

# Isokinetic Certification 101

## Episode 12: BFR and Program Review

**Introduction to Isokinetic Training and Testing**

Course Instructors:  
 John Hisamoto P.T./A.T.,C.  
 Daniel Bodkin PT, DPT, ATC

Intro music provided by Bensound.com

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- CSMi  
 - Daniel Bodkin PT, DPT, ATC  
 - Email questions to Rob:  
 Rob.potash@csmisolutions.com

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## Shout Outs

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THROUGH  
KNOWLEDGE



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## Discussion Topics

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### Training:

- E1: History and Science
- E2: Program Preview
- E3: Passive Mobility
- E4: Isometric Stability
- E5: Isokinetic Strength
- E6: Isotonic Stability

### Testing:

- E7: Isometric
- E8 & E9: Isokinetic

### POC:

- E10: Knee
- E11 Ankle & Shoulder

### Today:

- E12: BFR Applications & Program Review

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## Blood Flow Restriction Training

**HUMAC**  
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<https://images.app.goo.gl/Vq3FJdCn3p2Pc5A>

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## BFR Articles

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Pearson S, Hussain S. A Review on the mechanisms of blood-flow restriction resistance training-induced muscle hypertrophy. *Sports Med.* 2015; 45: 187.

Hughes L, et al. Blood flow restriction training in clinical musculoskeletal rehabilitation: a systematic review and meta-analysis. *Br J Sports Med* 2017;94-11. doi:10.1136/bjsports-2016-097071

Loenneke J, Wilson J, Wilson G, Pujol T, Bemben M. Potential safety issues with blood flow restriction training. *J Med Sci Sports.* 2011; 21(4):510-518.



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## Blood Flow Restriction Training

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- By occluding the blood flow to the limb, we can occlude venous return while maintaining arterial flow
- Limb occlusion pressure (LOP) measured by Doppler US
- Exercise pressures are controlled with precision by sphygmomanometer
  - UE training pressure up to 40-50% LOP
  - LE training pressure up to 60-80% LOP



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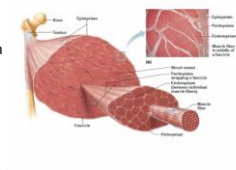
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## How BFRT Works

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- Reduced venous return results in cellular swelling
  - Stimulates mTOR which reduces muscular atrophy and increases protein synthesis



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## How BFRT Works

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- Reduced oxygen and outflow allows for build-up of lactate
  - Fatigues muscle fibers leading to type II fiber recruitment at low levels of resistance
- Inhibits Myostatin
  - Myostatin is an muscle growth inhibitor
- By stimulating mTOR and inhibiting myostatin, we can activate anabolic pathways



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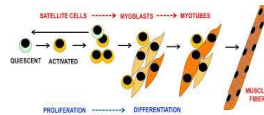
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## How BFRT Works

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- Rise in lactate induces satellite cell activation and proliferation
- Typically seen with moderate to high rates of muscle damage.
  - BFRT does not result in high rates of muscle damage



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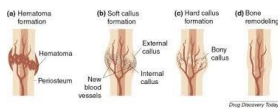
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## How BFRT Works

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- Hypoxic environment and lactate increases VEGF expression
  - Increases angiogenesis after fracture and injury and accelerates healing
- Studies being done on ACL tunnel and graft incorporation



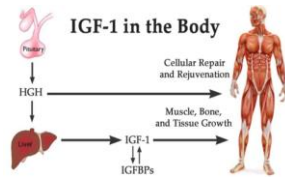
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## How BFR Works

- Soft tissue repair
  - Lactate stimulates Human Growth Hormone (HGH) production which leads to collagen synthesis
- Helps with muscle, tendon, ligament, and bone



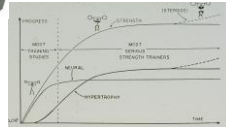
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## Blood Flow Restriction Training

- Training effects occur with low exercise resistance
  - 20-30% of 1RM with BFR = 80% 1RM without BFR
- Hypertrophy occurs as early as 4 weeks of training compared to 8-12 weeks with traditional training.

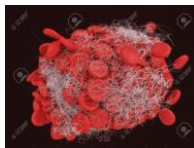


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## Safety

- Research shows BFRt is a safe and effective modality with low risk of thrombus and injury
  - All patients must be screened for risk factors prior to application
  - Numerous courses are available for clinicians
  - Clinicians must adhere to application and exercise recommendations



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## Combining Treatment Approaches

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## Advantages of Dynamometers

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- We can measure 1RM with isometric testing
- We can set precise exercise angles
- We can set the pace of exercise
  - 3-1 ratio isometric
  - 2-0-2-0 isotonic and isokinetic
- We can adjust resistance
  - Targets for isometrics
  - Isotonic mode by 1lb at a time on the fly
  - Isokinetic mode accommodates resistance throughout the ROM and exercise
- We can pre-set exercise protocols
  - 30-15-15-15 scheme

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## BFR Isokinetic Applications

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- Unloaded isometrics
- Loaded isometrics
- Isotonic pacing
- Isokinetic exercise

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## Unloaded Isometrics



- Setup the exercise as Isometric HAMSTRING and set angle to 60deg
- Adjust targets just below the resting weight of the limb
- Patient unloads the weight of the limb off pad
- 3 sec hold, 1sec rest
- 30-15-15-15 sets/reps
  - First set is 30 reps followed by three sets of 15 reps each
  - 60sec rest between

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## Loaded Isometrics



- Set the exercise as isometric QUAD and set angle to 60deg
- Find 1RM either with a full isometric test or with a trial rep
- Set target up to 20-30% 1RM
  - You can adjust the target as needed for fatigue
- 30-15-15-15 set/reps with 60sec rest between

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## Isotonic Pacing



- Isotonic Pacing Bar or Roadway application
- 2-0-2-1 pacing
  - 2 sec concentric, 0 rest, 2 sec eccentric, 1 sec rest
- 30-15-15-15 sets/reps and 60sec rest between
- You can set no resistance or light resistance and adjust as needed during the exercise

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## Isokinetic Exercise



- Set-up exercise as CPM mode and not isokinetic mode
  - See Rob's effort in video
- 2-0-2-0 pacing
  - Set ROM from 10-90deg (80deg total)
    - Velocity will be ½ that amount (40deg/sec) so that it takes 2 sec each way
- Continue with 30-15-15-15 sets, reps, and rest
- Resistance automatically accommodates to patient effort

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- BFR videos

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## Isokinetics 101 Program Review



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## Know Your Equipment

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- **Setups**
  - Perform each 10 times
  - Practice side-to-side switch
  - How to adjust
- **Exercise screens**
  - Biofeedback enhances exercise
- **Menus**
  - Know where everything is
  - Dashboard!!!!
- **Test reports**
  - Proper interpretation of results
- **Protocol Editor**
  - Create custom protocols

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## Know Your Patient

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- Select the appropriate tests to determine rehab needs and readiness for return to play.
- Understand the exercise progression/regression rules for each software application.
- Assess them and fit them into the appropriate isokinetic training category.

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## Pro-Active Approach

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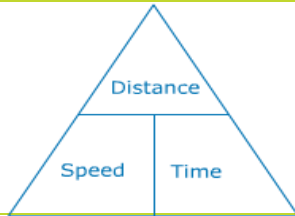
- Practical (Functional) applications of Isokinetic Eccentric Training for the 21<sup>st</sup> century

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## Distance Speed Time Formula

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## DECELERATION TRAINING

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Increasing The Speed Of The Eccentric Movement To Increase The Eccentric Force production.

Normally a 1:2 ratio eccentric to concentric timing.

Example: 20 degrees/sec Concentric: 40 degrees/sec Eccentric.

The first number represents the concentric speed, knowing that the eccentric speed will be twice that number.

Example: Deceleration 30/40/50 means the concentric speed is 30/eccentric is 60, 40/80, 50/100. Notice that as the numbers increase by 10 for the concentric speed it doubles that for the eccentric speed.

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## ECCENTRIC LOADING

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**Remaining In The Eccentric Mode Of Contraction Longer Than The Concentric Mode.**

Normally a 2:1 ratio eccentric to concentric timing.

Example: 20 degrees/sec concentric, 10 degrees/sec eccentric

The first number always represents the concentric speed, knowing that the eccentric speed will be half of that number.

Eccentric Loading 30/40/50

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## Questions/Answers

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**"Always pass on what you have learned"**

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## Other References

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- Music Provided by Bensound.com

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