Effects of Lupus on the Musculoskeletal System

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Lupus 101

- What is lupus?
- How does lupus work?
- Who is affected by lupus?
- What does this mean for someone living with lupus?
- Why should we care?
What is Lupus?

- Chronic Autoimmune Disease
- No present cure
- Not infectious or contagious
- Not related to HIV (AIDS), cancer, or rheumatoid arthritis
- Condition of flares and recessions

[http://www.lupus.org/]
How Does Lupus Work?

• Normal Immune System versus Autoimmune System

• Symptoms
  • Fatigue, photosensitivity, rashes, hair loss, tendonitis, osteoporosis, lupus arthritis, blood disorders, destruction of organs
  • Muscle/joint pain and weakness due to inflammation
  • If left undiagnosed and untreated, the inflammation can cause lasting, debilitating damage.

Images Courtesy of Lupus UK (www.lupusuk.org.uk)

[http://www.lupus.org/]
Who is Affected by Lupus?

• Lupus affects 1.5 million Americans
• Most of the people diagnosed with lupus are young women between the ages of 15 to 44
• Women of color are 2 to 3 times more likely to develop lupus than white women

[http://www.lupus.org/]
What Does This Mean For Someone Living With Lupus?

- Condition of flares and recessions
  - Symptoms appear suddenly and can incapacitate for some unknown time
- Increased risk of stress/anxiety disorders and depression
- Disease often overlooked or dismissed as imaginary
  - Lupus is very real and has very real implications in the day to day function of the individual, especially young women

Images Courtesy of Lupus UK (www.lupusuk.org.uk)

[http://www.lupus.org/]
Why Should We Care?

• Apply our engineering problem solving and physiological background to reduce muscle/joint pain and weakness due to inflammation
• Apply our biomechanics knowledge for increasing and measuring muscle strength
• Push and provide research for treatment as leaders in medical innovation
• Allow people living with lupus to maintain their mobility and functionality in society
Lupus and the Musculoskeletal System

• Inflammation in the Muscles
• Inflammation in the Joints
• Current Treatment Options
Inflammation in Muscles

- Muscle fibers decrease in cross-sectional area (also atrophy)
- A decrease in muscle fiber PCSA means a decrease in actual muscle volume
- A decrease in volume means a proportional decrease in the muscle force

![Diagram of Force-Length Curve]

\[ V^m = PCSA \times l_0^m \]

\[ F^m = F(l_0^m) \]

If PCSA ↓ then \( V^m \) ↓

Image Courtesy of understandingmyositis.org
Inflammation in Joints

• Stiffness, pain, and swelling in the joint due to inflammation reduces range of motion

• A decrease in joint angle ROM means a decrease in force production
Current Treatment Options

• Muscle/Joint Pain
  • OTC anti-inflammatories (NSAIDs)
  • Hydroxychloroquine
  • Alternatives

• Muscle Weakness
  • Strength Exercising

• More Severe Cases
  • Chemotherapy drugs
  • Corticosteroids
  • Immunosuppressants

[http://www.lupus.org/]
[http://www.drugs.com/hydroxychloroquine.html]
Building Treatment to Work With the Patient

- Will not increase fatigue
- Will not aggravate muscle/joint pain further
- Will not cause addiction
- Affordable
- Reduce muscle/joint inflammation
- Can be administered in tandem with anti-depressants
- Most importantly, allow freedom of mobility for regular exercising
Our Proposal

• Low-Dose Naltrexone with Regular Exercise
Previous Investigations

• Naltrexone
• Naltrexone and Chronic Pain
• Naltrexone and Antidepressants
Naltrexone

- Cheap, readily available, safe
- Anti-opioid: Will not cause addiction
  - Initially used to reduce alcoholism and opioid dependency
- Reduces inflammation response like hydroxychloroquine
- Appears viable with antidepressants without adverse side effects
  - The drug itself contains bupropion used in antidepressants although it is not yet approved to treat depression
- Promotes healing and inhibits cell growth

[http://www.drugs.com/cdi/naltrexone.html]
Chopra, Mechanism of action of Low Dose Naltrexone (LDN)
Naltrexone and Chronic Pain

• Studied for the treatment of chronic pain, fibromyalgia, and chronic fatigue syndrome
• Positive Results
• Next Step: Study specifically for lupus


Naltrexone and Antidepressants

- Studied with co-prescribed antidepressants
- Requires further investigation
- Next Step: More case studies in tandem with antidepressants

Naltrexone as an Aid

- Naltrexone alone will not treat lupus
- Merely acts to reduce inflammation (along with its other previously mentioned benefits)
- The second and very important part of our proposal is the regular exercise, which strengthens muscles weakened by inflammation
  - Naltrexone “accompanies” regular exercise
Regular Exercise

• Importance of Exercise with Lupus
  • Strengthen body parts affected by lupus
  • Reduce fatigue
  • Make muscles less stiff
  • Increase range of motion
  • Reduce inflammation (20 min. reduced 12%)

• For muscles in pain and swollen joints, high-impact aerobics want to be avoided.

Proposed Case Study

• 60 female subjects diagnosed with mild-moderate lupus
• 1 year study period
• Examination on a monthly basis
• 4 groups of 15 subjects:
  • 1st Group: Low-dosage of naltrexone (LDN) + antidepressants + regular exercise
  • 2nd Group: LDN + regular exercise
  • 3rd Group: Regular exercise
  • 4th Group: Control
Proposed Case Study

Exercise Routine
- Dynamic Warm Up
  - Walking lunges, walking high knees, walking straight leg raises
  - Basic movements to increase blood flow
- Static Stretch
- Main Exercise
  - Swimming for 20-30 minutes
  - Low impact exercise for joints and muscles
  - Effective at reducing inflammation
- Cool Down Phase
  - Static Stretch
  - Most important part of the workout routine
Proposed Case Study

Monthly Examination

- Determine subjects’ pain according to the universal pain assessment tool
- Determine subjects’ fatigue level and mental health
- Inflammation blood test (CRP)
- ROM testing
- Strength testing

![UNIVERSAL PAIN ASSESSMENT TOOL](Image Courtesy of mysurgery.nshealth.ca)
Proposed Case Study

ROM Testing

- Flexion
- Extension
- Rotation
- Abduction
- Adduction
- Horizontal abduction
- Supination
- Pronation
- Inversion
- Eversion

Strength Testing

- Dynamometer
- Digital measurements of muscle force production
- Can be applied to same extremities tested for ROM

Images Courtesy of jtechmedical.com
Expectations

Naltrexone and regular exercise as a novel treatment option for common lupus

- Subjects see improvement with pain management
- Viability with antidepressants
- Less fatigue throughout the day
- Decreased inflammation
- Increased ROM
- Weakened muscles are strengthened

Hopefully, people living with lupus can actually live!
Thank you!