Exploring the Myth About Stretching

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A Short History...

Mrs. Grinnell (1862)  
**avid cyclist**

Dio Lewis (1864)  
published *The New Gymnastics for Men, Women, and Children*

Mrs. Franklin (1875)  
**pioneer “walkist”**
Theory...

Good general fitness = Improved performance

✓ cardiovascular
✓ endurance
✓ strength
✓ flexibility

...but as a component of “flexibility”, does a corporate stretching program effectively reduce the incidence of work-related injury?
What is a Stretch?

“To cause the limbs of (a person) to be pulled especially in torture”  
Merriam-Webster

Uncle!
Stretching & Muscle Length

The relaxed muscle generates strong muscle contractions.

Shortened muscle (too much overlap)  

Relaxed muscle (optimal)  

Lengthened muscle (not enough overlap)  

The relaxed muscle generates strong muscle contractions.
Stretching & Muscle Length

Blood flow (oxygen)

Shortened muscle (not enough oxygen; too much overlap)

Relaxed muscle (optimal)

Lengthened muscle (not enough oxygen; too compressed)

The relaxed muscle generates good blood flow.
Theory of Motor Control

Motor Control: Theory & Practical Application, A. Shumway-Cook, M. Woollacott

- Individual
  - Perception
  - Cognition
  - Motor Action

- Environment
  - Size
  - Weight
  - Shape of box

- Lifting a box

Task

Movement

Stretching program
Stretching & Muscle Length

Shortened & weak pectorals

Over stretched & weak middle trapezius
Why Are Stretching Programs So Popular?

- Less up front cost to reduce work-related MSDs by improving physical condition of employee
- Reduces priority of engineering modifications
- Puts responsibility on employee not employer
- Encourages good will toward employer
Are They Really Low Cost?

- Video Development: $100 - $5000
- Stretch Identification & Development: $2500 - $5000
- Off the Shelf Program: $100 - $2000
- Handout &/or Poster Development: $100 - $1000
- Program Owner & Coach Training Time: $80 - $200 / person
- Employee Training Time: $5 - $20 / person

Start-up Costs
Cost of Program

If used as an ergo “fix” ☐ mandatory/during work
If used as wellness option ☐ voluntary/pre- or post-shift

5 minute program = (3 min stretch + 2 min prep/finish)

5 minutes represents approximately 1% of base payroll
5 minutes/480 minutes in workday = 1.04%
10 minutes/480 minutes in workday = 2.08%
Cost of Program

If employee makes $10/hour and is paid for 2,080 hours plus 30% for benefits, then the cost for this one employee for one daily session is:

\[
\text{Cost} = \left[\left(\$10/\text{hour} \times 2,080 \text{ hours}\right) + (0.3)\left(\$10/\text{hour} \times 2,080 \text{ hours}\right)\right] \times 1.04% \\
= \$281.22 \text{ each year per employee}
\]

Add on 30 minutes of orientation at 0.5 hour x $10 = $5.00
Cost of Program

If you have 100 employees, then your annual cost is:

100 employees \times (\$281.22 + \$5.00) = \$28,621.60 \text{ for a single session each day or}

100 employees \times (\$281.22 + \$281.22 + \$5.00) = \$56,743.60 \text{ for two sessions/day}

ROI = \frac{\text{(Reduced WC Cost / Prob. of Success)}}{\text{Direct Costs}} = \frac{\sim\$100,000 \times 10\%}{\sim\$28,600} = 35\%

\sim 10\% \text{ for most vulnerable workers}

Is this the best way to spend a limited budget?
Intended Benefits of Stretching

- Increase flexibility around a joint to
  - return muscle to normal length
  - and better prepare the individual for a specific physical task
- Reduce muscle discomfort
- Supplement injury reduction strategies when engineering improvements are not feasible or readily available
- Reduce work-related MSDs through improved flexibility
What is Flexibility?

- **Flexibility** is the intrinsic property of body tissues which determines the range of motion achievable without injury at a joint or group of joints.
  - Measures motions limited by extensibility of the musculotendinous units (MTUs) surrounding a joint

- **Stretching** (in most corporate stretching programs)
  - Focuses on elongating muscle around a joint(s)
  - Successful stretching should result in increased flexibility
Measuring Flexibility

Sit and stretch

Shoulder rotation

Trunk rotation
Gap Analysis

• Unclear if “sit and stretch” range improvement is due to flexibility in the back or hamstrings.
  - Probably due to hamstring length, but no correlation with low back flexibility

• Little evidence that lumbar/hamstring flexibility is associated with low back pain

• Flexibility and stretching may be unrelated to injury risk

• “There is insufficient data to support the common prescription of stretching programs to modify flexibility based on the hypothesis of reducing the risk of muscle injury.”
  - Little evidence that greater than normal flexibility reduces injury risk
...to stretch or not to...

- Decrease in flexibility is primarily due to changes in activity and arthritis rather than specific effect of aging.
  - Only normal levels of flexibility are needed for low risk of injury
  - High and low levels of flexibility may increase risk of injury
Assuming There Are Other Benefits to Stretching...

How much enough?

- 3 reps / 30 second hold each
- 3-4 reps / 3-60 second hold
  ➢ 30 seconds for young & 60 seconds for elderly
- 4 reps / 15-30 second hold
- Unspecified reps / 10 second hold
- Unspecified reps / 10 or 30 second hold
  ➔ (2 min. total)
- Unspecified reps / 15-20 second hold

Evidence for hold time and frequency is inconsistent
When Is Stretching Most Effective?

Evidence is inconsistent

- Part of warm-up
  » 15-20 min before exercise and directly after exercise

- After modality or warm-up when tissue temperature increases

➤ WHEN you stretch is not a significant factor for increased joint ROM as per available research data

Stretching programs do not necessarily include warm-up
Limited Gains

• Gains are most effective immediately then decline after 15 minutes
  » benefits may last 24 hours

• Long-term programs are needed for long term gains.
Is Warm-Up Important?

YOU BET!

• Facilitates rapid and complete dissociation of oxygen from hemoglobin (better delivery to target muscles)

• Preconditioning muscles with warm-up exercise can increase muscle temperature for up to 30 minutes, opening intramuscular blood vessels.

  » Reduces strain at the muscle tendon junction and reduces risk of injury here.

• Warm-up prior to static stretching enhances muscle extensibility and improves flexibility.
Benefits of Stretching?

- May reduce delayed onset muscle soreness (DOMS) after strenuous or prolonged exercise
  » DOMS is thought to be the stage preceding tissue damage

- No statistically significant reduction in DOMS
- No evidence of injury rate reduction
- Increased tolerance and analgesia may increase risk of damage at the cytoskeletal level
Benefits of Stretching?

- Muscle length not an issue with adequate length (e.g., jogging)
- Stretching beyond normal range would not reduce injuries when most are believed to occur during eccentric contraction within normal range
- May cause micro-tears if performed improperly
- Overstretching may cause micro fiber muscle tears resulting in injury

- Stretching increases flexibility and reduces imbalances that lead to injury
  - the more flexible side has higher risk.
- Must stretch agonist and antagonist to avoid imbalance
Benefits of Stretching?

- May increase muscle temperature and prepare them for strenuous physical activity and prevent

- May improve viscosity (ability to elongate) but not elasticity (stiffness)

- If an average of 100 people stretch for 12 weeks to prevent one injury, the average subject would need to stretch for 23 years to prevent one injury.
Benefits of Stretching?

Stretching programs may increase employee’s perception of his/her own body attractiveness and overall self worth.

It may also increase postural awareness and encourage employees to ask for help when needed and identify unsafe behaviors or situations.
Benefits of Stretching?

Even if you improve flexibility and stretch or strengthen a muscle, unless there is adequate neuromotor learning at this range with voluntary activation of key muscles, the added muscle fiber, strength, and range is nothing more than decoration.
Getting the Biggest Bang for Your Buck

Work with management to identify and reduce ergonomics risk factors first

- Institute engineering controls when possible (targets source)
- Supplement with administrative controls
  - job enlargement
  - job rotation
  - limited exposure
Getting the Biggest Bang for Your Buck

• Incorporate start of shift “warm-up” as part of overall safety and leadership program
  – Physically and mentally prepare employee for work
  – Ensure that warm-up incorporates exercises that first get the heart pumping blood throughout the whole body, then activate muscles at end range to integrate motor learning
  – Choose activities that “stretch” over-worked muscles while dynamically exercising the antagonist muscle
    > e.g., “Executive stretch” elongates pectorals while activating rhomboids and middle trapezium
Getting the Biggest Bang for Your Buck

• Incorporate start of shift “warm-up” as part of overall safety and leadership program
  – Encourage employees to incorporate warm-up exercises as micro-breaks as part of how they do business
  – Change activities every few months
    > Incorporate “props” to stimulate interest
  – Reinforce management commitment to employee wellness
  – “Recognize” participation with program specific rewards
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