar
  - HIP
  - Sacraliliac

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Screening of the Thoracic Spine

- Thoracic
  - Assess with ANY C/S or L/S Pathology

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Spinal Influence on the Extremities

- Cervical Spine
- Thoracic Spine
- Lumbar Spine

Referred pain is pain perceived in a region separate from the location of the primary source of the pain (Bogduk 1982).

- Is it the Disc?
- HNP or DDD?

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HISTOLOGY OF COMMON TISSUES IN LESION

- Type 1 Collagen
  - Test and treat with tensile forces

- Type 2 Collagen
  - Test and treat with compression forces
Type 1 Collagen

- Found in Muscle Tendons, Ligaments and the Annulus of the Intervertebral Disc
- Optimal Stimulus For Regeneration: Modified *Tension* in the Line of Stress
Type 2 Collagen

- Found in Articular Cartilage, Nucleus of the Intervertebral Disc
- Optimal Stimulus For Regeneration: Compression and Decompression with Glide
Bone

- Type 1 and Type 2 Collagen with Mineralization
- Optimal Stimulus for Regeneration: Compression and Decompression
Hypomobility vs. Hypermobility

- Implications for treatment

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Type IV Mechanoreceptors: Pain Receptors

**C Fibers**
- Unmyelinated, slow speed of conduction
- Heat travels along this path
- Non adaptive - pain may continue after stimulus removed

**A Fibers**
- Myelinated, fast conducting
- Cold travels along this path

**Location**
- Blood vessels, bone, type I collagen
- Not found in muscles
Clinical Neurology: Mechanoreceptors

Type I
- Firing: Beginning and end range
- Location: Fascia and Superficial Joint capsule
- Recruit/Inhibit Type I Muscle Fibers
- Decrease Pain
- Slow adapting, activate with HOLD/STRETCH

Type II
- Firing: Beginning and mid range
- Location: Fascia and joint capsule
- Recruit/Inhibit Type II muscle fibers
- Decrease pain/Inc ROM
- Fast adapting, activate with mid range oscillation

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Clinical Neurology: Mechanoreceptors

Type III

- Firing: QUICK STRETCH in mid/end range (Thrust Manipulation)
- Location: Fascia and joint capsule
- SLOW adapting
- **Huge inhibitory affect over multiple spinal cord levels**
- Decrease pain/Inc ROM
- Recruit OR inhibit mm.
- Sympathetic Effects
<table>
<thead>
<tr>
<th>Receptor type</th>
<th>Preferred location</th>
<th>Responsive to</th>
<th>Known results of stimulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golgi Type Ib</td>
<td>• Myotendinous junctions</td>
<td>• <em>Golgi tendon organ</em>: to muscular contraction.</td>
<td>Tonus decrease in related striated motor fibers</td>
</tr>
<tr>
<td></td>
<td>• Attachment areas of aponeuroses</td>
<td>• <em>Other Golgi receptors</em>: probably to strong stretch only</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Ligaments of peripheral joints</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Joint capsules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacini and Paciniform</td>
<td>• Myotendinous junctions</td>
<td>Rapid pressure changes and vibrations</td>
<td>Used as proprioceptive feedback for movement control (sense of kinesthesia)</td>
</tr>
<tr>
<td>Type II</td>
<td>• deep capsular layers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• spinal ligaments</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• investing muscular tissues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruffini Type II</td>
<td>• Ligaments of peripheral joints,</td>
<td>• Like Pacini, yet also to sustained pressure.</td>
<td>Inhibition of sympathetic activity</td>
</tr>
<tr>
<td></td>
<td>• Dura mater</td>
<td>• Specially responsive to tangential forces (lateral stretch)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• outer capsular layers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• and other tissues associated with regular stretching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interstitial Type III and IV</td>
<td>• Most abundant receptor type,</td>
<td>• Rapid as well as sustained pressure changes.</td>
<td>Changes in vasodilation</td>
</tr>
<tr>
<td></td>
<td>Found almost everywhere, even inside bones</td>
<td>• 50% are high-threshold units, and 50% are low-threshold units</td>
<td>• plus apparently in plasma extra-vasation</td>
</tr>
<tr>
<td></td>
<td>• Highest density in periosteum</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Schleip 2002*
Tissue Injury

- Type IV Mechano receptors
- Input into Dorsal Horn of corresponding Spinal Cord level

Inflammatory Cascade

- in the tissue: perpetuates pain via thermal, mechanical, ph
Dorsal Horn to:

I. Lateral Spinal Thalamic Track (LSTT)
   - to Sensory Humunculus of Cortex

II. Anterior Horn Cells
   - Motor area
   - Reflexive mm. spasm

III. Anterior-Lateral Area
   - Sympathetic Nervous System
     - Visceral/ Vascular/
     - Efferent System Only
The Manual Therapy Lesion
(Grimsby/Wyke)

- Receptor Damage
- Decrease Tonic Mm recruitment
- Tonic mm atrophy
- Weakness
- Movement around a non-physiological axis
- Joint Compression/abnormal loading
- Tissue damage (Cartilage/Capsule-Ligament)
- Pain
- Reflexogenic Mm guarding

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Manual Orthopedic PT

- Osteopathic Physicians - England (1950s)
  - Kaltenbourn
    - Thrust Manipulation
    - Non Thrust Manipulation/Mobilisation

- Norwegian Training

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Manual OMPT US

- Original OMPT Programs (1980s)
  - St. Augustine/Paris
  - Maitland
  - Grimsby

- Formation of AAOMPT
  - 1991

- FIOMPT (2012)

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Manual Therapy Treatment Paradigm

- Manual Treatment

- Education
  - HEP
  - Positioning
  - Posture
  - Nutrition

- Medical Exercise Training (MET) and Scientific Therapeutic Exercise Progressions (STEP)

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Development of M.E.T./S.T.E.P.

- Oddvar Holten (1960s)
  - MET

- Ola Grimsby Institute (1980s-present)
  - STEP

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Holten’s Curve/ Diagram

Holten diagram

% of 1 RM

100% 1 rep.
95% 2
90% 4 Strength
85% 7
80% 11 Strength/Endurance
75% 16
70% 22
65% 25 Endurance
60% 30

FREQUENCY ->

Speed:
> 80% Explosive
65-80% Breathing Rhythm
60-65% 25-30 rep/min
< 60% Tissue related

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Holten Curve Key Indicators

- Power/Strength 90% 1 RM/5 reps
- Strength 80% 1 RM/10 reps
  - Isolated Phasic Muscles
- Str/Endurance 75% 1 RM/15 reps
- Coord/Endurance 60% 1RM/30 reps
  - Isolated Tonic Muscles

- Vascular/Tissue Healing 50% 1RM/30+
  - WITHOUT FATIGUE

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Stages of Progression

- Stage I
- Stage II
- Stage III
- Stage IV
Functional Qualities

The number of repetitions dictates the functional quality influenced

- **Stage I 50% of 1 RM**
  - Vascularity: 30+ repetitions
    - Acute patient presentation
    - Mm. spasm and swelling
    - Without fatigue or provoking more swelling
  - Tissue Healing
    - Ligaments/Tendons/Cartilage
  - Coordination/Endurance (Low Level)
Functional Qualities

- Stage II-IV
- 60% 1RM
- 25-30 repetitions for endurance and co-ordination
- Tonic muscles
  - 1 set per minute

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Functional Qualities

- Stage II-IV
- 75% of 1 RM
- 15 repetitions for strength/endurance (Breathing 1 set per minute and 1/2)

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Functional Qualities

- Stage III
- 80% 1 RM
- 10 repetitions for strengthening

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Functional Qualities

- Stage IV
- 5 repetitions for power and strength
- Explosive Training

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Variables In Exercise Performance

1. Specific Exercise/Start position
2. Apparatus/Equipment
3. Resistance where in the Range
4. Range Of Motion
5. Type Of Contraction and Duration
6. Resistance Amount
7. Speed Of Motion
8. Sets and Repetitions
9. Work : Rest Ratio
10. Exercise Frequency

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1. Specific Exercise/ Start Position

- Exercise choice dependant on tissue in lesion
  - Specific tissue diagnosis essential
  - Optimal Stimulus of Repair

- Stage of Injury
  - Not necessarily from subjective Date Of Injury
  - Tissue/Pt. Tolerance

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2. Apparatus/Equipment
3. Resistance in the ROM
(Length Tension)

- Line of Pull 90 to Axis
- Parallel to mm. fibers (not acutely)
- Parallel to long axis of the limb (stabilisation)
- Lever arm 90 to the pull of gravity (strength)
Range Of Motion

- Training effects are range specific.

- Applied resistance should match the muscles ability to produce force.
4. Range of Motion

I. Inner to Mid ROM
   • Vascularity

II. Middle ROM
   • Stabilisation
   • Coordination

III. / IV. Outer ROM
   • Self Mobilisation
   • End Range Holds
   • Plyometrics
   • Functional Patterns

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4./5. Range of Motion (I) Type of Contraction

- Begin with Vascular thor ex OPPOSITE the Pathological ROM (INNER ROM).
- May be AAROM, AROM, or Resistive
- Perform Concentrically without sx. exacerbation or more swelling

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4./5. Range of Motion (II) 
Type of Contraction

- Follow with Vascular and then Stabilisation towards the Pathological ROM (MID ROM).
- AROM against gravity or Resistive with an Apparatus.

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4./5. Range of Motion (III)  
Type of Contraction

- Self Mobilisation Ther Ex TOWARDS Pathological ROM (OUTER ROM).
- Utilize Apparatus /Equipment to move Eccentrically; Progress with end range holds.
4./5. Range of Motion (IV)  
Type of Contraction

- Coordination or Strengthening Ther Ex TOWARDS the Pathological ROM
- Utilize Apparatus/Equipment to move concentrically (OUTER ROM)
- Progress with Outer ROM holds & Plyometrics

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6. Resistance Amount

- Inversely related to each other.
- 1 Repetition Maximum (1RM) or 1 Maximal Voluntary Contraction (1MVC) is the maximum resistance that can be overcome once in a movement.
6./8. Resistance Amount Sets and Repetitions

The number of repetitions dictates the functional quality influenced.

- 30+ repetitions for vascularity (I)
  - Mm. spasm and swelling
  - Without fatigue or more swelling
- 25-30 repetitions for co-ordination (II-IV)
  - Tonic muscles; 1 set per minute
- 15 repetitions for strength/endurance (III-IV)
  - Breathing (1 set per minute)
- 4-12 repetitions for strengthening (IV)
  - Explosive Training

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7. Speed of Movement

- Training effects are speed specific.
- Concentrically, slow speeds can produce more force.
- Eccentrically, high speeds produce more force.
- High speeds place more demands upon central nervous system processing to maintain stability.

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8. Sets and Repetitions

- 5 x 30-45 for mobilisation
- 2-3 sets for vascular (30+), coordination (20-30), endurance (15), and strength ther ex (4-12)
- Mix 1 set of isometrics for 5-10 sec holds for strength in a specific ROM
9. Work: Rest Ratio

- >80% 1RM: Explosive speed
- 60-80%: Respiratory Rate (1 set/min)
- <60%: 30 reps per minute (1 set/min)

- Rest period for >80% work: 3-5 minutes per set.
- Rest period for 60% work: 30-60 seconds.
10. Frequency of Treatment

- Dictated by aim of treatment and restitution rate.
- <60% several times per day
- 60% 1RM 6-10 hours for full restitution.
- >80% takes 48-72hrs.
Example of Exercise Progression
Hypermobility (Early Phase).

- Target Functional Quality = Co-ordination.
- Resistance Dose = 60% 1RM or less.
- Repetitions = 25-30 reps or more.
- Range Of Motion = Middle to Inner.
- Type Of Contraction = Concentric - Eccentric.
- Speed Of Movement = Slow.
- Frequency Of Treatment = 2 or more times daily.
- Can begin with contrary motion
Progression Of Hypermobility (Late Phase)

- Increase Range Of Motion to match physiological available range.
- Increase Speed.
- Add isometric holds throughout available range (1 set).
- Increase resistance to approximately 80% 1RM (if phasic).
- Increase Reactive (Peturbation) Component and Plyometrics.
Example of Exercise Progression Hypomobility (Early Phase).

- Target Functional Quality = Mobilisation.
- Resistance Dose = <60% 1RM or less.
- Repetitions = 30+ reps.
- Range Of Motion = Outer.
- Type Of Contraction = Concentric - Eccentric.
- Speed Of Movement = Slow.
- Frequency Of Treatment = 2 or more times daily.
Progression Of Hypermobility (Late Phase)

- Increase Speed.
- Add isometric holds at end ROM (1 set).
- Increase resistance to 60% to 80% 1RM.
- Increase Reactive (Peturbation) Component and Plyometrics
Case Studies