A Novel Tool and Training Methodology for Improving Finger Strength in Rock Climbers

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International Rock Congress 2016

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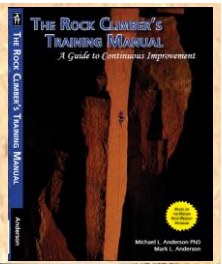
The Rock Prodigy Training Method

- Finger strength-focused
- Linear Periodization



Finger Strength Training - Hangboard

- Isolates finger flexors and extensors isometrically
- Static two-arm dead hangs
- Various grips are trained in-turn
- Suggested protocol:
  - 7 x 7 second hang, baseline weight, 3 sec rest between reps
  - 6 x 7 second hang, baseline +10 lbs, 3 sec rest
  - 5 x 7 second hang, baseline + 20 lbs, 3 sec rest

6- 8 grips

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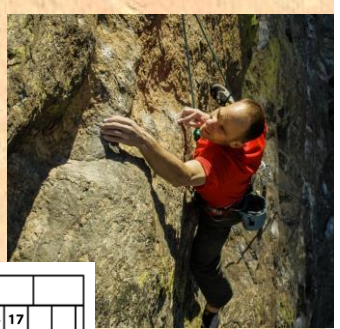
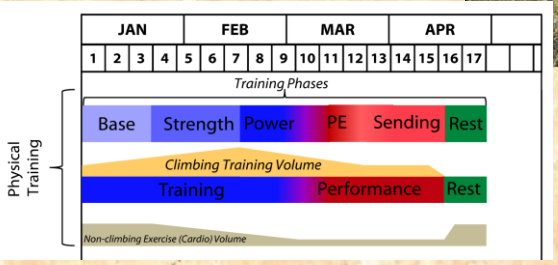
The Rock Prodigy Method

- Linear Periodization
- 12 week training cycle, 6 week performance period
- Finger & “whole body” training





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Traditional Hangboards

- Single Piece, hand-crafted, not designed for elite finger strength training
- Implicated in injuries (shoulder, elbow, wrist, fingers)

Design Goals:

1. Increase Ergonomics
2. Eliminate Skin Wear
3. Reduce unused material
4. Increase grip specificity to real rock

The Rock Prodigy Training Center

A Novel Hangboard Training Device

1. Two piece design – adjustable width, rotation
2. Angled grips
3. Grips sets with progressive geometry
4. Rotated Pinch Grips

The Rock Prodigy Training Center

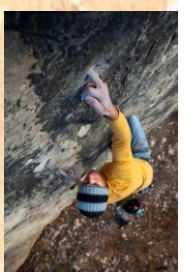
What is Wrong With Existing Hangboards?

Form Over Function

- **Poor Ergonomics:**
  - **One Size Fits All**
  - **Dead Space**
  - **Clearance**
  - **Too Sharp**
- **Poor Specificity:**
  - **Unrealistic Pinch Grips**
  - **Not Repeatable**

One Size Fits All

- Climber size varies (shoulder width, finger size)
- Climber ability varies
  - ➢Grip spacing should be shoulder-width, or **selectable** (ideal)
  - ➢Grip depths should be varied, or **selectable** (ideal)



Dead Space

- Forces hands too close together
  1. Bad for shoulders
  2. Bad for fingers
  3. Bad for Wrists
- Center Grips cannot be used safely
- ***Wasted Plastic in center***

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Solution

Split board into two pieces

- Spacing becomes selectable, even **variable**
- Pieces can rotate freely to accommodate climber's preferred grip allignment

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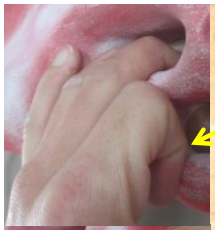

Clearance

- Hangboards often interfere with inactive fingers (esp 1-2-3f pockets)
- Bottom row pockets can alleviate
  - Not enough room for multiple pockets of different sizes
  - ➢ Drives "One Size Fits All"

Solution:

- Place pockets near edges of hangboard
- Two-piece design creates more "edges"

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Too Sharp

- Grip Radius's are too small, so lip of hold "stabs" into bone
- Too much texture

All this tape is to protect my skin from my hangboard!

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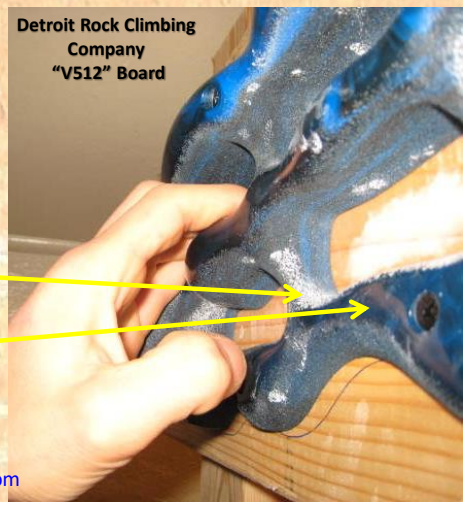
Solution

- Large radius on lip of all grips
- Dual-Texture
  - Rough on the flat surfaces
  - Smooth on other surfaces



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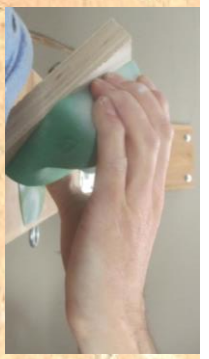
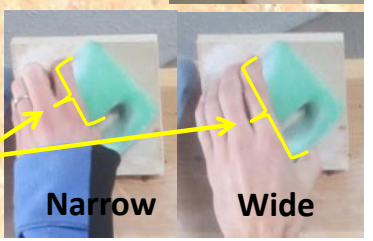
Pinches

- Unrealistic shapes
- Unrealistic hand positions
- Too Narrow



Solution:

- Rotate pinches to "overhang"
- Provide multiple width options



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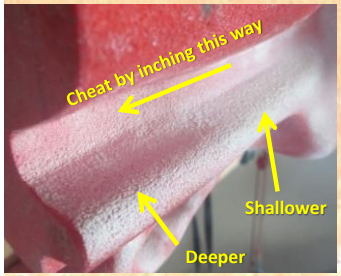
Not Repeatable



- Varying hold depth solves problem of different-sized fingers
- Also provides progression

➢ ***The Problem?***
- Reduces repeatability
- Encourages "cheating"

Solution:

- Tactile position reference
  - ➢ Small "Position Index Bumps" for reference points
  - ➢ I.e., *place bump between M&R fingertips*

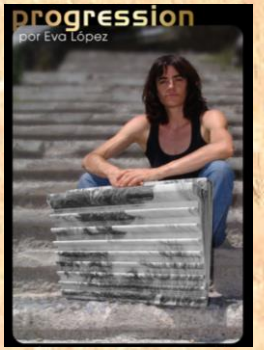
Previous Innovations

Franklin: Vertical Pinches

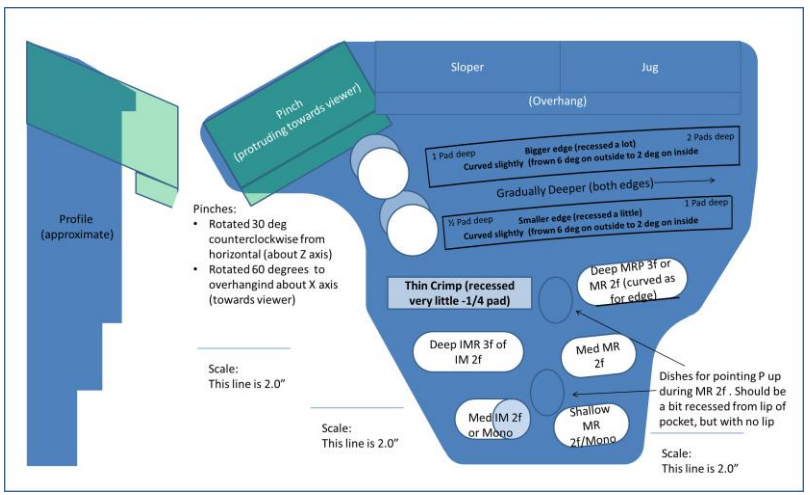
Metolius: CNC

Detroit Rock Climbing Co: Dual Texture

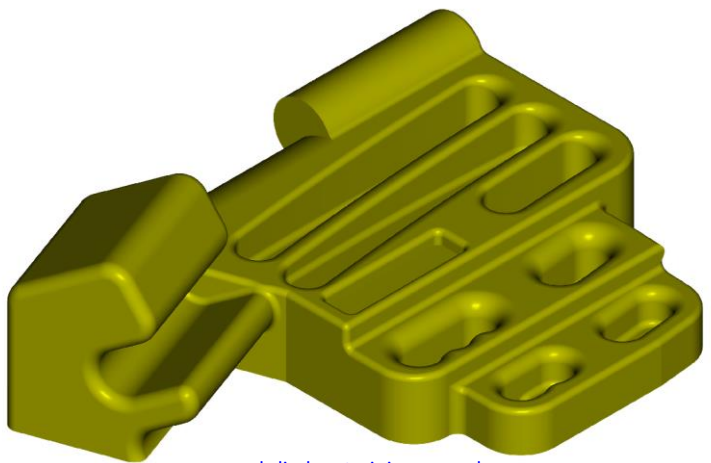
Eva Lopez: Progressive Difficulty



First Draft Crude Design



RPTC CAD Model



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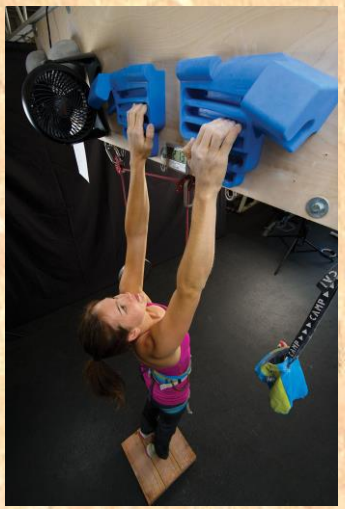
Features

- Two-Piece Design
  - Adjustable Mounting
  - Plastic where you need it
  - Improved Clearance
- Ergo/Specific Pinches
- Progression:
  - 3+ Sizes per Grip
  - Variable Depth Edge Rails
- Large Lip Radii
- Tri-Texture



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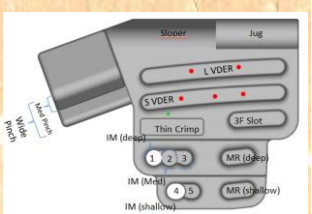
Evaluating the Rock Prodigy Training Center & Rock Prodigy Method

- Does the RPTC and/or RPM improve finger strength in rock climbers?
- Does the RPTC and/or RPM improve rock climbing performance?



- Web-based survey was used, 61-questions
- Voluntary participation
  - Respondents had used the RPTC and/or RPM
- 118 respondents:
  - 13 countries - 10.6 years average climbing experience
  - 94% Male - *69% indicated they "closely followed" the RP Method*
- Pre-study climbing ability was not well-predicted by experience, frequency of training, or use of a systematic training program
  - Common for long-time climbers to experience long performance plateaus
  - *Indicates lack of effective training protocols for rock climbing*

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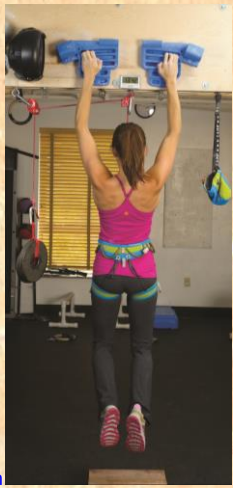
Results – Finger Strength Improvements

- Athletes recorded "Weight Hanging Ability" for each trained grip (6-10)
  - WHA = Body weight +/- added weight
- After one, 4-week training phase (8-10 workouts)
  - Avg increase = 26.1 lbs (11.8kg)
  - N = 158 grips
  - 21.5% increase in WHA (finger strength)
- After multiple, 4-week training phases (8-10 workouts)
  - Avg increase = 38.3 lbs (17.4kg)
  - N = 73 grips
  - 32.0% increase in WHA (finger strength)



Conclusion: The RP Training Center and RP Method are effective at improving finger strength in experienced rock climbers.

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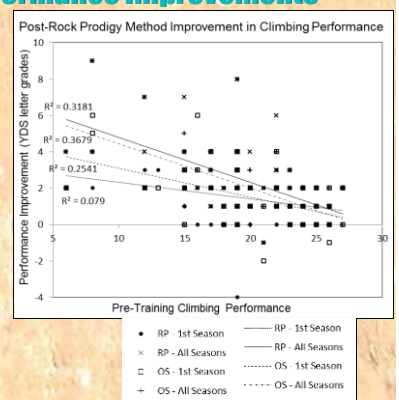
Results – Rock Climbing Performance Improvements - *Rock Prodigy Method*

- Performance quantified by YDS grade
- Reporting hardest climb performed following training
  - Compared w/-pre-training baseline
- After one, 12-week training cycle:
  - Avg "red-point" change = +1.44 YDS grades, N = 75
  - Avg "on-sight" change = + 1.51 YDS grades, N = 70
- After multiple, 12-week training cycles:
  - Avg "red-point" change = +2.50 YDS grades, N = 61
  - Avg "on-sight" change = + 2.03 YDS grades, N = 60
- 95.3% reported improvement (N = 107)



Conclusion: The RP Method is effective at improving rock climbing performance.

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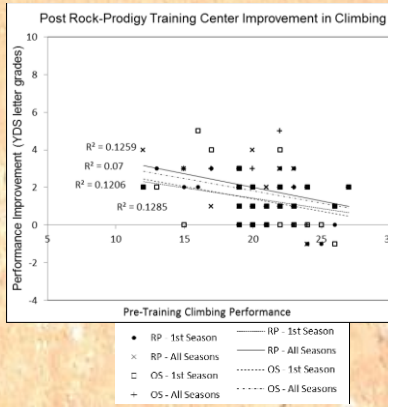
Results – Rock Climbing Performance Improvements - *Rock Prodigy Training Center*

- Performance quantified by YDS
- Reporting hardest climb performed following training
  - Compared w/-pre-training baseline
- After one, 12-week training cycle:
  - Avg "red-point" change = +1.35 YDS grades, N = 31
  - Avg "on-sight" change = + 1.29 YDS grades, N = 38
- After multiple, 12-week training cycles:
  - Avg "red-point" change = +1.96 YDS grades, N = 27
  - Avg "on-sight" change = + 1.72 YDS grades, N = 32
- 92.3% reported improvement (N = 65)



Conclusion: The RP Training Center is effective at improving rock climbing performance.

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Evaluating the RPTC

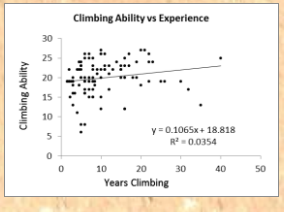
To what extent did each element contribute to your improvement?*	No Change	Slightly Disagree	Not Sure	Slightly Agree	Strongly Agree	# of Respondents
In general, please indicate how much you think the RPTC has changed your climbing performance**	4.9%			42.6%	52.5%	61
I am able to push myself harder on the RPTC without fear of injury than with other training methods (bouldering, route climbing, campusing, etc).		5.0%	10.0%	36.7%	48.3%	61
I am able to push myself harder on the RPTC without fear of injury than with other hangboards.		10.9%	27.3%	32.7%	29.1%	60
While using the RPTC, I experienced fewer overuse injuries (to include skin injuries) than with other training methods.		5.3%	22.8%	33.3%	38.6%	60
While using the RPTC, I experienced fewer overuse injuries (to include skin injuries) than with other hangboards:		10.4%	37.5%	31.3%	20.8%	60

**Web-based, voluntary survey*

*** Answer options: "No Change", "Slightly Improved," "Significantly Improved"*

Discussion Points

- Study yielded dramatic improvements
  - Long-term improvement is rare in climbing
- Climbers are relatively *under-trained* compared to typical athletes
  - Climbers don't typically follow systematic training programs
  - RPM is very prescriptive, easy to follow, results are motivating
- 74% of users reported fewer injuries (24% "not sure")



To what extent did each element contribute to your improvement?	N/A (No Improvement)	Not at All	Slightly	Significantly	*N*
The synergy of the RPTM periodization creates a performance peak:	7%	4%	38%	51%	*71*
A defined training schedule made it easier to follow the training protocol:	0%	0%	3%	97%	*74*
Goal setting helped me ID weaknesses, focus my training, and/or adhere to the program:	3%	5%	34%	58%	*74*
The exercises allow better control over training frequency, intensity, and rest:	0%	0%	13%	87%	*75*
A framework for documenting my results (quantifiable improvement was motivating):	0%	1%	22%	77%	*74*
The RPTM provided a practical framework for skill development:	7%	15%	57%	22%	*74*
Improved weight management:	17%	24%	39%	21%	*72*
Performance concepts of the RPTM improved my effectiveness at the crag:	14%	12%	44%	30%	*73*
Hangboard weight addition/subtraction w/pulleys allows me to tune training intensity:	4%	1%	4%	90%	*73*
The RPTC provides more effective grips to train on than other devices:	31%	1%	22%	45%	*67*
The RPTC's improved ergonomics allow me to push myself harder:	28%	3%	34%	35%	*68*
The RPTC provides a progression of grips of increasing difficulty:	28%	1%	22%	49%	*69*

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Future Work

- Continue long-term study of:
  - Rock Prodigy Method
  - Hangboard training & Design
- RPTC provides:
  - Standardized Training & Evaluation Tool
  - Enables larger studies w/ wide-ranging subjects
- Future Hangboard Improvements:
  - Advanced CAD/CAM techniques
  - 3D Printing for grip design optimization
  - Cooling, Force Sensing

TRANGO

ISEA '16: Anderson, et al, "An innovative hangboard design to improve finger strength in rock climbers," Procedia Engineering, 147: p. 269 - 274, 2016. doi:10.1016/j.proeng.2016.06.276

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