Optimizing Periodization and Program Design Muscle Performance Adaptations

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Overview

- 2 Parts:
  - 1. Definitions/Examining the Data, 2. Progression/Implementation

- Defining Periodization

- Background Data
  - Linear vs. Non-Periodized
  - Linear vs. Undulating

- How to Design a Program
  - DUP, Liner, and Block

- Not, does this work? **Is This Optimal?**
Periodization

**Periodization**: Planned manipulation of training variables to maximize adaptations

- 1. Linear Periodization – Altering training volume and intensity across multiple mesocycles (Buford et al. 2007)
- 2. Undulating Periodization
  - Daily Undulating Periodization (DUP)
  - Alterations each training session
- **Non-Periodized**: Constant intensity and volume throughout a training cycle. (Fleck 1999)
Resistance Training Emphases

• **Traditional Hypertrophy** – Moderate-High Repetitions (8-12)/Moderate-Low Intensity

• **Traditional Strength** – Low-Moderate Repetitions (≤6)/High Intensity

• **Power Training?**

*Baechle and Earle 2001*
This Data Demonstrates a Significant Difference in Distance From Center in Experienced Lifters Between a 1RM and a 60% Squat (p=0.01)

Greater Deviation at 60% than at 1RM

Zourdos et al. In Preparation
Periodization Rationale: Interrelationship

- **Bottom-Line:** Increases in hypertrophy, strength, and power are **interrelated** and in some cases possibly dependent on each other. Due to this it is important to utilize a periodized training program, even when one specific goal is the outcome.
  - Linear Periodization
  - Undulating Periodization
Traditional (Linear) Periodization

Examining The Data: Non-Periodized Vs. Linear Periodization
Periodized vs. Non-Periodized Strength

**Back Squat 1RM Increase w/ LP**

LP BREAKDOWN – GROUP 3
- 4 weeks – 5X10 RM (80% 1-RM)
- 4 weeks - 6X8 RM (83.3 % 1-RM)
- 4 weeks – 3X6-RM with (87.6% 1-RM)
- 4 weeks of 3X4-RM with (92.4% 1-RM)

NP#1=5X10RM
NP#2=6X8RM
C=No Training

Willoughby 1993
Mechanisms/Limitations of Linear Periodization

- **Positive Mechanisms**: Allows for more variation than non-periodized training

- **Limitations**: May lead to loss of specific adaptations due to extended time in one phase
  - Motor Unit Recruitment

- **Conclusion**: Linear yields greater gains than non-periodized training

  But, Is it Optimal?
Non-Linear/Undulating Model

Undulating Design

• Weekly Undulating Periodization (WUP)
  – Alterations every week (Baker et al. 1994)

• Daily Undulating Periodization (DUP)
  – Alterations each training session (Buford et al. 2007)

• Non-linear Periodization (NLP)
  – May constitute any undulating design (Monteiro et al. 2009)
Examining The Data:

Linear Periodization
Vs.
Undulating Periodization
DUP Is Superior To Linear

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Exercise</th>
<th>Percentage Increase in 1RM Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear Periodization</td>
<td>Bench Press</td>
<td>14.37%*</td>
</tr>
<tr>
<td></td>
<td>Leg Press</td>
<td>28.78%*</td>
</tr>
<tr>
<td>DUP</td>
<td>Bench Press</td>
<td>25.61%**</td>
</tr>
<tr>
<td></td>
<td>Leg Press</td>
<td>55.78%**</td>
</tr>
</tbody>
</table>

-20 Trained Males: At Least 2Days/2wk. Training for 2 years
-12 Week Training Study, 3Days/wk.

*Significantly Different From Baseline
**% Gain Significantly Different From Baseline and LP Group

Rhea et al. 2002
DUP Yields Greater 1RM In Trained Males Than LP

14 Well-Trained Firefighters, 3X/Wk. for 9 Weeks

Peterson et al. 2008

Effect Sizes > 0.50 and increased power/task performance

- Standard Training Control
- Undulation Training

Performance Variables

- Upper Body Muscular Strength
- Lower Body Muscular Strength
- Peak Power Output*
- Vertical Jump
- Grinder Performance
DUP Design
How To Design DUP

- **2 Options** how DUP is designed in the literature
  
  1. Undulate the typical training phases
    
    - Peterson et al. 2008

<table>
<thead>
<tr>
<th>DUP</th>
<th>Day I</th>
<th>Day II</th>
<th>Day III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squat</td>
<td>Hypertrophy</td>
<td>Strength</td>
<td>Power</td>
</tr>
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<table>
<thead>
<tr>
<th>Training emphasis</th>
<th>Repetitions</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertrophy</td>
<td>8-12</td>
<td>65-75%</td>
</tr>
<tr>
<td>Strength</td>
<td>≤ 6</td>
<td>85-95%</td>
</tr>
<tr>
<td>Power</td>
<td>1</td>
<td>80-90%</td>
</tr>
</tbody>
</table>
How To Design DUP

• 2 Options DUP is designed in the literature
  – 2. Undulate the reps

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<th>DUP</th>
<th>Day I</th>
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<tbody>
<tr>
<td>Squat</td>
<td>4X8</td>
<td>5X6</td>
<td>6X4</td>
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No Typical ‘Power’ Day, but the repetitions still undulate to classify as ‘DUP’
DUP Works, But Is It Optimal?

Traditional Model: Adapted from Peterson et al. 2008

<table>
<thead>
<tr>
<th>UT Model</th>
<th>Day I</th>
<th>Day II</th>
<th>Day III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Body</td>
<td>Endurance/Hypertrophy</td>
<td>Strength</td>
<td>Power/Speed</td>
</tr>
<tr>
<td>Lower Body</td>
<td>Strength</td>
<td>Power/Speed</td>
<td>Endurance/Hypertrophy</td>
</tr>
</tbody>
</table>

**Modified Model:** Does This Allow For More Volume?

<table>
<thead>
<tr>
<th>DUP</th>
<th>Day I</th>
<th>Day II</th>
<th>Day III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Body</td>
<td>Hypertrophy</td>
<td>Power</td>
<td>Strength</td>
</tr>
</tbody>
</table>
Significant Correlation Between Volume and Strength

*Strength is Related to Volume*

*Significantly different from HSP Zourdos et al. In Preparation*

*Bench Press: Total Volume*

*HSP:*

*HPS:*

*p<0.05,* significantly different from HSP

Zourdos et al. In Preparation
Results: 1RM Bench Press Strength

*p<0.05, significantly different from pre-training
#p<0.05, significantly different from post-training HSP

Zourdos et al. In Preparation
Flexible Nonlinear: Training When Ready

Flexible Nonlinear > NLP for Maximum Strength

Figure 1. Superior leg press performance using a flexible non-linear periodized workout program compared to a non-linear periodized one, $p = 0.02$. Pretest and posttest mean leg press results shown by group.

McNamara and Stearne 2010
Research Notes

• Muscle Performance Adaptations (i.e. Hypertrophy/Strength) are related to training volume and not muscle damage
  – Volume (Sets X Repetitions X Wt. Lifted)
  – Structure Volume Accordingly

• Research gives us an idea, however, we have to take the ‘cookie-cutter’ research programs and practically implement them.
### Specificity: Training Ratios

Option 1: Is a 1:1:1 ratio

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<th>Day II</th>
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<td>Hypertrophy</td>
<td>Power</td>
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Option 2: Is a 1:1:1 ratio

<table>
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<th>DUP</th>
<th>Day I</th>
<th>Day II</th>
<th>Day III</th>
</tr>
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<tbody>
<tr>
<td>Squat</td>
<td>4X12</td>
<td>5X8</td>
<td>6X4</td>
</tr>
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Make The Ratios Specific

• Current Ratio Hypertrophy : Strength : Power
  – 1:1:1

• Powerlifter may utilize a 2:1:1 ratio in favor of strength...endless possibilities

• Optimal Ratio
  – Does it exist?
Applying The Literature

• Bridge the gap between science and application
• Linear, Block, and DUP are NOT mutually exclusive
• We want to take the relatively new concept of DUP (and the unique designs) and implement them into a linear and block fashion
Block Periodization

• Preparatory Phase
  – Multiple Mesocycles
    • Volume Blocks

• Peak Phase
  – Multiple Mesocycles
    • Intensity Blocks
Prep Phase: Volume Block Mesocycle
Sample Week

• Volume Block Week 1:
  – Submaximal Intensities
  – Repeated bouts over many sets

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Day I</th>
<th>Day II</th>
<th>Day III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squat</td>
<td>4X8 @70%</td>
<td>5X6 @75%</td>
<td>6X4+ @80%</td>
</tr>
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</table>

RPE Should Be Around 7-8 During a Volume Block
Implementing RPE for Resistance Training Periodization

- Utilize a 1-10 Scale
- 10 = Max Effort
- 9 = Could Have Completed 1 More Rep
- 8 = Could Have Completed 2 More Reps
- 7 = Could Have Completed 3 More Reps

AUTOREGULATION
Preparation for a volume block?

INTRODUCTORY MICROCYCLE
Muscle Damage

• When an unaccustomed exercise or volume is introduced significant myofiber damage will incur (Nosaka 2006)
  – This will lead to fatigue and soreness resulting in a decreased ability to train

• Repeated Bout Effect (RBE)
  – The attenuation of muscle damage and increased performance when an exercise or relative volume is repeated (can occur with just 10%) (Zourdos et al. In Review)
Exam The Data
Implement The Design

Moving Forward, Questioning The Establishment
Recalling Traditional Recommendations: Is it time to Question This?

- **Hypertrophy** – Moderate-High Repetitions/Moderate-Low Intensity
- **Strength** – Low-Moderate Repetitions /High Intensity
- **Power** – Low Repetitions/Moderate-High Intensity

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Or, is there really just a volume/intensity effect

Baechle and Earle 2001
Common Question

• “So, how many sets and reps should I do”

This is a nonsense question
It implies magic

We are dealing with a theory/an overarching concept. There is not the ‘DUP’
**Frequency Theory: General Adaptation Syndrome (GAS)**

1. Muscle Growth
2. Neural
3. Endurance

**Stage of Resistance**

**Stage of Exhaustion**

**Rebound**

**Overtraining**

**Alarm Reaction**

**Rest**

**Repeat the Process**

Seyle 1956
Conclusions and Summary

- DUP in Large Training Phases: Preparatory and Peaking Volume and Intensity Mesocycles
- Tapering and Intro Cycles
- Specificity

The training possibilities are endless, more research and the concept of optimization will always continue.

- Linear Periodization, Block Periodization, and Daily Undulating Periodization are NOT mutually exclusive. They can and in some cases should be implemented together.
Acknowledgements

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