Independent Comparison of Blood Flow Restriction Devices

By Patrick Edgecomb, Co-Founder
Regenerative Edge Physical Therapy & Wellness LLC

April 24, 2022

For a lot of great reasons there is a vast amount of information and discussion being shared currently about the benefits of BFR training for physical therapy, wellness and fitness. Since I have used BFR training both professionally and personally since 2015, I would like to share my experience with and a careful review of the most popular BFR devices available today.

To save time, here's the conclusion first:

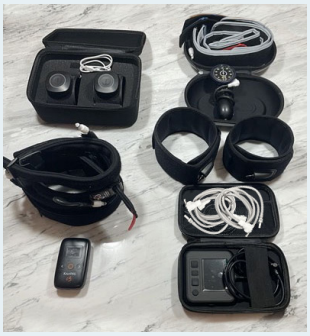
COMPARISON SUMMARY

	KAATSU C3	AirBands	B Strong	SmartCuffs	Delfi
Quick	A+	B	B	D	C
Easy	A	A	C	D	F
Comfortable	A+	B	A	D	D
Programmable	A+	B	D	C	B
Accurate	A+	C	C	C	B
Effective	A+	B	B	C	B
Price (4 bands)	$999.95	$628	$474.99	$399.99	$4,995
Overall	A+	B	C	D	D

Categories studied and my questions

1) **Quick:** Is set up, attaching to limbs, launch and use (inflate, deflect, sets) quick? What devices are involved?
2) **Easy:** How easy is it for the practitioner and user to use as instructed?
3) **Comfortable:** How comfortable are the cuffs/bands during calibration and use (whether wellness routines or exercise) and do they interfere with movement?
4) **Programmable:** What settings are recommended or possible?
5) **Accurate:** What is the accuracy, consistency and safety features of the device between limbs, during and between sessions?
6) **Effective:** What is the post use effect of using device? Is there a feeling of lactate creation, fatigue, irritation, soreness or condition improvement?
7) **Price:** What is the price for four bands including pumps?
8) **Overall:** Combine rating of all factors considered.

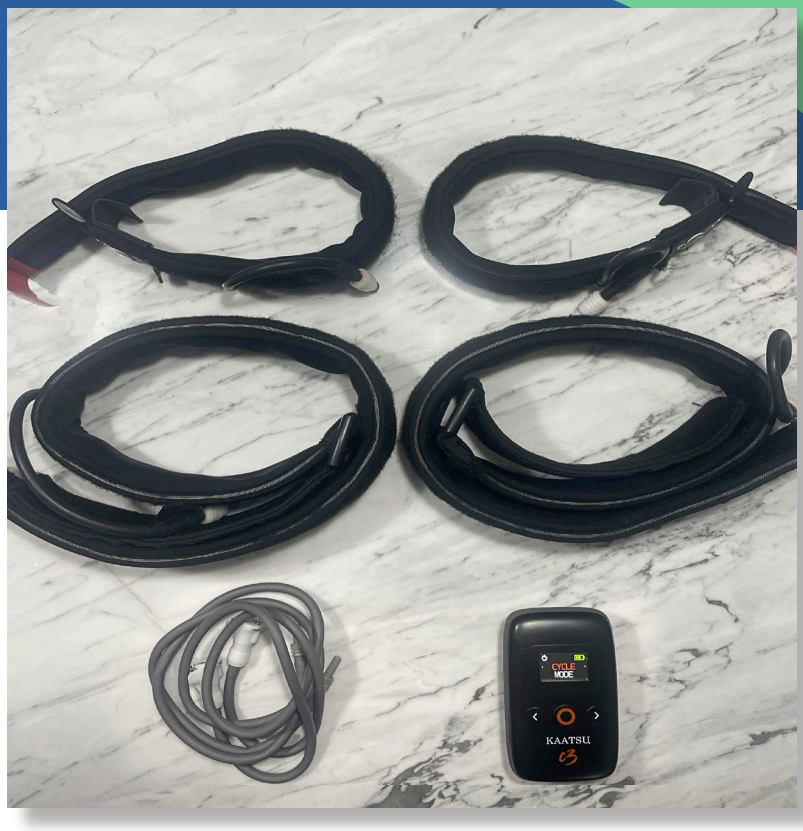
CONCLUSION



KAATSU offers the best value for the money. They also are the only device that allows for "cycling" of the air pressure with intermittent compression on the extremities and does not create blood occlusion but instead blood moderation and therefore safer and easier to use. They have the most research to support their claims as well. All other devices require a calibration that was at times inaccurate and unreliable.

Full disclosure, I have taken the official training certification courses for Delfi and KAATSU devices. I have used all five products extensively in clinical settings and retested each for this article. I followed instructions for use as prescribed by their manufacturer but it may be possible to use devices in other ways with different results.

KAATSU C3



Quick: A+

Setup is very fast. KAATSU has two options for users; Cycle or Constant mode. KAATSU recommends starting with Cycle mode which consists of 30 seconds inflation with 5 seconds of deflation repeated for 8 rounds with progressive increases in pressure. Each cycle should take about 4.5 minutes. It is recommended to start with the lowest setting and increase the pressure with each cycle up to 400 Standard KAATSU Units (SKU). The device has arm or leg bands attached with a tube to a controller that can slip in your pocket or clip on a waistband. Constant mode means the air tubes are detached from the bands so nothing is restraining your mobility. This is great for swimmers, runners, cyclists, cross-country skiing, yoga, etc.

Easy: A

The arm bands are easy to place on the limbs and tightened bands to the recommended amount which always allows for “one finger” to fit between the band and limb. It is also easier to connect the air tubes prior to putting them on your arms. This is not an issue for the leg bands. Operation of the device is simple with directions easily visible on the controller’s screen.

Comfortable: A+

These are by far the most comfortable bands that I tested whether deflated or inflated. During exercise, even with intense pressure, the bands remain comfortable and there is very little to no interference with both static or dynamic movements.

Programmable: A+

KAATSU is recommended when stationary (ex: sitting at a desk or on an airplane), and for vigorous or dynamic exercise / treatments. The controller allows for selection of various pressures, time settings, cycles and more. So users can set the device as a warm-up to harder sessions, for a hard workout or as a way to help specific muscles recover at the end of a workout. The KAATSU website has a vast amount of useful information and the user manual also goes deep on the physiology of using the device.

Accurate: A+

KAATSU is the safest of all BFR devices I have ever tested, and always allows for arterial blood flow. The bands slightly moderate venous flow and “pool blood” in the distal capillaries for optimal hormonal release especially in Cycle mode. Also, the calibration was consistent from session to session and from limb to limb. Even when underwater if used while swimming, the calibration stays accurate.

Effective: A+

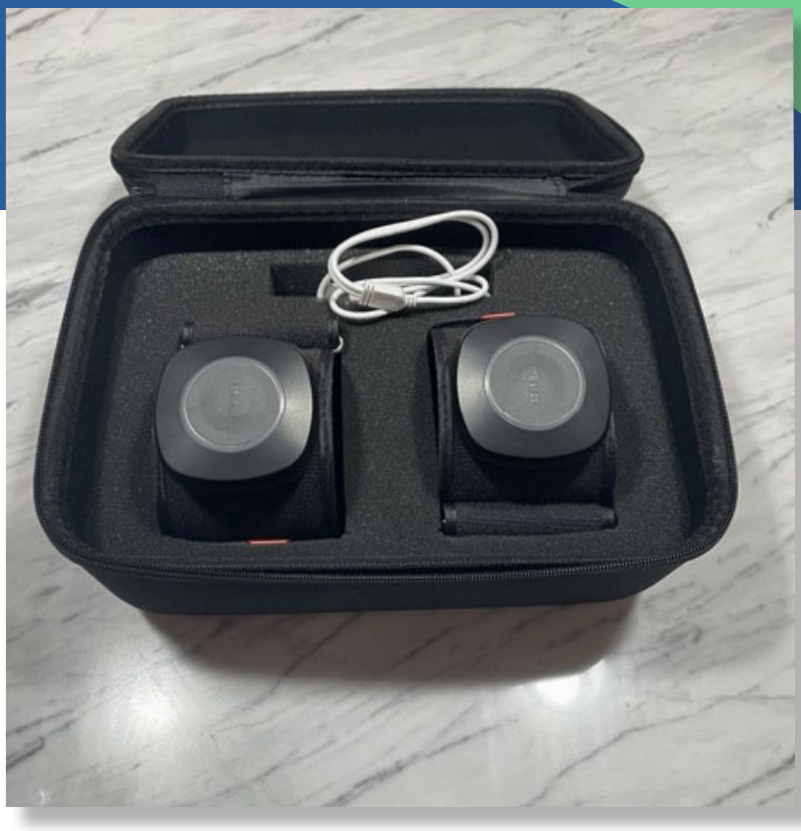
If you select only a light pressure, the user may feel relaxed with only some feeling of muscle activation in the extremities. If pressure is set higher, users may feel the buildup of lactate and possibly some soreness in muscles later that day. But the user in our experience will not feel super sore the next day after use. You can actually use the device multiple times per day to facilitate tissue healing from an injury or help with recovery with limited or no discomfort. As long as used according to instructions, users in our experience will notice improvement in condition with little or no soreness.

Overall: A+

No other device we know of has KAATSU’s patented intermittent pressure and increasing of pressure from low to high. Albeit more expensive than other choices, the safety, accuracy, ease of use, plus achievement of desired outcomes for the user make it our top recommendation.

AirBands

(Also sold as Saga BFR cuffs)



Quick: B

The initial setup is moderately quick if you don't mind downloading an app to your phone. The cuffs have built-in compressors which inflate to the desired pressure via bluetooth connection to the users' phone after turning on the app. The app has a screening tool to determine if safe for the user to do BFR training. The app recommends pressure settings but you can also enter your own settings.

Easy: A

Since no hand pumps or control devices, you can perform exercises physically unconnected from any external objects which makes it useful for athletes. You still need your phone to operate it though.

Comfortable: B

The bands are sometimes uncomfortable during exercise as they can dig into the inner arm/thigh as exercise gets more intense. The calibration is somewhat difficult and not comfortable. The device uses Limb Occlusion Pressure (LOP) to find a pressure setting for obtaining total occlusion. Once found, the bands are inflated to a pressure less than the LOP for training (50% of LOP for arms; 80% LOP for legs). The problem with all devices using LOP to determine pressure settings is occlusion is dangerous and usually not recommended. Only KAATSU does not use LOP or occlusion in any way.

Programmable: B

The phone app has the basic settings but doesn't have many details about how to perform BFR training. They recommend you seek out a medical professional to use the bands safely.

Accurate: C

Calibration is through one arm or one leg band even if user is wearing a band on each extremity. The bands appear to partially allow for arterial blood flow and potentially stop some venous return of blood. The pressures that were recorded when I ran the calibrations varied greatly. I initially tested my LOP one morning on each arm and got 164 mmHg on the left and 165 mmHg on the right. Later in the day, when I recalibrated my LOP after exercise, I got 197 mmHg on the left and 270 on the right. That is a pretty large discrepancy in LOP that would also affect what pressure I would be using for training. Also, the calibration was not consistent from session to session. Accurate calibrations are important for doing BFR correctly.

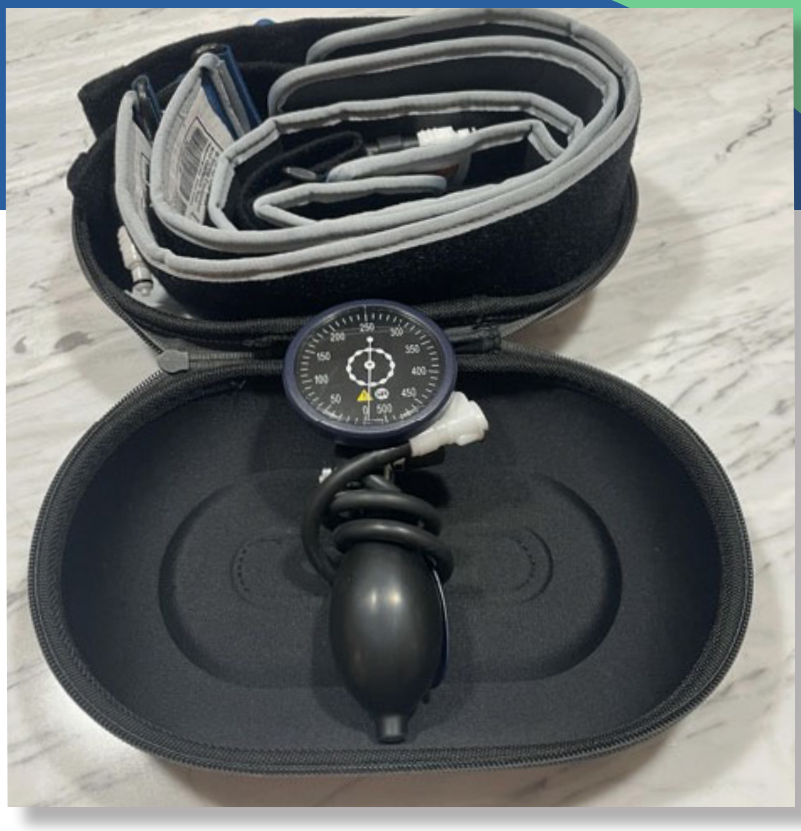
Effective: B

There was some localized soreness where the cuffs were inflated on the arms. This is expected since the device provides only consistent pressure, no cycling of pressure is possible. Definitely could feel lactate in the extremities with light exercise. Muscle exertion shortly after competing sets felt good but was brief. There was some light skin irritation on the inner arm that could be seen the next day. Using the bands on consecutive days was uncomfortable because of the irritation from previous day's use.

Overall: B

This device is cool looking and the app makes it easy to screen out people who may not be good candidates for BFR. The wireless device is also an advantage for many users and specific exercises. Unfortunately, the calibration is painful and inconsistent. The bands are cumbersome when moving. The device also don't allow for intermittent pressure so it is hard for someone to train for longer periods or get maximum BFR benefits.

B Strong bands



Quick: B

These bands are definitely the simplest of those tested. But that is not a compliment. They are the hardest to use as prescribed. A hand pump is used to inflate the cuffs to the “desired pressure”. The pressure is constant. They have no ability to use intermittent cycles of compression.

Easy: C

After inflating each cuff individually, I found there is a good chance the cuffs will lose air as you move around. So you need to consistently monitor the pressure manually as you exercise. At the same time. It is easy to modify the pressure via the hand pump if you feel the pressure may be too intense.

Comfortable: A

These bands are very comfortable even when inflated to high pressures. Their design, similar to KAATSU, appears to have air pockets throughout each band that can dissipate the compressive forces while the bands are inflated. During exercise the bands are comfortable and narrow enough to allow full mobility of local musculature without impeding exercise.

Programmable: D

Since there is no control module, just a manual pump, no programming is possible. Even if you make or follow an exercise plan, having to interrupt a training session to re-inflate the cuffs to a desired pressure interrupts the flow and is frustrating.

Accurate: C

B-strong bands are accurate enough if you know a lot about BFR training. As you perform more sessions with them it becomes easier to gauge the correct level of tension. Again, these bands do not offer intermittent compression and it is up to you to determine the correct pressure to use. I found the calibrations were relatively different from session to session and from limb to limb. The design of the cuffs does help to ensure that you get more venous compression versus arterial or nerve compression. Warning though, if you inflate the cuffs too much it would be easy to cause arterial blockage.

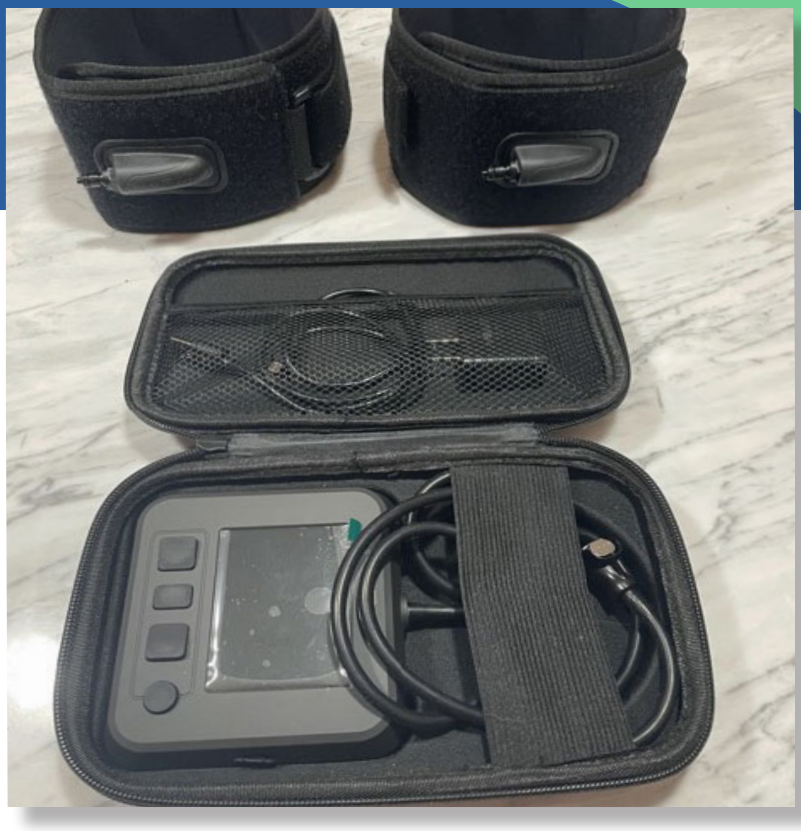
Effective: B

After use there is a good amount of fatigue and feeling of lactate build up in the tissues with these bands. The bands cause very little localized damage at the site of compression. I also experience minimal soreness directly under the bands during use and afterwards.

Overall: C

These bands are the cheapest of all the ones that were tested here. They also require the most experience to use properly.

SmartCuffs



Quick: D

Not a super great design. It doesn't have an on-screen process for how to set it up if not already trained in BFR exercise. There is an option to choose between low, medium or high intensity for arms or legs. For arms this corresponds to 40%, 45% and 50% of LOP and on legs it is 70%, 75% and 80% of LOP. The manual suggests re-calibrating the pressure every 2-4 weeks but blood pressure is always changing. The device only allows you to train with constant pressure on the arms or legs. It does not provide much information on how to set it up correctly or how to adjust it to someone who may not tolerate it well.

Easy: D

Not easy at all. You need to calibrate each limb separately and then inflate separately. You can't be active while doing this. I checked calibration a few different times over the course of one morning and the numbers varied greatly.

Comfortable: D

When calibrating or inflated to tight pressures are not comfortable at all. With exercise, they dig into your inner arm or inner thigh and get worse with movement.

Programmable: C

The device is pretty bare bones. There is not a lot of guidance in the instruction manual. Also, the recommendations are very basic. They suggest doing reps of 30-15-15-15 at a weight of about 20% of 1 RM and choose exercises like a squat, hip hinge, upper body push or lat pull downs. For aerobic exercise they suggest that you use Heart Rate Reserve (HRR) to determine if you are training at the correct intensity. The manual suggests that you only wear cuffs inflated for no more than 20 minutes.

Accurate: C

Device does the bare minimum for BFR training. For the accuracy of calibrations from test to test were not maintained. When I tried calibrating my legs, it did not work roughly 50% of the time. Also the calibration was not consistent session to session or from limb to limb. The device couldn't show a reading in the supine position. When I switched to the seated position, the LOP number jumped to nearly 280 mmHg.

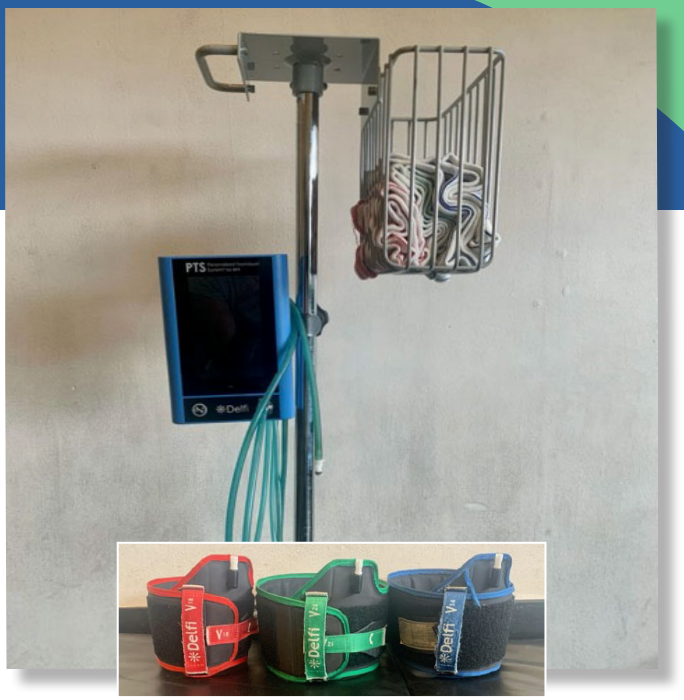
Effective: C

The device can definitely cause fatigue and muscle soreness if used as prescribed. It is difficult to assess how much soreness is DOMS versus muscle fatigue. Patients will likely have more soreness where the cuffs are inflated given the poor design.

Overall: D

It's hard to justify using this device when all of the other ones seem superior to it. It might be a little cheaper but you would be as safe using this as you could with using flossing bands at a subjective intensity of 7/10.

DELFI



Quick: C

This unit is not well designed unlike the other units listed here. Each Delfi unit can only be attached to one inflatable cuff at a time so the time needed to train doubles or you must buy two devices to operate simultaneously. The set up for each session takes more extra time because the user must be supine to measure the pressure for each extremity to safely train. Delfi only provides constant pressure. Interestingly, this device has a setting to perform ischemic preconditioning which means full tourniquet mode applied for 5 minutes then released for 3 minutes, repeated for about three rounds. Some research has shown it may be helpful to "prime" tissues before performing exercises. It would be just as effective and much cheaper to use wide elastic bands wrapped around your legs or arms for the same task.

Easy: F

As stated above, each session takes a while to set up because of the need to calibrate the pressure for each limb for each session to safely train. The unit is very large and needs to remain attached to the user by an inflatable tube. The most common set up I've seen in clinics is to have the unit attached to a rolling IV stand. This makes it very cumbersome to perform exercises. Unlike all of the other devices listed here you cannot train untethered from the control unit.

Comfortable: D

This cuff is very uncomfortable. In our reviews, it is most likely one to cause localized tissue damage that could include arterial nerve impingement during exercise. Anecdotally, I've seen patients use this device and quickly experience increased distal numbness and/or tingling more than with any other devices we've ever tested.

Programmable: B

The Delfi unit provides narrow parameters for performing BFR training but there is an option to override the recommendations and adjust the pressure. You can also perform a different rep scheme than the 30-15-15-15 with 30 seconds rest between sets they advise. Delfi recommends lower body or upper body strength training with a weight that is roughly 20-30% of 1RM (one rep max weight) for muscles under the cuffs. They recommend 50% 1RM if muscles are proximal or distal to the cuffs. This doesn't make sense to me from an exercise stand point. But the size of the cuffs are very large and the muscles under the cuffs will be more impeded. Delfi offers a BFR course. The course helps troubleshoot problems arising from errant pressure calibration that comes up too often when using the device.

Accurate: B

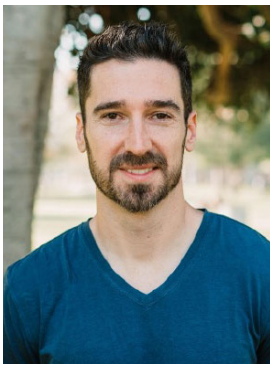
The pressure calibration seems fairly consistent during the same session but between sessions there was some variance. It is easy to accidentally choose the incorrect limb when calibrating each which in turn delivers incorrect recommended training pressures. Most users will catch this but if missed, it would be easy to apply 80% LOP to an arm and fully occlude arterial blood flow. Their course recommends calibrating pressure at each session but in practice I've rarely seen it done because time consuming and inconvenient. The device has a large easy to see screen to adjust the speed of exercise and measure rest periods. The newer model also has on the screen the number of reps to complete per set (standard setting is 30-15-15-15).

Effective: B

This device gives the feeling of muscle fatigue and lactate buildup following a session. And there is more localized tissue damage around the site of the inflatable cuff. The leg cuff definitely digs into the groin/hamstring and the arm cuff definitely digs into the brachial artery/nerve bundle. I've seen patients with increased sciatic symptoms the day after doing knee extensions using the Delfi unit. This usually occurs in patients that already have some nerve sensitivity but I would not recommend performing exercises that place excessive tension on the peripheral nerves (i.e. skull crushers or seated knee extension) until the patient is screened for nerve sensitivity.

Overall: D

This grade is predominantly a result of the risks, discomfort, cost, size and difficulty using in non-clinical settings. It definitely advertises as the most useful in the clinical setting but once compared with other devices it would be hard to justify getting. The ischemic preconditioning setting is neat but as I said earlier, this could be accomplished with two wide elastic bands at a fraction of the cost. Also, the increased chance of nerve discomfort/damage and pain following sessions is unacceptable.



Patrick Edgecomb

Patrick Edgecomb has a doctorate in physical therapy and is a Board-Certified Orthopedic Clinical Specialist. He and his wife, Courtney Edgecomb, also a physical therapist, co-founded Regenerative Edge Physical Therapy and Wellness LLC. They operate PT clinics in New Haven and Hamden, Connecticut plus a mobile PT unit on the Connecticut shoreline. They specialize in treating patients with orthopedic, athletic, pelvic, pregnancy, and postpartum issues. Patrick can be reached at Patrick@REdgePT.com or via www.REdgePT.com.

Regenerative Edge

Physical Therapy & Wellness