NFPT CEC Self-Test Packet

Fueling for Success

Pre and Post Workout Meals

FUNCTIONAL IMAGERY TRAINING

Re-Injury Prevention

A FRESH PERSPECTIVE ON A PREVELANT PROBLEM

Ice or Heat for Pain?

BIANNUAL EDITION: December 2019

Continuing Education Articles for Personal Trainers
from www.nfpt.com/blog

National Federation of Professional Trainers

NFPT SELF - TEST

DECEMBER 2019 EDITION

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This packet includes continuing education articles that come from NFPT's Blog. Articles for this December 2019 self-test edition are from the publication months July 2019 to November 2019. All articles are enclosed here to assist you with answering the questions in the back of this packet. If submitting your answers in hardcopy, complete the bubble sheet provided (include your name and contact information) and return to:

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NOTE: there are articles in this packet which contain links and/or references to resources and information only available online. Go to: www.nfpt.com/blog/cec for these additional resources.

We thank you for your commitment to the fitness industry and to the NFPT organization of trainers. Please contact us at 800-729-6378 or at info@nfpt.com with any questions, or to just be in touch. *We wish you continued success in your endeavors!*

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Functional Imagery Training: Visualizing Performance and Health Success

Personal trainers might be interested to learn about Functional Imagery Training (FIT), a new motivational intervention that utilizes mental visualizations to achieve personal goals.

"Tell me and I forget. Teach me and I remember. Involve me and I learn."–Benjamin Franklin

Our brains are best wired to learn by being fully immersed in an experience versus reading or hearing about the same experience. However, only recently have scientists harnessed this power by involving and channeling mental imagery toward successful behavioral change. As personal trainers, we can employ this same methodology to help clients reach their goals.

The Root of the "Behavior Change" Challenge

In England, over half of the adult population is overweight and physically inactive. Sadly, a similar situation exists throughout many countries, including the US. According to statistics, a sustained weight loss of 5-10% of one's bodyweight goes a long way towards reducing risk of health problems and potential costs associated with the long-term management of obesity. Technology has the potential to help each of us make lifestyle changes; however, there is a need for *personalized motivational support* in order to sustain long-term shifts in behavior.

Human behavior is at the root of "lifestyle conditions" such as heart disease and diabetes. Simply prescribing different behavior – a healthier diet or smoking cessation– is generally ineffective, and with good reason: *changing habits requires motivation*. **Often individuals do not follow through with suggestions for change coming from doctors or therapists, even if they agree with the premise**. As psychological science has shown, drug cravings exert a powerful dominance over other thoughts due to the power of mental imagery (*I enjoy my smoke breaks at work*); when channeled properly, that same process could make us work successfully towards new goals, despite significant obstacles.

Imagine a "New" You

FIT is based on the Elaborated Intrusion theory of desire, which describes the conscious experience of craving as a cycle of mental elaboration of an initial intrusive thought triggered by environmental cues. **FIT works by training the habitual use of personalized, goal-directed mental imagery to plan behaviors, anticipate obstacles, and mentally try out solutions from previous successes.** It uses imagery to increase desire and self-efficacy for change.

Delivered in the empathic and respectful client-centered spirit of Motivational Interviewing (MI), FIT allows participants to act as experts on themselves, thereby assisting them in identifying their own goals and related behaviors rather than trying to convince them to adopt a preset regimen.

The FIT protocol prescribes similar steps to MI:

- eliciting one's incentives for change
- exploring discrepancies between core values and current behavior
- boosting self-efficacy
- developing specific action plans for implementing a commitment to change

At each step, FIT also invites participants to cultivate personalized imagery to maximize its emotional impact.

Cultivating Self-Efficacy

Once a person develops a plan for change, he becomes his own FIT therapist, supporting his unique autonomy and ability to respond to self-management challenges using imagery. Individuals learn how to develop the cognitive

habit of practicing goal-related imagery in response to cues from a routine behavior, and further, to generate this imagery whenever motivation wanes.

Imagery encompasses more emotive than verbal thought; as such, vivid functional imagery sustains desire for change until each new behavior becomes a habit. Functional imagery also interferes with cravings when temptations occur, by competing for working memory with craving imagery. Detailed bouts of imagery grounded in experience allow one to anticipate problematic situations as well as plan and rehearse effective responses. Repeated successes in this endeavor increase self-efficacy over time.

The Science Behind Functional Imagery Training

In a recent study, overweight individuals who were instructed in FIT lost an average of five times more weight than those engaging in talk therapy alone. FIT encourages a client to come up with his own imagery of what change might look/feel like to him, and then how to achieve/maintain progress in the face of obstacles/challenges.

During the study, all participants received two sessions of their allocated intervention, which included an hour-long face-to-face session, followed by a second phone session lasting no longer than 45 minutes. "Booster calls" of up to 15 minutes in length were provided every two weeks for three months, dropping to once a month for another three months. Maximum contact time totaled four hours of individual consultation. Participants were assessed at baseline, the end of the intervention phase (six months), and again at 12 months post-baseline. At the six-month mark, FIT participants had lost 4.11 kg and saw a reduction in waist circumference of 7.02 cm, compared to a 0.74 kg weight loss and a 2.72 cm reduction in waist circumference seen in the MI group.

Nixing the Snack Attack

In a related research study, scientists at the University of Plymouth tested how a single session of FIT plus a booster phone call might affect snacking. Forty-five participants who wanted to lose weight or reduce snacking were randomly assigned to receive a booster call immediately following the FIT session *or* after a two-week delay. High-sugar and high-fat snacks were recorded using timeline follow-back for the previous three days, at baseline, and then again at the two- and four-week mark.

At two weeks, snacking was lower in the immediate group than in the delayed group, and the reduction after FIT was replicated in the delayed group between two and four weeks. Frequencies of motivational thoughts about snack reduction rose following FIT for both groups, and this change correlated with reductions in snacking and weight loss. By showing that FIT can support changes in eating behaviors, these findings clearly indicate its potential as a motivational intervention for lifestyle weight management. It remains to be determined if combining FIT with diet and physical activity education would generate superior outcomes.

Imagery and Athletic Prowess

A study on soccer players designed to measure the effect of FIT on players' grit, a personality trait associated with perseverance for a long-term goal, revealed interesting results. The participating players agreed that FIT had helped them improve performance on the soccer field. The researchers also noted that the impact of FIT seemed to continue beyond the interventions during the term of the research, with improvements after six weeks of intervention and significant gains after 12 weeks. Scientists openly admit that a significant degree of subjectivity coupled with a plethora of unknowns exist when trying to measure things like grit and determination. FIT techniques, if applied consistently and by knowledgeable practitioners, should help create more meaningful data for future researchers. In the meantime, we can arm ourselves with knowledge on this fascinating subject, adding to our already full and varied "bag of tricks" for helping our clients succeed on all levels.

Dynamic Deltoids: Understanding and Training the Shoulders Muscles

The deltoid muscle, otherwise known as the deltoideus or shoulder muscle, consists of three distinct “heads” with very different joint actions that, when engaged simultaneously, work together to produce shoulder abduction: the anterior deltoid, the middle deltoid and the posterior deltoid. Each fiber has a separate origin and but they share one point of insertion.

What’s remarkable here, however, is that at least two studies of cadavers and healthy volunteers indicate that each head invests into the insertion via separate tendons. PET scans indicate the anterior deltoid can be divided into two segments and the posterior deltoid can be divided into four distinct segments (the middle deltoid remains a solitary unit) for a total of seven (I-VII) compartments.

This suggests, and was supported by testing, that each segment’s fibers can separately perform a distinct motion from the remaining fibers.

The Anterior Deltoid

Also known as the front deltoid.

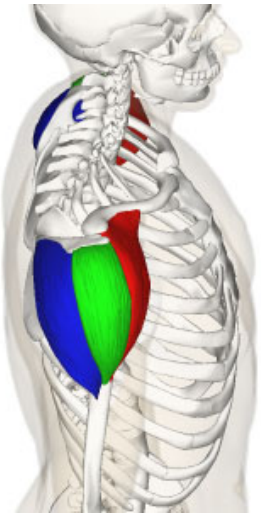
Origin: The anterior, superior surface of the lateral third portion of the clavicle. It inserts into the deltoid tuberosity on the lateral aspect midway down the humerus.

Function: The anterior deltoid works as a synergist to pectoralis major for shoulder flexion and transverse (or horizontal) adduction (as in a chest press). These fibers also assist the subscapularis and latissimus dorsi with internal rotation.

But that’s not all! When working in unison with the middle and posterior fibers, the anterior delt also performs shoulder abduction, especially when the humerus is externally rotated, as in an overhead press. In fact, it becomes the primary shoulder abductor in this position.

When medially or internally rotated, the fibers of the first segment (I) of the anterior deltoid will actually contribute to *ad*duction, or returning from being raised in the scapular plane.

Chew on that for a moment: Anterior deltoid fibers perform shoulder flexion, transverse adduction, abduction, *and* adduction.



The Middle Deltoid

Mistakenly referred to as the medial deltoid. It is not since *medial* refers to a location close to the midline of the body, not the "middle". In fact, this is more accurately referred to as the lateral or side deltoid.

Origin: The lateral and superior surface of the acromion. It also inserts into the deltoid tuberosity, though somewhat posterior to the anterior deltoid.

Function: Shoulder abduction when the shoulder is medially rotated. However, when the shoulder is externally rotated, the middle deltoid assists in transverse abduction, as in a supinated wide row or a banded "W" pull.

The Posterior Deltoid

Also known as the rear deltoid.

Origin: Just inferior to the posterior border of the spine of the scapula.

Function: Transverse adduction. Assists latissimus dorsi in shoulder extension. May also contribute to shoulder external rotation, though this is not its primary role and it may become *synergistically dominant over the primary external rotators: the infraspinatus and teres minor.

The rear compartments of the rear delt, VI & VII, will also contribute to shoulder adduction.

**A note on the rear delt*: Because of the synergistic dominance that is common with these fibers, they have a tendency to become overactive. However, this overactivity occurs when other shoulder muscles become over/underactive, evidenced by imbalanced posture and shoulder dysfunction. Such dysfunction, such as short pec minor/major and lats, will cause the rear delt to rest in a lengthened position. *That means, stretching the muscle is not a remedy for overactivity.* Instead, a static manual or self-myofascial release may reduce signs of overactivity and synergist dominance in these muscle fibers.

Unified Movement of the Deltoids

While the separate fibers of the deltoid can by synergists in several joint actions, its principle role as a single unit when all fibers contract simultaneously is shoulder abduction. When the shoulder is medially rotated, the fibers are able to contract to their maximum potential. This is one reason why the upright row is a favored shoulder movement.

However, it bears mentioning that placing the humerus into medial rotation may cause impingement of the humeral head within the glenoid fossa. Only healthy, balanced shoulders should perform this motion and with great care.

Exercising the Deltoids

As mentioned above, the one movement that will target all three heads of the deltoid is shoulder abduction. For most general fitness and weight loss clients, this is the only targeted shoulder movement that is worth programming. The compound movements for chest (push-ups, chest press, dips) and back (lat pul-down, pull-ups, chin-ups, rows) will recruit the deltoids adequately.

For those who are geared towards hypertrophy and would like to focus on developing the deltoids further, there are certainly options:

Dumbbell or *cable front raise: Raising one or both straight arms out in front of the body into shoulder flexion will target the anterior deltoid fibers. Changing the hand position will vary the degree of fiber recruitment. Since we know that the anterior fibers assist in media (internal)l shoulder rotation, rotating the palms down into pronation will shorten the anterior fibers more than supination.

To maximize that contraction, you might start with the hands supinated and rotate into pronation by the time the arms reach 90 degrees of flexion. Be mindful to keep the shoulders depressed during this motion to reduce likelihood of humeral head impingement. If you feel uncomfortable, or "crunchy" while performing this rotation (or the front raise with any hand position) then abandon this motion.

Dumbbell or *cable lateral raise: The middle deltoid is recruited most during simple shoulder abduction with the shoulder in medial rotation. That means, outside of an overhead press, raising straight arms out into abduction in the frontal plane will also effectively recruit these fibers.

Again, the caveat here is that most shoulder joints do not like being extremely medially rotated, and the humeral head may rub or become impinged in the joint. A compromise is to keep the palms neutral during abduction. Supination is an option as well, but this will now emphasize the anterior deltoid over the middle deltoid. Finally, flexing the elbows to 90 degrees and performing abduction with dumbbells or a machine will also emphasize the middle deltoid while also minimizing joint stress.

*Using a cable will exert resistance sooner than the gravity of a free weight will, creating more muscle tension through the exercise.

Reverse Flye: Essentially transverse abduction, a reverse flye will emphasize posterior deltoid contraction, (and middle delt if the shoulders are more externally rotated) but will also recruit other back musculature such as the rhomboids, trapezius, and even levator scapulae if shoulder elevation and scapular downward rotation are an issue. This exercise should only be employed if shoulder mobility is sound and the posterior deltoid is NOT overactive.

High Pulley Row: (Or Face Row) This variation of the row will recruit the posterior delt as a synergist to the lats. If you keep your arms and hands wide and palms supinated (causing the humerus to adduct more that when palms are neutral or pronated), then the middle delt will also fire.

Best Approach For Deltoid Programming

For general fitness and weight loss clients, the focus should always be on compound movements over isolation movements. Because the shoulder joint is so vulnerable to injury compared to other joints, the deltoids in particular, should not be emphasized given the risk-benefit ratio. However, many activities of daily life involve lifting things overhead, and indeed, many people can get injured this way (like lifting a carry-on into an overhead compartment). So, programming an overhead press in its many variations is probably a good idea.

For athletes or hypertrophy clients, isolation exercises can be performed with care. No one wants an injured shoulder, definitely not an athlete that utilizes the shoulder to perform his or her chosen sport. Pay attention to form, apparent discomfort wincing or twinges. Ask for feedback from your client if he or she is unlikely to report discomfort or injury.

Performing shoulder mobility assessments is a worthwhile endeavor given the problems that tend to arise in the shoulder joint. Even programming some corrective work may be a welcome challenge for most clients. And you will have better prepared them to move forward with deltoid development.

The Delicate Sodium-Potassium Balance and Summer Heat

The summer season brings with it heat and humidity, and when humidity levels exceed 70%, that excess moisture can interfere with the body's ability to sweat and cool itself as it attempts to maintain homeostasis. This can spell trouble for some clients who like to exercise outdoors, or perhaps, work out in a facility without A/C.

Personal trainers armed with a deeper knowledge of the physiology of bodily heat regulation and the sodium-potassium balance can successfully prevent serious health issues from arising. **Although anyone can be impacted by heat and humidity, individuals over the age of 50, those who are overweight, or those who have comorbid heart, lung, or kidney issues run a higher than normal health risk.**

If you work with clients who fit this description, knowing when and how to address this concern can mean the difference between a good workout and an exhausting wasted effort.

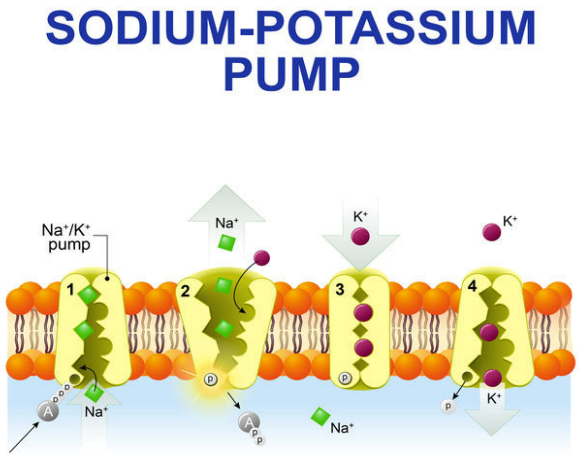
When Heat is High, Blood Pressure is Higher

Blood pressure specifically may be affected in summer weather because of the body's attempts to radiate and disperse heat. High temperatures coupled with high humidity cause more blood flow to the skin, placing heavy demands on the heart to exert extra effort. Heat and sweating can also lower the amount of fluid in the body, thereby decreasing blood volume and increasing risk of dehydration, placing even more strain on the heart. In some cases, the body may circulate twice as much blood per minute compared to a cool day.

Sodium-Potassium Pump: Striking the Perfect Balance

The human body's cardiovascular system relies on a delicate yet critical sodium-potassium balance in order to pump optimally. **A number of studies have shown an association between low potassium intake and increased blood pressure compounded by a higher risk of stroke.** Individuals already living with and managing high blood pressure can significantly lower their systolic blood pressure reading by increasing potassium intake through healthy whole-food choices.

Recent research found that in the absence of hypertension issues, women who consumed the most potassium (nearly 3,200 milligrams per day) had a 21% reduced risk of stroke. Those whose diets were rich in potassium were also 12% less likely to die during the time frame of the study than those did not focus on this element in daily meal plans.



Sodium-potassium pump or sodium-potassium adenosine triphosphatase. After binding ATP, the pump binds 3 ions sodium. ATP is hydrolyzed. The ions go to the outside. Then the pump binds 2 extracellular potassium ions and transports the ions into the cell.

How Potassium Protects Us

Foods that are rich in potassium are important in managing high blood pressure in addition to overall health. **The more potassium one consumes, the more sodium will be lost through urine output.** Most of the body's supply of potassium resides inside the cells as opposed to sodium, which resides outside the cells. To that end, potassium eases tension within blood vessel walls, further helping to lower blood pressure and guard against muscle cramping.

In addition to helping to maintain a proper fluid balance in your body, potassium also fosters the following functions:

- Ensures proper clotting
- Protects the stomach lining from acidic damage
- Maintains healthy blood pressure
- Promotes heart and bone health
- Maintains the body's pH balance
- Carries nutrients to the cells

All Sodium is Not Created Equally

Salt in one's diet provides two key elements – sodium and chloride –which are essential for life. The human body cannot make these elements on its own, so the proper amounts of each must be obtained through one's diet. However, not all salts have the same effect on the body's various systems.

It is important to keep in mind that, aside from the basic differences in nutritional content, it is the *processing* that renders table salt detrimental to our health. Table salt is mined salt from the earth and the processing is intended to remove the minerals, some of which may be unfit for consumption. But it also removes the minerals we *need*. The human body operates optimally by consuming natural, unprocessed salt, *without* the addition of potentially harmful chemicals, anti-clumping agents.

Consider the following data:

- Natural unprocessed salt, such as sea salt and Himalayan salt, contains about 84% sodium chloride; about 37% of this is pure sodium. The remainder consists of naturally-occurring trace minerals, including silicon, phosphorus, and vanadium. (table salt contains about the same percentage of sodium)
- Himalayan salt boasts a higher potassium content in comparison to other salts, including naturally occurring sea Celtic salts. Himalayan salt contains 0.28% potassium, compared to 0.16% found in Celtic salt, and 0.09% in regular table salt.

Adding Potassium is Easier Than Reducing Sodium

The balance between sodium and potassium may be a deciding factor in whether an individual's salt consumption will ultimately be harmful or helpful. The authors of one research study proposed an interesting approach: rather than recommending aggressive sodium reduction across the board, they raised the possibility of consuming a high-quality diet rich in potassium.

This, they surmised, might achieve greater public health benefits, most notably blood-pressure reduction. As observed by one scientist, Dr. Martin O'Donnell of McMaster University, "… it is easier for people to add things to their diet than to take away something like salt."

Potassium, Athletes, and Food Sources

Today's American diet suggests that most individuals barely consume half of the recommended Adequate Intake (AI) of potassium — 4,700 milligrams (mg) a day. **Because potassium is lost through sweat and urine, athletic and very active clients might need reminding to consume potassium-rich foods each day.**

Low potassium levels can reduce energy and endurance, given its role in the storage of carbohydrates to fuel muscles. The frequency and degree to which muscles contract depend heavily on an appropriate potassium/sodium balance in the body.

Beyond the highly touted banana, many melons and citrus fruits, dark green leafy vegetables, lima and kidney beans, sweet potatoes, nuts and fish are delicious, dense sources of potassium that incorporate easily into a variety of recipes.

At-Risk Populations

The data from a 2011 federal study into sodium/potassium intake, published in the *Archives of Internal Medicine*, was one of the first and largest studies undertaken in our country to evaluate the relationship of salt, potassium, and heart disease deaths.

As the scientists expected, participants who consumed an abundance of salt and very little potassium were more than twice as likely to die from a heart attack as those whose diets contained equal amounts of both nutrients. E**vidence continues to point towards the correct potassium to sodium balance exerting a greater influence on one's risk for high blood pressure and heart disease than high sodium intake alone.**

While we have been extolling the benefits of healthy potassium consumption, such a practice can be harmful to individuals with kidney disease or any comorbid condition that affects how the body handles potassium.

In patients with chronic kidney disease (CKD), the higher the ratio of urine sodium and potassium over a 24-hour period, the faster the deterioration of renal function. Research has elucidated how low sodium intake coupled with a dedicated consumption of foods higher in potassium could delay the deterioration of renal function. In addition, certain prescription medications can render the processing of potassium problematic.

Acknowledging the legal scope of practice to which personal trainers adhere, we may point these issues out to clients; however, such matters are best left to the judgment of a client's physician or registered dietitian.

BFR Training: How it Works and How to Use it with Fitness Clients

If you are immersed in the world of fitness, chances are you have already heard of, or seen, or researched blood flow restriction (BFR) straps and training, also known as occlusion training. What on the outset may appear to be a fitness fad, there is plenty of solid research backing up the efficacy of this training methodology across a variety of approaches and outcomes to improve size and strength, endurance and speed. While it's getting the limelight more today than ever, the concept was first studied in 1994 by Dr. Yoshiaki Sato in Japan.

What is BFR Training?

Although the exact mechanisms for creating muscle growth aren't totally clear, most agree that mechanical loading coupled with metabolic stress are the primary drivers spurring hypertrophy. What exactly is metabolic stress? It is "a physiological process that occurs during exercise in response to low energy that leads to metabolite accumulation [lactate, phosphate inorganic (Pi) and ions of hydrogen (H^+)] in muscle cells."

Resistance training results in this metabolite accumulation, which then has a cascading response of hormone release, hypoxia (trapped blood), heat shock proteins (highly conserved "stress" proteins) and cell swelling (Conrado de Freitas et al, 2017). This cascade ultimately results in greater growth hormone release and Insulin-like Growth Factor (IGF-1), which have an anabolic effect on adults contributing to muscle adaptations and growth.

BFR as a strategy works by intensifying this metabolic stress effect. A strap, wrap, band or some other tightening device is placed around the working limbs in order to restrict the outgoing veinous blood supply but to allow the deeper, incoming arterial blood flow to continue unaffected. Mechanically, the result is more trapped blood and accumulation of metabolites in the active muscle tissue, which causes the cells to swell.

This, in conjunction with greater metabolic stress than training *without* the BFR, is thought to be responsible for greater strength gains and hypertrophy than *load-matched* traditional resistance training. In other words, put the straps on and pick up the same weight you've been lifting and your results will be more significant.

BFR can be successfully employed with endurance activities such as walking, but is most commonly used with resistance training. It has been researched in a myriad of exercise settings with impressive results.

BFR for Hypertrophy

It appears that Type II muscles are recruited in greater numbers when BFR methods are employed, most likely since the restriction causes increased muscular fatigue even with low relative loads. You know what that means. Type II fibers respond to metabolic stress by growing.

In studies where low-load BFR resistance training was compared to traditional *high*-load resistance training *without* BFR, the results indicate similar outcomes on measures of hypertrophy.

So what happens when the *same* loads are used with and without BFR?

A meta-analysis of 13 studies determined that hypertrophy was greater in the groups utilizing BFR than the groups that didn't. What's even more interesting is that using BFR with non-resistance training, such as walking, is effective for hypertrophy compared to that same activity without BFR.

This means traditional endurance activities can result in muscle growth when blood flow to the muscle groups doing the work is restricted.

Another study examined whether greater gains were seen with emphasis on the eccentric or concentric motion and found that the latter was actually more beneficial for muscle growth.

The implications of this are notable, especially when clients want to be challenged without heavy loads or suffer from chronic pain and cannot necessarily handle intense weights.

BFR for Strength

The benefits of BFR don't stop at impressive hypertrophy results. Strength gains are also seen, though the results are not as consistent nor significant.

In studies comparing BFR with low loads to traditional resistance training without BFR using higher loads, the strength gains were the same or somewhat inferior. Similarly, when matched loads were compared, the BFR groups showed greater strength gains. Again, the BFR strategy can come in handy when strength gains are desired but handling heavier loads is contraindicated.

For the client who is injured, BFR can play an astounding role. Even without exercise, BFR appears to prevent loss of strength in patients with broken, casted ankles when compared to patients performing isometric contractions over a period of two weeks.

BFR for Endurance

A few studies looking at BFR *resistance* programs seem to indicate that BFR does improve muscular endurance outcomes but no better than conventional resistance programs. However, research studying *non*-resistance exercise using BFR does seem to improve muscular endurance when compared to non-resistance exercise without BFR.

Furthermore, a few studies indicate that BFR non-resistance training is better at improving muscular endurance than non-resistance training without BFR, but more research needs to be done in this area.

BFR for Speed

What happens when BFR resistance training programs are intended to improve sprinting speed? Turns out, at least one study compared a 3-week strength training program with BFR to the same program without it and found the BFR group improved their sprinting time more than the control group.

Want to get faster without even running more? Throw some wraps around your legs and work out!

BFR Use and Applications

By now I'm sure you are convinced that occlusion training is certainly worth trying. I bought myself a pair of BFR wraps about two months ago. They run about $30 bucks for a mid-grade pair that are woven strongly and equipped with heavy hook and loop closures in two places. You can get more expensive wraps that have numbers on them so that you can remember your correct "tightness setting."

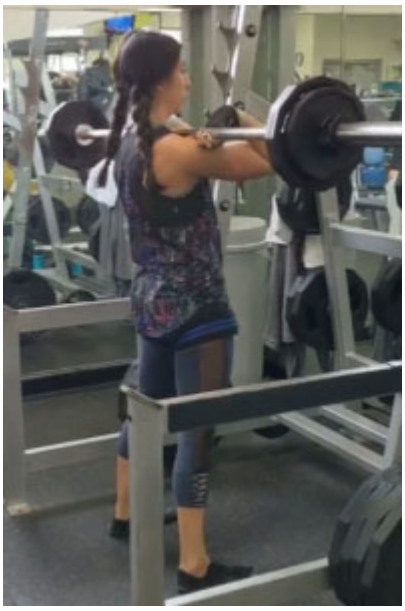
These particular wraps are intended to go around the upper thigh right below the gluteal fold. Always keep the straps away from the middle of the limb to avoid choking the arteries.

Wrap the bands around the thigh once and the first set of hook and loops will meet. Wrap around one more time and the second closures will meet, creating a snug, secure fit.

The instructions direct the wearer to tighten the bands enough to feel pressure but not too tightly to feel like circulation is completely cut off. Some researchers found that lifters had a hard time pinpointing this sweet spot, so they devised a scale. Aiming for a degree of tightness that equates to a 7 on a scale of 1 to 10 for legs and only a 5 for arms will keep you in the correct range to prevent arterial occlusion. It may help to experiment with different degrees of tightness first to make that number assignment possible

Smaller wraps are available to wear at the top of your arms below the shoulder, but there's no rule saying you have to make a special purchase. I used hair bands around my arms because they fit and I wanted to find out if they could work appropriately. (They were 'meh'). But you could probably even use boxing wraps,

The BFR strategy should not be employed in one area for longer than 10 minutes at a time.



Select a weight that is only 20-50% of your 1RM for the exercise you want to perform. I personally have been using them solely for squats and worked in the 12 rep range for four sets. But the same researchers who devised the tightness scale mentioned above suggest four sets with reps of 30, 15, 15, and 15, with only 30 seconds rest between sets, 2-3 times per week.

For someone like me who has chronic low back pain but a desire to lift heavy and grow bigger muscles, the BFR strategy is promising and exciting.

If you have clients who shy away from heavy lifting, you may want to try this approach with them or any other client who is intrigued by it.

Another great use is to bring up one limb that may be smaller or weaker than another, perhaps from a previous injury or sports overuse.

It's always good policy to dip your toe in the water before throwing someone else in, so if you haven't given occlusion training a try yet as a trainer, what's stopping you?

Gender Bias in Trainer Selection: Helping Clients make the Right Choice

Whether we want it to or not, gender preference often plays a role when choosing a personal trainer. Unfortunately, this can come at the expense of negating a trainer's qualifications and experience. Therefore, it becomes incumbent upon gym owners and fitness center managers to educate members about the *professional virtues* of each trainer. In so doing, not only might gender bias fade as a factor in trainer selection, but such information can foster an ideal match between the client and a trainer who specializes in his/her goals.

Gender Preference in Sports Coaching

Clients vary greatly in their reasoning for desiring a male or female trainer. Parkhouse and Williams (1986) reported that male athletes tended to have negative attitudes toward female coaches.

In addition, some female athletes admitted that they would rather risk having an unsuccessful experience with a male coach over working successfully with a female coach (1988). These studies may be decades old but, such prejudices are far from eradicated.

Other more recent qualitative research has indicated that the majority of female collegiate athletes, engaging in a variety of endeavors ranging from basketball, softball and golf to cross-country, track/field and soccer, also preferred a male coach (Frey et al, 2006).

Medwechuk and Crossman (1994), on the other hand, reported that swimmers tended to exhibit a preference for same-gender coaches. More recent research revealed that when choosing a strength and conditioning coach, male collegiate athletes preferred training under a male's guidance, whereas female collegiate athletes showed no gender bias (Maguire and Mansfield, 1998).

Importance of Personality Factors vs Gender

One study led researchers to conclude that perhaps those individuals who exhibit no gender bias in trainer selection might reflect the different emphasis placed on exercise and fitness by competitive athletes versus the average gym-goer.

Both male and female collegiate athletes, who by their very nature place a greater value on physical conditioning than the general population, might feel that they can improve with a dominant and aggressive coach/strength coach of either gender, whereas gym members as potential clients do not often aspire to that same level of physical performance.

For these individuals, the idea of a helpful and approachable personal trainer with a reasonable amount of knowledge and a flexible schedule might hold more sway. Past association with trainers of a particular gender may also color one's choice. Perhaps the nature of these trainer/client interactions — demanding, assertive and intimidating as opposed to positive, social and friendly — reflect male and female characteristics respectively (Eagly et al, 2000).

The polar opposite effect has also been demonstrated and noted. **Male athletes often seek out a male trainer who displays the physical attributes he desires in himself, believing that training with this individual will render him an exact replica in terms of muscularity and testosterone-laden prowess**.

These same types of men also tend to view a female trainer as nothing more than "fluff in a uniform". Underestimating the capabilities of a female personal trainer or athletic coach in terms of strength is another consideration. Testosterone aside, women do possess the ability to achieve incredible amounts of power and strength through proper training and nutritional fueling and are just as capable of directing male clients towards successfully achieving their goals.

Sending the Right Professional Message

Such issues give us pause while also offering an opportunity to learn why such delineations exist. What messages are we as trainers sending to potential clients with regard to our abilities to successfully engage with either gender?

In an attempt to clarify some of these points, one study focused its research on answers provided by interviewees regarding attitudes towards gender bias in trainer selection. **While most subjects cited trainer empathy as an important factor, they also admitted to evaluating potential trainers based upon their physiques.**

The consensus among female interviewees was that the professional with a "good body" would boost their confidence in acquiring the trainer's practical knowledge. Furthermore, trainers with attractive physiques were perceived as placing greater emphasis on their own health and would likely pass such motivation on to their clients.

While the majority of subjects clearly equated a sculpted physique with competence, they also recognized that appearance alone failed to indicate knowledge of personal training. Interviewees felt that as long as they achieved results with their own bodies, the trainer's physique diminished in importance. This sentiment tied into the subjects' desires to observe positive results achieved by other clients who worked with a particular personal trainer.

The "fun factor" is something that interviewees deemed important toward maintaining motivation and program adherence. **Regardless of the experience or competency of a personal trainer or coach, if workouts are not enjoyable, clients' desires to continue in the relationship deteriorated.**

How Trainers Perceive Gender

Gender bias is not the sole realm of the client, either. A trainer with 14 years of experience, Chris Broomhead of Salford, UK admits to a preference for working with female clients, noting a difference in their training mentality. He trains twice as many female clients as male clients.

"I do prefer training women and it's mainly because males generally have a bigger ego in the gym. Women are just easier to teach, they accept help and advice better, and they are not bothered about admitting that they don't know how to do something," Chris explains. "When I started out, I had to ask the guys how to do the 'big stuff'; everyone starts somewhere. But some men just don't understand that and don't want to be seen asking for help."

Interestingly, one of our own NFPT trainers and blog editor, Michele Rogers, has experienced the opposite in her fitness career. "I've trained a lot of men, and have found they are generally far more receptive to my directions and adhere to programs better than most of the women I've trained."

Perhaps there is a cross-gender interaction where egos are less dominant versus same-gendered relationships where similarities and the perception of being judged is more possible.

Special Considerations for Both Genders

Even personal trainers who are highly qualified and have years of experience in the industry might not be aware of key biological/physiological differences with regard to male and female bodies. Knowledge of these aspects can better prepare trainers to engage with clients of either gender. For example, the female body contains more slow-twitch fibers than the male body; as such, women can typically achieve more repetitions than men at any given percentage of their 1RM.

Most women can handle more volume and recover faster between sets than men, especially evidenced in females who are more aerobically fit than muscular. Furthermore, in terms of cultivating lean muscle mass, male clients typically

perform optimally with an upper body/lower body training format, or daily body part split, whereas women fare better with whole body routines. Such subtle but important differences can prove invaluable for trainers when embarking upon program design for novice clients.

Remaining Judgment-Free

Putting aside the expected issues with male-female gender biases, LGBTQ individuals deserve additional consideration. **There may be members at any gym facility who do not identify with either gender and/or identify as LGBTQ and certainly deserve the same respect and unbiased treatment that shown to cisgender and heterosexual clients.**

As potential clients, there may be a bit of hesitation as they ponder which trainer and coach. The trainer's job is to treat all of the members at their gym, whether they are clients or not, with equal courtesy, dignity and inclusiveness.

If a client shares his/her background and story, engaged listening skills will help determine the method in which this individual wishes to be trained: weight loss, adding lean muscle mass, prepping for a ski trip or hiking adventure, or simply overall wellness. This we do for all of our clients, so sexual preference ought never come into question with regard to professional behavior.

If a client is forthright about being transgendered then treat him/her as any other client with physical goals and potential physical considerations. Asking for a full medical history and about potential hormone replacement therapy is well within your scope of practice for designing an exercise program.

Trainers work with all types of individuals: significantly overweight or underweight, attractive or plain, young, elderly, and those with health conditions such as exercise-induced asthma. Ours is a helping and healing profession above all. Though we may not take an oath to "Do no harm" as is required for physicians, common decency dictates that we treat others as we wish to be treated.

Conversely, how might a potential client react to a fitness professional who is not cisgender or straight? Or later on in the training relationship discover that the trainer does not identify with their birth gender?

If you are such a fitness professional it's probable you've faced such challenges and will continue to through the course of your career. There's no easy way to navigate this issue in our current social climate. The best approach in the fitness industry is to decide how transparent you want to be about who you are and want to project to your comfort level.

Fill the Need, Don't Play the Role

What additional considerations might we suggest to a client who is considering personal training? What qualities are they looking for in a trainer?

Asking questions will allow us to assist him/her in greater detail. Is the client concerned with a trainer's experience with all ages and ability levels, or one with specific knowledge in a particular area (post-partum, competitive bodybuilding, weight management)?

What is the client's comfort level with regard to a personal trainer's need for the occasional physical contact required when spotting or pointing out form/body mechanics? Remind the potential client that if this relationship is going to continue over time, communication skills should come under consideration, as well as the ability to cultivate a comfortable working rapport that does not cross any unwanted boundaries.

Heavy Metals in Protein Powders: Are they safe to consume regularly?

Clients often seek out their personal trainers' opinions on the best protein powder to consume following tough workouts. This seems like such a harmless and expected inquiry since so very many trainers work out arduously themselves and are happy to endorse their favorite products. However, much controversy seems to surround the purity of protein products as of late. Are trainers stepping outside their scope of practice to recommend a powder?

If you are inclined to make a recommendation, are you aware of the current legal climate regarding heavy metals found within many protein supplements? We already know that artificial sweeteners are a hidden culprit contained within most popular protein powders and bars. Is it even safe to supplement with protein when such health risks are being intimated from varying sources?

Watchdog Findings of Heavy Metals

A private group called the *Clean Label Project* identified and analyzed the top 134 protein powder formulas for high levels of heavy metals and other toxins. The search included powders from a variety of protein sources: egg, whey and plant-based. The *Clean Label Project* enlisted the help of Ellipse Analytics, a fairly new independent laboratory, to conduct tests for arsenic, lead, BPA and cadmium, among other materials.

It was determined that plant-based proteins contained higher amounts of certain heavy metals than those derived from either whey or egg protein. Such products have been popping up on the market in abundance to meet the needs of an ever-increasing population of vegan and vegetarian athletes. As expected, there was a public outcry as soon as the *Project* revealed its data.

Natural Products Association (NPA) pushed back, claiming uncertainty regarding sources of funding for the research, thereby implying that it remained unclear who stood to profit from such revelations. Executive Director Dan Fabricant, PhD, felt that the mere presence of ***trace amounts*** of heavy metals was made to seem like a dire health threat.

Sunwarrior, a leading producer of vegan plant-based protein powders, likewise fought back against the recent edict. Spokesperson Susanna Kaines informed the scientists at *Clean Label Project* that a vegetable as common as spinach may naturally contain up to 60 mcg of cadmium, and that even this amount is well below the federally mandated allowable amount per serving.

Andrea Wong, PhD, a toxicologist and Vice-President of Scientific and Regulatory Affairs at the *Council for Responsible Nutrition*, pointed out that "A detectable level of a contaminant is not necessarily an unsafe level; it merely means that the instrumentation used for testing was sophisticated enough to detect it." Dr. Wong also noted that plant-based protein powders will reflect minerals absorbed from the soil, yet these are all naturally occurring substances.

A Matter of Dosage

"The advent of mass spectrometry techniques has greatly increased the reliability of analytical methods" said James Neal Kababick, founder of *Flora Research Laboratories* in Oregon. He reminded researchers to consider the dosage and not merely the presence of a compound; therein lies the most significant difference in toxicity levels. Kababick does not necessarily believe that a life-threatening situation had been unleashed upon the unsuspecting public. Rather, he claimed that such reporting "…is only creating confusion and clouding the issue." Clearly the *Clean Label Project* feels the word must get out regarding what ***potential*** dangers lurk in the best-selling brands of protein powders. **The company claimed to be thinking about a bigger picture in reporting their findings, or what health risks may develop over the course of 20 years of product use.**

The Truth Behind Toxicity

Vega is another top-selling retailer of plant-based protein powders. The company conducts its testing for the heavy metals lead, arsenic, mercury, and cadmium utilizing a process known as ICP/MS (inductively coupled plasma/mass spectroscopy). A highly sophisticated process such as this is able to detect heavy metals at concentrations as low as one part per ***quadrillion*****.** It is among the most powerful methods in the industry for trace element detection. Therefore, it becomes possible to detect metals at levels well below regulatory thresholds and therefore much less than any risk-causing amount.

The company maintains that the level of detectable heavy metals in their products are at levels expected among minimally-processed plant products and fall within the government thresholds of what is safe for human consumption.

California's *Proposition 65*, which monitors consumer exposure to chemicals, allows for safe amounts of certain compounds – including heavy metals — to be present in a product. The proposition refers to these amounts as "safe harbor" levels, which are based upon an average consumer's ***daily exposure level*****.** Such calculations are highly complex, requiring expert analysis. It is the government's belief that such variables were most likely not taken into account by the *Clean Label Project*. Applying appropriate and approved guidelines for proper, accepted scientific and statistical analysis ensures that Vega's products are within this "safe harbor".

"Chronic" Is Critical

While not all exposure to heavy metals presents a risk of harm, there are certain heavy metals that can be toxic to human health in cases of ***chronic or high-level exposure***. Lead, cadmium, arsenic and mercury are the compounds that have come under recent scrutiny. Lead is involved in many manufacturing processes and can be found in paint (especially pre-1988), cosmetics and toys. Cadmium is often used in television screens, lasers, batteries, paint pigments, and cosmetics. Arsenic can be detected in the air, water and earth. Mercury is released following volcanic activity, erosion and from various human activity involved with land.

Because heavy metals are also commonly found in nature, including in the soil, they can be present in many foods we find at a local grocery store. Recognizing this fact, the FDA published a study on minerals and heavy metals such as arsenic, mercury, cadmium and lead, including their presence in a variety of foods. Below are some examples of their findings:

- 1 large cucumber may contain 3.08mcg arsenic
- 2 cups of strawberries may contain an average of 4.56mcg cadmium
- Adding 2 cups of spinach into a smoothie equates to in 0.24mcg lead

Simply because there may be detectable amounts of heavy metals in these foods does not render them unsafe to consume, nor does it detract from the benefits derived by including them in a regular meal plan, such as fiber and antioxidants from spinach and berries, or vitamins and minerals found in cucumbers.

Some professionals disapprove of consuming protein powder supplementation, regardless of the level of heavy metals contained therein. "I don't recommend using protein powders except in a few instances, and only with supervision," says registered dietitian Kathy McManus, Director of the Department of Nutrition at Harvard-affiliated Brigham and Women's Hospital.

That has not seemed to slow down the industry, however. More and more supplement companies appear on the Internet each month. It is a daunting task to sort out what information is reliable, and therefore what answers to give our clients who pose questions/concerns regarding protein powder choices.

Government Control

The FDA actively monitors levels of heavy metals in our food supply. They take a systematic approach to reduce the risks posed by these metals, taking into consideration vulnerable populations such as infants and children, who are most susceptible to some of the harmful neurological and developmental effects of these compounds. Understanding the risk these metals pose in our food supply is complicated by the fact that no single food source accounts for most people's exposure to metals in foods. Exposure comes from many different foods, each containing low levels of these metals. Combining all of these minimal-level foods, not to mention the aforementioned products, may potentially add up to a level of concern over time.

A branch of the FDA known as *Toxic Elements Working Group* aims to reduce exposure to toxic elements in food, cosmetics and dietary supplements. The group is made up of senior leaders and risk managers within the Center for Food Safety and Applied Nutrition (CFSAN), who have combined experience in microbiology, toxicology, chemistry, medicine, epidemiology, policy and law. Working with these professionals, the group tackles the issues presented by metals through a wide range of policies and actions. Such procedures include requiring or encouraging industry to take steps to reduce the presence of the metals in products, as well as educating consumers about ways they can reduce their risks.

Are Other Countries More Cautious?

Countries throughout the world differ in their approach to regulation of health products. Canadian manufacturers, for example, must get a product license from Health Canada to sell their products within the country. Health Canada assesses the product to consider its safety, efficacy and quality. Only upon passing such stringent testing will Health Canada issue a license.

In the United States, dietary supplements are considered to be food products under the *Dietary Supplements Health Education Act*. A protein powder is a dietary supplement. The FDA leaves it up to manufacturers to evaluate the safety and labeling of products. In the absence of federal testing, there is no surefire way to know if a protein powder contains what manufacturers claim.

These products are ***not subject to mandatory review***, ***approval or quality requirements***, and do not go through testing for identity, purity or potency of active ingredients. Often these supplements cannot be sold in Canada, due to the lesser restrictiveness of the FDA. However, many Canadian protein powders are available for sale in the United States through the Internet.

On A Personal Note

As a microbiologist and competitive bodybuilder, I have made adjustments to my own choices of plant-based protein powders in response to this research. It remains my contention, however, that the purity of such products rests largely in the microfiltration procedure and the temperature at which this is performed. Bioavailability of the protein source is also a key factor in my decision process.

Once these parameters have been adequately satisfied, I do not dwell upon the issue of heavy metals in such products. At ½ serving of protein powder per day, coupled with an otherwise clean meal plan consisting of fish, vegetables and plant-based whole-food protein sources (tofu, hummus, tahini, etc.), my belief is that any heavy metal presence will be adequately diluted out at the end of the day's total consumption.

Fueling for Success: Pre and Post Workout Meals

In an effort to maximize energy stores during a workout, and ensure adequate recovery post-workout, proper nutritional fueling provides the key to success. Knowledge in the kitchen can rival gym savviness in terms of utmost importance when sculpting a physique and cultivating strength.

Contrary to claims made by supplement companies, glucose remains the human body's preferred energy source. An ideal pre-workout meal, therefore, includes slow-burning forms of glucose (complex carbohydrates), the optimal provider of sustained energy.

Foods that are high in fiber, such as a grainy bread, brown rice, oatmeal, quinoa, whole-wheat couscous/pasta and sweet potatoes, serve as perfect examples. Pairing such options with a lean protein source, such as eggs/egg whites, lean turkey/chicken/beef, or low-fat dairy, creates a balanced meal, guaranteed to get hard-working athletes through even the most grueling exercises.

Fueling with the Ideal Macro Ratios

The best protein source to replenish the amino acids, the building blocks of lean muscle tissue that get broken down during the workout, has traditionally been whey protein concentrate or whey protein isolate, in powder form, hydrated with water, fruit juice or skim milk.

Ideally, experts suggest looking for a whey product that has been micro-filtered at a cold temperature. Vegan protein powders, derived from hemp, pea or pumpkin, have recently been gaining in popularity as alternatives to whey. Research has determined that these proteins are just as effective as whey for fostering muscle growth, and that the best delivery system regardless of protein source is prompt ingestion through liquid means (protein shakes). Plant based powders may also contain higher, if not still legally safe, levels of heavy metals.

A shake is convenient to bring to the gym; many athletes bring the measured powder in their shaker bottle and simply hydrate it immediately after racking the weights from their final set.

A slight insulin spike facilitates the body's ability to shuttle post-workout protein into the bloodstream, where it can readily go to work. This is the best time of day to enjoy "simple carb" sources that will drive up insulin just enough to be effective: fresh or dried fruit, organic raw honey, rice cakes or a high-glycemic-index cereal such as Rice Chex. Coupling this with the protein shake creates a perfect and easy-to-digest meal. Most athletes aim for a 2:1 – 3:1 ratio of simple carb grams to protein grams. Experimentation helps determine what works best for each individual.

A strength-training workout accelerates metabolism, which is a highly desirable bonus. Rather than risk reversing this dynamic effect with the consumption of slow-digesting fats, this macronutrient is best kept to a bare minimum both pre- and post-workout. Most athletes aim to include less than 6-8 grams of fat during these fueling times.

The Whole-Foods Re-Fueling

Within two hours of the post-workout shake/simple carb fueling, consuming a meal of regular whole foods allows the anabolic process to continue seamlessly. This is where the addition of fats comes into play. Complex carbohydrates, lean protein, dark green leafy veggies and a small amount of "good" fats (avocado/coconut oil/nuts/nut butters) make for an ideal meal.

One example of a balanced post-workout meal might be as follows:

~ ½ sweet potato OR ½ cup cooked brown rice

~ 4-5 ounces lean turkey/chicken/fish (salmon is always an excellent choice, rich in omega-3 fatty acids)

~ 1 cup steamed green veggies OR mixed green salad with low-fat balsamic dressing (oil and vinegar)

Delicious and nutritious fuel such as this should keep the body/metabolism satisfied for the next 3-4 hours. Of equal importance is adequate hydration throughout the day, since higher amounts of both fiber and protein necessitate extra fluid in order to "move through" the body effectively.

Clients may ask how to proceed with this meal if they train in the evening and plan on bedtime being within an hour or so of consuming their post-workout fueling. If remaining awake for another few hours is simply not an option, there are a few suggestions you can make to ensure the best possible results.

The shake can go a bit lighter on the grams of protein and the simple carb/protein ratio may be lowered. Then, a whole-food meal that is on the lighter side can be consumed an hour later, stressing the importance of including all essential macronutrients. A client of mine opts for scrambled eggs and toast at this meal.

Fueling with Supplements

Many athletes and bodybuilders opt to supplement with a pre-workout fueling drink product, such as creatine or combination drinks with various ingredients intended to decrease muscle fatigue, increase blood volume, and boost energy. Some people have success with these supplements and others can have unpleasant sometimes dangerous reactions.

In addition, proper recovery from training is essential regardless of whether one's fitness goal is to burn fat or build muscle. While meals provide all one really needs, certainly some supplements can give an added boost to the recovery process. The wide range of products and substances available on the market today can create plenty of confusion and warrants its own article.

However, one supplement with which I have had tremendous success when paired with a post-workout shake is called *Ignition*, made by 1stPhorm.

***Ignition* signals the body to begin the process of repair by spiking insulin and replenishing glycogen stores.**

Ignition consists of pure dexanhydrous glucose, which delivers glycogen directly to the muscles more effectively than any other simple carbohydrate source. Spiking insulin levels to allow maximum protein assimilation, as previously mentioned, creates an optimal environment for recovery and protein synthesis.

When an insulin spike occurs, the muscle "cell doors" open, enabling the body to retain and utilize a much higher percentage of protein by pushing it directly into the muscle. *Ignition* bypasses liver storage and helps the body dive into recovery mode much more effectively. The more time the body spends in recovery, the better the results.

The Fasting Mindset

Despite the abundance of literature endorsing what is written here, there will always be clients who insist on working out in a fasted state, such as, first thing in the morning before breakfast. While there is research supporting this theory — to an extent — it remains to be seen whether such a trend can withstand the test of time. Check our website for upcoming articles delving deeper into this topic. In the meantime, remember that while it is our job to move clients safely and effectively towards their goals, we are powerless to insist that they adhere to all aspects of our advice.

Fasting and Exercise

There are a number of dedicated gym-goers who prefer to work out on an empty stomach, perhaps because they like working out early but don't like breakfast, or they believe working out fasted will burn more fat instead of food energy.

While I am not a proponent, my husband is a steadfast pre-breakfast daily exerciser. There is a modicum of research to support this practice. However, intermittent fasting (IF) is not without potential pitfalls to be aware of before making it a habit.

What Happens When Exercising in a Fasted State

Dr. Valter Longo, Director of USC's Longevity Institute, believes IF can be problematic because "it allows people to improvise and pick and choose periods of fasting that range from 12 hours to weeks, giving the impression that… some 'abstention from food' is similar or equivalent, and all provide health benefits." It's not technically fasting if you're going without food for 24 hours or less. The correct term for this practice is **time-restricted feeding** (TRF).

An empty stomach triggers hormonal shifts within the body that are conducive to both building muscle and burning fat. Improved insulin sensitivity is one such example. Our bodies release insulin when we eat, facilitating the absorption of nutrients from food. Once broken down into glucose, this sugar is then shuttled out of the bloodstream and into the liver, muscles, and fat cells, to be used as an energy substrate.

However, overconsumption of calories as well as eating too often can create decreased resistance to insulin's effects, thereby elevating the risk of heart disease and cancer. By eating less frequently, the body releases insulin less often, heightening the body's sensitivity to insulin, thereby fostering fat loss and more positive blood flow.

During exercise, the body tends to utilize fats for fueling low- to mid-level exertion, and carbs for high-level exertion. Surprisingly, even athletes with very low body fat have access to relatively large reserves of fat calories, an average of approximately 50,000. Endurance athletes sometimes experiment with time-restricted feeding (TRF) since fasted workouts improve the storage efficiency of glycogen.

Training on an empty stomach makes the body more efficient at glycogen storage. An occasional fasted training session, therefore, may improve the quality of workouts performed after normal fueling. When the body learns to exert energy in the absence of calories, it gets better at performing when normal fueling patterns return.

Glycogen Stores Versus Fat Stores

Liver and muscle glycogen are almost always a limited commodity, only supplying 1,400 – 1,800 calories when fully stocked. In a fasted state, the body conserves glycogen and instead utilizes fat as fuel. Some experts claim that weight training in a fasted state induces the release of growth hormone (GH). Activities that promote the release of GH include sleep, exercise, and fasting.

However, while the release of GH during a fast may have an anabolic effect, this is most likely a result of the body trying to mitigate the catabolic impact of not eating, according to a study at the University of Virginia. The conclusion drawn here was that if one's goal in the gym includes pushing oneself, working out in a fasted state can backfire and actually lower productivity.

Finding the Middle Ground

A happy medium does exist, as my competition coach taught me. If a client prefers to exercise in a fasted state first thing in the morning, a bedtime meal can help ramp up glycogen stores for use the next day.

Knowing that fats will temper digestion, a banana or a sweet potato paired with nut butter scores big points.

Even though I always fueled prior to morning lifting, if the designated body part the next day was going to be back or quads (large muscle groups), I would mix some protein powder in with the peanut butter and couple this blend with the banana or sweet potato at my bedtime meal. This combination is not only delicious but will also yield extra energy for the next day's workouts.

Prolonging the Burn

A few studies have found that cardiorespiratory exercise performed in a fasted state can burn 20% more fat compared to exercising after healthy fueling. One study showed that 24 hours without food increases GH production in men by 2000%,and 1300% in women.

However, experts point out that fasted cardio does not increase the body's capacity to burn fat *over the ensuing 24 hours*. As such, this does not always lead to sustained weight loss. The effect ends at the conclusion of the fast. Ingesting complex carbs prior to hitting the gym increases the post-exercise "afterburn" effect more than that which one experiences in the fasted state. This translates to extra calories burned throughout the day, and not solely during the workout.

Cardiac Benefits of Fasting

Research cardiologists at the Intermountain Medical Center Heart Institute are reporting that fasting not only lowers one's risk of coronary artery disease and diabetes, but also causes significant changes in a person's blood cholesterol levels. Both diabetes and elevated cholesterol are known risk factors for coronary heart disease.

"Fasting causes hunger or stress. In response, the body releases more cholesterol, allowing it to utilize fat as a source of fuel, instead of glucose. This decreases the number of fat cells in the body," says Dr. Benjamin D. Horne, PhD, MPH, Director of cardiovascular and genetic epidemiology at the Intermountain Medical Center Heart Institute, and the study's principal investigator. "This is important because the fewer fat cells a body has, the less likely it will experience insulin resistance, or diabetes."

The Risks of Fasting and Exercise

Before you jump on the fasted cardio trend, there is a downside to consider. **Skipping a meal or two can be profoundly difficult for some people, ineffective for others like bodybuilders, and downright dangerous for those who have wrestled with eating disorders.**

While exercising in a fasted or semi-fasted state, the possibility exists that the body will begin catabolizing hard-earned muscle as a fuel source, says Chelsea Amengual, MS, RD, Manager of Fitness Programming & Nutrition at Virtual Health Partners. "Plus, you're more susceptible to hitting the wall, which means you'll have less energy and not be able to work out as hard or perform as well," she adds.

Priya Khorana, EdD, a nutrition educator at Columbia University, believes that intermittent fasting and exercising long-term isn't ideal. "Your body depletes itself of calories and energy, which could ultimately end up slowing your metabolism."

Certified personal trainer Lynda Lippin stresses the importance of heeding one's total consumption of macronutrients the day before exercise as well as after training has been completed. "For example, strength workouts generally require more carbohydrates the day of, while cardio/HIIT workouts can be done on a lower carb day," she explains.

Dr. Niket Sonpal suggests that the optimal method of combining intermittent fasting and exercise involves timing workouts during eating periods so as to utilize the peak nutrition levels. “And if you do heavy lifting, it’s important for your body to have protein after the workout to aid with regeneration,” he adds. Amengual is a big believer in following up any strength training with the carbohydrates and protein combination, ideally within 30 minutes of finishing the workout.

Safety First

The success of any weight loss/exercise program depends upon the safety of sustaining it over time. A few key tips on proceeding prudently can make all the difference when a client is experimenting with TRF.

Drink Up!

Sonpal stresses that fasting does not include fluid consumption encouraging fasters to drink more water during periods of restricted feeding. In an effort to maintain electrolyte homeostasis, Sonpal suggests coconut water. “It replenishes electrolytes, is low in calories, and tastes pretty good,” he says. Many sports beverages are laden with sugar and empty calories and are best avoided during TRF.

Stick to Low-Intensity and Shorter Workouts

If a client says he/she is pondering a 24-hour intermittent fast, Lippin suggests sticking to low-intensity workouts (walking, yoga, or Pilates). Working within the parameters of a 16- hour fast/8- hour fuel plan, bear in mind that the majority of the 16-hour fasting window is evening, sleep, and early morning. A client on this program can feel comfortable sticking to his/her regular type of exercise.

During my foray into TRF, I chose a fueling window of 12 hours per day, allowing me to tap into the benefits while not having to sacrifice any part of my training. According to Dr. Longo, if you eat only for four to six hours a day, “then you start to see gallstone formation [and] increase the chance that you’re [going to] need your gallbladder removed.”

Tune Into Your Body

The most important advice to heed when exercising during IF is to listen to your body. “If you start to feel weak or dizzy, chances are you’re experiencing low blood sugar or are dehydrated,” explains Amengual. If this occurs, she suggests choosing a carbohydrate-electrolyte drink immediately, followed by a well-balanced meal.

While exercising and intermittent fasting or time-restricted feeding may prove highly effective for certain individuals, others may not feel comfortable working out at all during a fast. According to *Harvard Health*, a full 38% of individuals who experimented with intermittent fasting were unable to sustain the process. If fasting runs the risk of inciting a binge on the weekends or cheat days, this may not be an ideal plan.

Trainers should insist that prior to exercising on any TRF or IF program, clients consult a doctor or healthcare provider, particularly if they have any pre-existing medical conditions. Just as each client has unique goals in the gym, discovering his/her nutritional habits can help foster not only a relationship with open communication, but yet another avenue down which you can travel together as you impart your knowledge on this subject as well as fitness!

The NEAT Way to Burn Calories

Are your clients getting bored with endless treadmill sessions, stationary cycles, or counting Stairmaster steps? Or maybe they are so fixated on how many calories they burn during their 30 minute cardio sessions they neglect the remaining 23.5 hours of their waking day? If so, you can pair their resistance training workouts with the *NEAT* way to achieve wellness.

The Thermogenic Effect of NEAT

Energy expenditure associated with spontaneous movement is referred to as Non-Exercise Activity Thermogenesis (*NEAT).* According to the IUPS Thermal Commission, **thermogenesis is defined as "heat production due to metabolic energy transformation by processes that do not involve contraction of skeletal muscles**". Put simply, this translates into the body working smarter throughout the day, resulting in the the use of brown adipose tissue–a desirable outcome for metabolic activity.

According to Dr James Levine, the Mayo Clinic scientist who first described the phenomenon of *NEAT*, its energy expenditure can vary by as many as 2,000 calories a day, depending upon one's genetics, stature and build. There has been much research in this area, as obesity-related disorders such as diabetes continue their rise to epidemic proportions. Scientists and exercise physiologists alike agree that individuals struggling with their weight can tap into *NEAT* as an easy-to-execute, practical tool. Coupled with a focus on the metabolic effect of our food choices, N*EAT* becomes even more significant.

The Body Is A Verb

Whether we are active or sedentary, our bodies are constantly utilizing energy. Daily total energy expenditure (TEE) is the net amount of energy utilized by the body to maintain core functions, such as respiration and basic movements. This value is determined by assessing three parameters: basal metabolic rate, the thermic effect of food (how the body digests what it consumes), and the energy spent on physical activity.

Furthermore, this total value reflects other factors such as age, body composition, thyroid status, medications and even body temperature. A larger body shape requires more energy to move; unfortunately, individuals who are significantly overweight tend not to reap this benefit due to a tendency toward more sedentary lifestyles than their leaner counterparts. Research has revealed that lean individuals stand, walk and fidget significantly more during the day, amassing an additional 350 – calorie expenditure.

Simple Daily Doses Add Up

As one would expect, *NEAT* corresponds to energy expenditure associated with ADL (Activities of Daily Living). This is in contrast to exercise activity thermogenesis, which refers to the energy required to engage in any type of purposeful exercise (fitness, running, skiing, etc.). While the latter puts a greater energy drain (calories burned) on the body, it is amazing how much IS burned simply by performing *NEAT* movements. "It takes energy — calories — to move even the smallest muscle," explains exercise physiologist Polly de Mille, RN, Director of the Tisch Sports Performance Center at the Hospital for Special Surgery in New York City. "For example, you burn about 1.5 calories per minute just lying still while your body performs its most basic functions." As an average body transitions from a horizontal position to sitting in a chair, an additional 25% more calories will get burned.

By focusing upon increasing regular ambulatory motion – our hunter and gatherer forefathers had no choice but to ***move*** through life –an additional 2,000 calories can get utilized without ever setting foot in the gym. When compared to an hour spent on a stationary cycle, which typically burns 300-400 calories, this seems like a very worthwhile endeavor!

NEAT Ideas For Non-Athletes

Even if a client struggles with being purposefully active – due to time constraints or health issues – there are many ways in which you can encourage and help him increase his daily caloric burn.

The simplest way to expend energy is to pass right by the elevator and find the nearest staircase. This can be accomplished at the client's office, the shopping mall, or to his front door if he lives above the first floor. If his long workday is spent at a desk, suggest he ask the company's Human Resources Department if they offer the option of utilizing a variable-height desk. While the number of calories expended standing at a desk versus sitting is not tremendous, there is a much greater chance of moving around the office if one is already vertical as opposed to relaxed in a comfortable office swivel chair. Another great suggestion is to limit emails to co-workers in favor of walking to their desks to deliver the message.

Sometimes it is necessary to help a client think outside the box. If his job tends toward the tedious, number-crunching variety, he might choose to break up the monotony of his workday with periodic excursions. Taking a coffee break at the *second* nearest Starbuck's instead of the one adjacent to the office, or walking with a co-worker to a local eatery for lunch rather than dining at one's desk, can keep blood circulating, minds active, and energy consumption high.

If purchasing groceries is on the client's agenda, remind him that he can walk, bike or drive to the store and peruse the aisles. Except in emergencies or severely inclement weather, there is really no reason to regularly use shopping delivery services.

Similarly, while it is often easier to hire professionals to perform chores such as housekeeping, cleaning and lawn maintenance, caring for one's home and its environs is a positive and productive way to burn calories. From sweeping and vacuuming to weeding the garden, basic movement is not only good for a healthy body but sustains mental health as well. Once in the habit of regular movement, remaining seated for an extended length of time feels unnatural.

Walk to Wellness in the Workplace

Not every employee at a gym defines himself as an avid exerciser. There are many "behind the scenes" individuals at my community center who help keep our Fitness Department running smoothly: those in our Business Office, Payroll Department, Marketing/Management, and Housekeeping, to name a few.

Consider working in tandem with the Human Resources Department to initiate a *NEAT challenge*. This may be as simple as attempting 10 consecutive days' worth of walking 10,000 steps per day, the number promoted by the U.S. Department of Health. Employees who meet or exceed the goal can perhaps be rewarded with a pedometer, or 1 free session of personal training.

The more *NEAT* activities in which sedentary individuals engage each day, the more calories are burned, facilitating weight management and improving overall health, according to research published in June 2018 in the *Journal of Exercise, Nutrition & Biochemistry*. If one is already active, such as a client or group exercise participant, incorporating simple *NEAT* movements will add to the benefits they already reap!

Is Your EPOC Epic? Understanding the Body's Oxygen Debt

The concept of excess post-exercise oxygen consumption (EPOC) has been described as a benefit of high-intensity exercise and a major player in weight management and weight loss.

But what exactly is going on and how important is it to weight management? Why is respiration more labored some times more than others? Can a 60-minute workout continue to burn more calories for the rest of the day?

The answers lie in understanding the demand for of oxygen by the muscles and how much oxygen reserve is currently available in the body.

Oxygen Availability

There is a supply and demand oxygen economy that takes place with intense exercise and many variables dictate how that oxygen is supplied to working muscles, especially when all the available oxygen is used up and the muscles need more. If the balance of oxygen debt exceeds the bank of reserves, the muscles will suffer. Only through increased respiration and accelerated heart rate can the oxygen debt get repaid. The body requires energy to do this!

EPOC refers to the amount of oxygen our body consumes following a bout of exercise that elicits an excess of the pre-exercise oxygen consumption at baseline level. Essentially, the body uses more oxygen *after* exercise than *before* exercise, enabling it to expend additional calories during recovery from exercise than prior to engaging in it.

The purpose of EPOC is to restore the body to its resting state and create physiological adaptations which will help the body handle the same amount of exercise-related stress more easily in the future.

The Science and Implications Behind EPOC

After a bout of exercise, the body strives to restore itself to homeostasis. This recovery process requires energy, which explains the increase in calories expended post-exercise compared to pre-exercise. Reynolds & Kravitz (2001) state that the following occurs during EPOC:

- replenishment of energy resources
- re-oxygenation of blood and restoration of circulatory hormones
- decrease in body temperature
- return to normal breathing rate and heart rate

High-intensity and/or longer duration cardiorespiratory and resistance exercise seem to elicit the greatest EPOC response. As a general rule of thumb, the higher the intensity (and the more the exercise disrupts homeostasis), the greater the magnitude and duration of EPOC following exercise. **Though longer exercise sessions have been shown to elicit a greater EPOC response compared to shorter sessions, *exercise intensity* is suggested to be the main contributor to EPOC.**

EPOC is the greatest immediately post-exercise. Some studies have found that EPOC lasts up to 24 hours, while others have found its duration to be much shorter, less than an hour in some cases. The large range of EPOC durations across studies has been attributed to differences in exercise intensity and duration, as well as variations in study methodologies.

Despite claims from professionals in the fitness industry, **some areas of research suggest that the EPOC effect is fairly small, contributing only slightly to weight loss as compared to the energy cost during actual exercise.** In fact, some studies have shown that when tracking energy expenditure for several hours following completion of a training session, HIIT and continuous cardio burn about the same amount of post-exercise calories. Different studies report varying, yet

small, caloric expenditures that can be attributed to EPOC, ranging from 51 (Haltom et al. 1999) to 127 (Burleson et al. 1998) kilocalories.

Given this modest boost in expenditure, any weight loss benefits would be seen slowly and steadily over time, with all other factors being stable.

The Role of Oxygen in the Phases of Muscle Contractions

In attempting to understand the complex process of EPOC and how it relates to lifting, it helps to know exactly what muscles experience during a typical workout:

Stage 1: At first exertion, sufficient ATP is present to fuel the muscle cells for only a few seconds. Once ATP becomes depleted, creatine phosphate takes over, appearing within the muscle tissue in very limited supplies. Depletion of this substrate typically occurs after the muscle has sustained a contraction for about 25-30 seconds, giving the muscle energy for a total of about 35 seconds. Longer term energy demands require oxygen.

Stage 2: Metabolic oxidation kicks in; this describes the process whereby pyruvate, the energy source derived from the muscle's glycogen stores (which converts to lactic acid during rest pauses), combines with oxygen to produce *additional* ATP. Energy production via metabolic oxidation will only occur in the presence of sufficient oxygen levels. Since muscle tissue does not store oxygen, it must be taken up from outside the cell. This buys the heart and lungs some time to catch up and supply more oxygen.

Stage 3: A small drop in blood oxygen levels triggers a complex cascade of responses, eliciting more labored breathing and an elevated heart rate. The freshly oxygenated blood shuttles energy into the muscles within the first few minutes of exercise and ignites a process known as *aerobic metabolism*. Glycogen remains the major fuel source here; but now the body can utilize oxygen to generate water and carbon dioxide (CO_2). This allows the body to maintain exercise without creating additional lactic acid.

If at the point of creatine phosphate depletion there has been no movement of oxygen into the muscles, an oxygen debt quickly develops and must be repaid by the body.

Aerobic Training and EPOC

During aerobic activity, initial labored heart rate/breathing will ultimately lead to comfortably sustaining continued exercise; the point at which the oxygen debt is repaid during aerobic activity is commonly referred to as experiencing one's "second wind". Breathing resumes a more regular pace, the vascular tissue dilates and the heart's stroke volume is optimal as sufficient oxygen reaches the working muscles. As intensity of aerobic activity increases, the oxygen demand elevates and the cardiorespiratory system responds by once again becoming more labored.

As heart rate increases, fat slowly gets released from storage. Within 10 to 15 minutes, the release of fat reaches its peak; it circulates in the blood and gets taken up by the muscles. Inside a muscle cell, both glycogen and fat are used as the fuel mix to sustain the energy required for continuous muscle contractions.

Resistance Training and EPOC

When resistance training, increased recovery time between sets is recommended to counter the labored cardiorespiratory activity.

Under optimal training conditions, the muscle cell experiences intermittent periods of momentary relaxation. During these pauses (like the pause between eccentric and concentric phases), the cell walls become permeable and allow for the *inward* movement of nutrients (including oxygen) and the *outward* movement of waste (carbon dioxide).

If a *maximum contraction,* as in high weight and very low reps*,* is sustained, oxygen cannot be introduced; the contraction will fail upon depletion of internal creatine phosphate. This explains in part why maximal muscular contractions cannot be sustained for longer than 25-30 seconds. **As long as intermittent bouts of relaxation are combined with forceful muscular contractions, a set can be sustained for a longer period.** A longer set will increase time under tension and allow for higher volume.

Likewise, if the contractions are sub-maximal, as in lower weight and high reps, some degree of permeability exists in the cell wall, allowing for intermittent oxygen transport into the cell and prolonging the contractile period. To test this, you can perform a maximally sustained contraction and measure the time required to reach failure. Then, after sufficient recovery, try maintaining a sub-maximal contraction of this same movement, measuring the contractile period and observing its longer duration. If a maximum contraction is executed with intermittent periods of relaxation, even longer contractile periods should be achievable.

Metabolic Boost During Recovery

Once exercise ceases, the process of recovery immediately begins. Some individuals continue to sweat, often for hours after completing a training session. The body utilizes sweat production to remain cool as muscles, liver, heart and immune system begin the complex and energy-demanding process of recovering. This persistent increase in metabolism explains how EPOC comes into play.

Many recovery processes make use of this extra energy. Lactic acid, a chemical by-product, must be cleared and converted into a useful energy source. The pathway to turn lactic acid back to glucose (then glycogen), an important function of the liver, demands energy.

At the same time, muscles need to repair and adapt. This process of protein breakdown and synthesis also requires energy. Nerves need to make fresh neurotransmitters, and hormones used during exercise need to be freshly synthesized. We can easily begin to recognize this collective process as extracting a high energetic cost to the body.

Commitment to Recovery Efforts

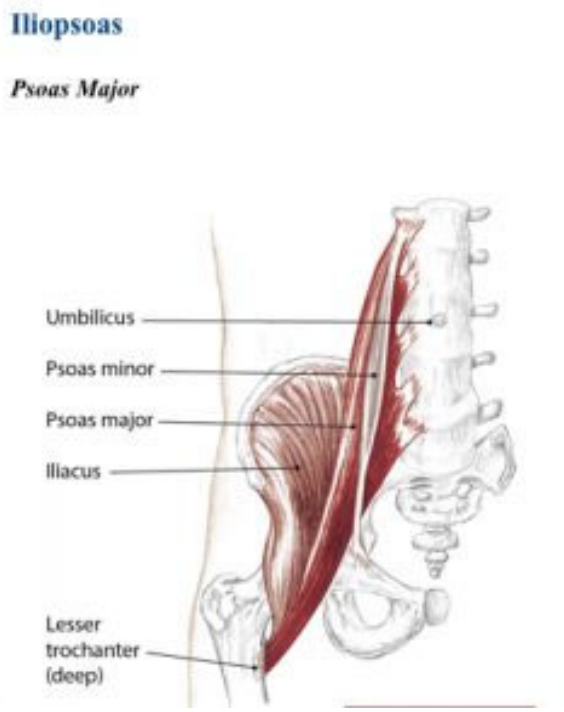
Like the workout itself, good recovery technique can improve performance and boost the benefits of training. Vital recovery begins with proper hydration and nutrition. Adequate fluid consumption facilitates the removal of lactic acid and allows glycogen stores to be regenerated. High-quality carbohydrates and proteins should feature prominently as part of any prudent recovery meal. This in turn should be followed up with adequate, good-quality sleep. A restful night helps muscles recover for another day of fun, high-energy, EPOC-laden output!

The Leg Raise: Not an Ab Movement

If there's any move I've seen done in the gym most frequently and largely in vain, is the hanging leg raise, or lying leg raise. You'll often see this move in the ab-day circuit along with Russian twists and side bends (also not ideal ab moves), the perpetrator of the movement swinging legs all willy-nilly up and down.

Unfortunately for the majority of folks favoring this type of exercise, leg raises *don't* actually work your abdominal muscles effectively, if at all.

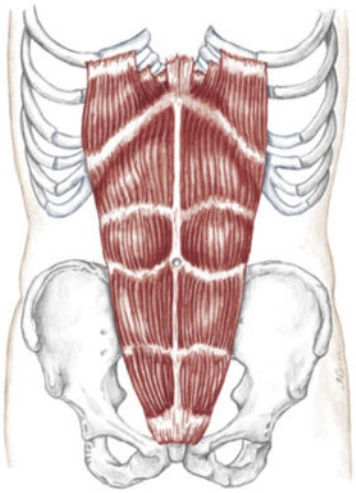
The Anatomy of a Leg Raise



Raising your leg is hip flexion, and hip flexors are what flex your hip. Which muscles perform that motion? Well there are 11 hip flexors, most of which assist in flexion including the adductors and abductors. The rectus femoris, TFL and all the adductors coordinate with the iliopsoas (which is really two muscles sharing common insertion points: the iliacus and the psoas) to flex the hip but only to 90 degrees. Past 90 degrees, all but the iliopsoas becomes actively insufficient (they go slack).

The Rectus Abdominus (RA) attaches from the ribs to the pelvis. It does not cross the hips and has no role in hip flexion In order to work RA, which is presumably what someone is trying to do with most of their exercises on ab day, but especially the leg raise, one would need to flex the spine. And by work, we mean to move through a range of motion for the sole purpose of developing that muscle. This movement doesn't do that at all. At least not as described above.

That's also not to say some people don't need hip flexor strengthening; athletes that are kickers, gymnasts and average fitness clients that have a posterior pelvic tilt can stand to add leg raises to their routine so long as they understand the purpose of the movement.



Rectus Abdominis

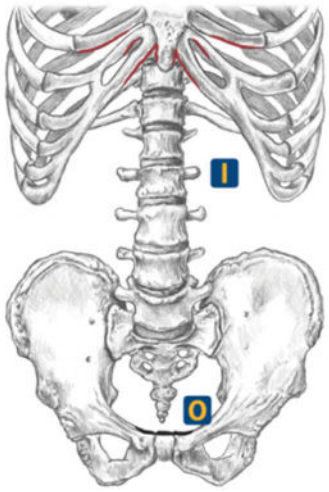
A Flex the vertebral column

Tilt pelvis posteriorly

O Pubic crest, pubic symphysis

I Cartilage of fifth, sixth and seventh ribs and xiphoid process

N T5, 6, T7-11, T12, ventral rami



4.98 *Anterior view of rectus abdominis*

4.99 *Anterior view showing origin and insertion*

Books of Discovery 2014

But I *Feel* it in My Abs!

Now what tends to happen during a leg raise that ends at 90 degrees is the degree of force exerted upon the spine by the weight of two legs is usually greater than can be isometrically resisted by the RA, the other spinal flexor muscles (the obliques) and stabilizers (TVA). In other words, in order to prevent the spine from *extending* (or arching) good ol' RA and TVA have to remain engaged isometrically for the entire set. This causes the build-up of lactic acid that makes the muscles feel worked. Not to mention the psoas will certainly tire from all of its action; because it's so deep in the abdominal cavity, it can feel like "abs" when fatigued.

This isn't completely worthless of course, but it comes at a cost: The stabilizers are likely to fail under the weight of the legs by the end of the set allowing spinal compression to occur concurrently with spinal extension.

Whenever we continuously perform a movement that extends or flexes the spine in a contraindicated way, our intravertebral disks slowly acquire a new deformed shape.

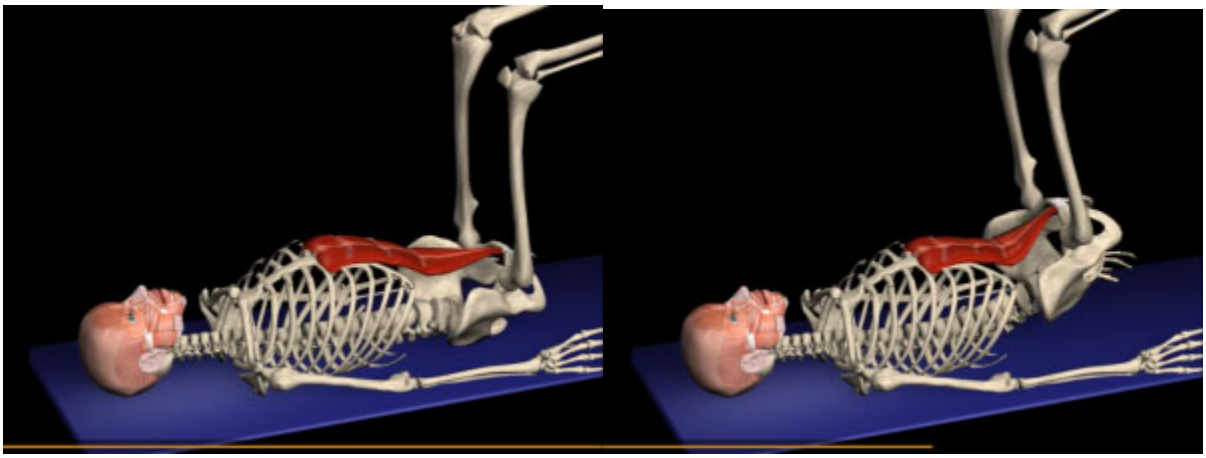
This new shape diminishes the nerve cavity eventually causing pinched nerves. The worse possible result of this deformity is a herniated disk, which is not necessarily irreversible, but nobody wants that.

Furthermore, anyone who has an excessive lordosis, or resting anterior pelvic tilt, already has an overworked and short psoas and most *definitely* does not need it to be worked even more.

This is the worst-case scenario. Certainly, it is possible that someone's abdominal muscles are strong enough to resist the force of the psoas pulling up on the legs and the lumbar spine will remain stable for the set, but then what good is this movement for the abs anyway? *An isometric contraction will improve performance of Type I endurance fibers but it won't do much to grow a muscle.* If you want to improve abdominal endurance look no further than the plank, a far more effective and less risky exercise for deep core musculature. That'll do it.

How to Modify the Movement to Hit the Abs

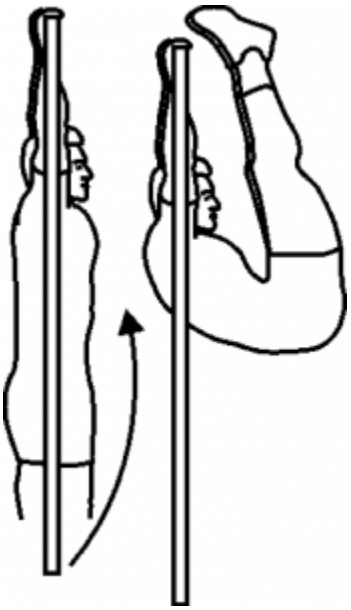
We now know we need to flex the spine and create a posterior pelvic tilt. So essentially, one could perform the initial leg raise and not lower the legs back to the floor but instead try to pop the pelvis off the floor and engage the RA while doing so. Keeping the knees bent is a regression. To advance, straighten legs and reach feet towards the ceiling. Except now, we don't have to call this a leg raise anymore. It's basically a reverse crunch.



Take it to an upright position as in the hanging leg raise and apply the same principle

We're looking for the same thing. The abs will not effectively engage until there is spinal flexion. Start with knees flexed to 90 degrees (the dotted outline below) and then attempt to lift the lower back away from the bench while lifting the knees even higher.

To advance this, (and this is really advanced!) keep legs straight while hanging from a bar and attempt to bring toes to the bar. There's some serious spinal flexion!



How a Trainer Can Assist

First of all, never act like a know-it-all when you attempt to correct someone. **Telling someone they're doing something wrong will likely just make them bristle and shut down.** If you already have a relationship with someone tell them that you can help them perform the exercise in a way that engages the abs even more and also protects the spine.

If you work in a club and don't know the person well or at all, be sure to introduce yourself during a rest period and courteously ask if you can give them advice based on new findings that can protect their lower back from becoming injured and a much more intense method of activating their abs.

If they're unfamiliar with the anatomy, quickly educate them on how the iliopsoas attaches from the spine to the leg and flexes the hip, as in daily walking, and is mainly responsible (along with a bunch of other hip flexors that *aren't* abs) for leg raises.
If they want to work the abs, they have to flex the spine, not the hips.

How to Perform the Reverse Crunch or Hip Lift (i.e., a better leg raise)

Get the client in reverse crunch position (starting with straight legs) and place your palms 3-4 inches above their toes, your hand in a vertical line with their Iliac Crest. Ask him or her to perform five reps of the reverse crunch in a direct linear, perpendicular path to the ceiling, reaching for the center of your palms.

This is what it should look like; Knees and ankles are in a direct line over the iliac crest:

If they're unable to control the movement this way, have the client bend the knees to 90 degrees and try again, aiming instead with just the knees. They may quickly learn they have a lot to gain by practicing this exercise and getting better at performing this true ab movement!

Ice or Heat for Pain?

As fitness professionals, we have well-acquainted ourselves with the PRICE protocol; pressure and ice help to reduce the swelling associated with acute injuries. And when it comes to muscle tension, moist heat applications are recommended. However, as of late, there has been some conflicting research about how effective icing certain injuries really is, and also some debate about whether chronic pain would benefit more from heat or ice. Let's look at what we know.

PRICE Principle

Acute injuries are common and might occur in the course of a fitness client's journey with you as their personal trainer. They include muscle strains, ligament sprains, contusions (or bruises), subluxations or partial dislocations, full dislocations and bone fractures. The NFPT's official recommendation for acute injuries is to employ the PRICE protocol. This acronym stands for:

Protect the injury from further damage. Depending on the injury, stabilizing it with a splint or even an ACE bandage may help prevent it from additional damage.

Rest is necessary for the body to begin the healing process. Excessive movement can increase swelling with increased blood circulation. The research seems to support this rest being limited to immediately after the injury (the day of) but some restricted and thoughtful movement to restore mobility may be in order in the short term following the injury. Known as optimal loading, employing appropriate functional movement to encourage healing may be a more useful step than extended immobility.

Ice, or cryotherapy, is applied to constrict blood vessels and minimize a swelling response, and also to numb the pain or provide an analgesic effect. Placing a barrier like a thin towel between an ice pack or bag of crushed ice and the skin will prevent skin damage and discomfort. The ice pack can be taped in place, but should be left on for only 20 minutes at a time. This can be reapplied every 2 hours while the injured client is awake.

Compression wraps should be applied to the injured area when it's not being iced, to further minimize swelling. Narrower bands should be used for children and adult wrist injuries. Wider bands of 4" are appropriate for knees and elbows, while 6" bands are available for thigh injuries.

Elevation is helpful to further reduce blood flow to the injury and minimize swelling. Elevating the injured area above the heart when possible is ideal.

The PRICE protocol should be employed for the first 4-5 days of injury in most cases, and then the injury should be re-evaluated for healing (or a determination made if swelling was present, whether it was edema or hematoma). **This has been the generally accepted sports medicine approach to dealing with acute injuries in the short term, although most of the support for each approach has been largely anecdotal or inferred from research studying other medical conditions.**

The entire PRICE protocol itself has not been rigorously researched, and the material that *is* available is largely focused on ankle sprain injuries. Conclusions on meta-analyses point to, well, inconclusiveness. It seems that every injury is unique and outcomes employing the PRICE protocol seem to vary. So we do our best with the information we have and employ this methodology until someone learns a better way, if one exists.

Cryotherapy

As would be intuitively gathered, we believe icing works on inflammation and soft tissue damage. When we traumatically injure ourselves, the pain is typically sharp and hot while tissue swells. Ice seems like the common sense approach to cooling a hot area and restricting tissue swelling.

Heat Therapy

We apply heat with muscle tension and trigger point syndromes are the underlying cause of pain and discomfort. This kind of pain tends to be chronic and mild but can certainly be jarringly painful and sharp when left unchecked too long and unaccompanied by stress and anxiety.

Adding a moisture barrier or even being submerged in water is said to improve the ability of the heat to penetrate the muscles in need. A wet towel under a heating pad is what I normally recommend.

Therapeutic Contrasting

A little-a-dis, a little-a-dat! Alternating between ice and heat *may* have some benefit to the healing process by stimulating tissue without too much stress. This should not be used for the beginning stages of an injury, but maybe more appropriate for repetitive tissue damage such as tendonitis, shin splints, or even carpal tunnel.

There's not much harm in trying it but it may also not produce any results. To try it, alternate 3-6 periods of intensifying heat and cold. Start with 2 minutes of heat, followed by 1 minute of cool, then 2 minutes of higher heat followed by, 1 minute of colder cold, etc.

Why Do Any Of It?

Utilizing heat and ice are desireable approaches when managing acute and chronic pain because they are non-invasive, inexpensive, easy to implement and adhere to. When applied properly, they can be effective and may reduce the need for medications. However, applying them to the inappropriate condition will likely just worsen symptoms or just not help at all.

Occasionally, the waters are a bit muddied by circumstance and knowing which approach to take might be a bit tricky. As mentioned above, acute soft tissue damage benefits from icing, so for certain, attempting to ice a stiff or tight muscle will only make matters worse.

Say its two hours after a workout that didn't include an adequate cooldown and your client's right lower back starts to ache and throb a bit. Since nothing obvious took place and the pain came on following earlier activity, the pain is more likely to be tension or trigger point pain than acute injury. Moist heat is probably a good first step to soothe the aching muscles.

How about the reverse? An achey back (or muscle) seems to improve once someone starts exercising. This is almost always a case of a tight muscle that starts to "loosen up" with the warmth of circulation and blood flow. This is definitely not the kind of pain that would benefit from icing!

Furthermore, backs rarely benefit from icing unless something went really wrong, and then you should be in the ER for the pro's to figure it out. Most back discomfort is mysterious and unable to be attributed to a single cause. I can personally attest to this as a chronic low back pain sufferer for over two decades now. I have a diagnosis of a legit back

condition, but many folks with bona fide pathologies like mine have no pain whatsoever and don't even know anything is amiss.

This is where chronic pain management becomes as much a guessing game as pinpointing the source of pain in the first place. Sometimes you have to just experiment and find what works. However, research suggests that when it comes to back pain, the body can't really tell the difference between hot and cold. Back muscles can run deep, and heating or cooling the body externally can rarely penetrate as deeply as though painful muscles (if that's where the problem is).

And when someone has lived with chronic pain as long as I have (in varying degrees over the years) it points to the neurological system being somewhat amped up artificially. Ice seems to aggravate the nerves and stimulate them even more, which is not going to produce *less* pain. (I can attest to this as well as I recall walking around with an icepack in the waistband of my shorts for a week thinking it would help. Nope. I couldn't even stand up straight).

What's A Trainer To Do?

We've discussed four plausible scenarios:

1. Acute Trauma: PRICE principle to initiate the healing process (for now, this makes the most sense)
2. Repetitive Soft Tissue Damage: Suggest Therapeutic Contrasting if all else has failed
3. Chronic muscle tension/trigger point syndrome: Moist heat applications to soothe muscles
4. Chronic low back pain: Heat is probably the way to go for some moderate relief.

Isometrics: Immovable Forces Toward Strength and Growth

Personal training is not always about how much weight a client can lift. Sometimes lifting no weight at all can challenge a client in new and different ways. This is the beauty of isometrics.

Isometrics refer to exercises wherein the muscles are *producing force in the absence of movement*. Think about pushing or pulling against immovable resistance, like a wall, or simply holding the weight of a barbell in bench press position for a designated period of time. You will certainly feel tension in the chest, shoulders and arms, but it is in the absence of any movement around a joint.

In positions like these, the muscle fibers are activated; but since there are equal forces against each other, there is no movement.

Push/Pull Balance of Isometrics

Whether pushing or pulling, the intent may differ but the result remains the same. We refer to ***overcoming* isometrics** as the act of attempting to shift the position of an immovable object. ***Yielding* isometrics,** on the other hand, refers to holding a weight in place (against the pull of gravity) and preventing it from falling to the ground. Finally, ***functional* isometrics** employs a static hold at a chosen stop during a lift.

Overcoming isometrics transfer a greater amount of energy to concentric strength and thereby demand more from the neurological pathways. Such moves lend themselves to short, intense efforts. This approach does not result in muscle damage and therefore, cultivates much more muscular strength versus size.

Yielding isometrics will spare the neurological system in favor of transferring eccentric strength to the muscle. As such, these moves can be executed for longer durations and increase *can* muscle size over time.

Functional isometrics involve using a very short range of motion or partial lift (about 2 inches of movement), immediately followed by a static hold in the end position for 6-9 seconds. By selecting the strongest position of the movement, 20-50% more weight than one's 1RM for that complete movement can be handled. This enables the neuromuscular system to adapt to handling heavier weights, effectively *desensitizing* the protective mechanisms that prevent one from reaching his full strength potential.

Calling All Growth Factors

On a scientific level, research has determined that if a muscle does not sustain a *hard* contraction, i.e. putting maximal effort into the contraction, then the body will only recruit a minimum number of fast-twitch fibers, (the ones most involved in muscular growth). Muscle fibers that are not recruited cannot be fully fatigued, and a fiber that is not fatigued receives little to no stimulus to grow.

Muscular growth is influenced by maximal muscle tension when maintained longer than a typical dynamic exercise. Research conducted by Kanchisa et all, in 2002, revealed an average muscular growth of 12.4% when a maximal isometric contraction (100% Maximal Voluntary Contraction) was sustained for six seconds in each of 12 sets per training session, significantly higher than a group sustaining longer contractions with less weight, but equal volume.

This experiment was conducted over 10 weeks, and the above isometric group was measured against a second group of subjects who trained at only 60% of MVC for 30 seconds sets and executed four sets per training session. It would appear, then, that a purposeful effort to accelerate a load might be equal in effectiveness to the *actual* acceleration, in terms of stimulating muscular adaptations.

In a blog article I wrote earlier this year, Symbiosis of Maximizing Size and Strength the concept of how hypertrophy is best achieved is underscored: by performing sets that last 30 to 60 seconds. A training set longer than only a few seconds forces the body to switch to the glycolytic-energy system, leading to the formation of lactic acid. Lactic acid is vital to the production of new muscle tissue, as it induces a surge of testosterone, a key component of hypertrophy. The increased time under tension is imperative for growth.

Utilizing Isometrics to Increase Muscular Strength

A 1985 study by Jackson et al. comparing two groups of conditioned lifters illustrated that adding isometric training to an isotonic program significantly improves strength gains.

With proper training, up to 10% more muscle fibers can be recruited during a maximal isometric action than during the typical concentric or eccentric movement. Since fiber recruitment is primarily responsible for affecting neural strength, frequent isometric training can literally *train* the nervous system to be more efficient at recruiting *more* muscle fibers.

The firing rate of the fibers soars during a maximal isometric action, more so than during a maximal eccentric action. So just like the body adapts to recruit more muscle fibers it can also get better at firing faster with isometric training. Not only do muscle fibers get stimulated with isometric exercises; bone mass, too, receives a boost. All of this explains the phenomenon often observed by athletes (myself included) wherein a small body can push a significant amount of weight!

Use in Rehabilitation

Isometric exercises are commonly utilized in the early stages of rehabilitation exercises. Their key advantage lies in orthopedic applications–those in which patients attempt to isolate and strengthen particular muscles by virtue of their ability to localize an exercise without involving any joint movement. Isometric exercises have likewise been utilized to counteract muscular atrophy.

Isometric program frequency is determined by a client's fitness goals. If he or she seeks to rehabilitate from an injury or illness, 5-7 days per week is not considered excessive. If the aim is to build both strength and muscular endurance, a mere three days per week can have a dramatic effect. Athletes, in general, tend to lack isometric and eccentric strength in comparison to their concentric (lifting) capabilities. A prudent trainer or coach seeks to incorporate isometric moves into any workout, regardless of the client's weightlifting ability.

Most isometric training programs require at least four weeks for real results to occur.

Training Smaller Muscles

While most weightlifting exercises work large muscle groups, isometrics facilitate the isolation of small muscles. Some activities require the strengthening of small muscles, such as those in the palms and fingers.

As an example, a client who frequently performs in piano recitals would benefit from small muscle isometric exercises. Also, clients who may have lost the ability to effectively grip silverware or writing utensils, due to either arthritis or a stroke, can be taught to strengthen these weakened areas with appropriate isometric movements.

Isometric Training Safety Considerations

It is important to rotate your client's isometric exercise routine so as not to overwork particular muscle groups. While isometric exercises are generally gentler than most strength training workouts, overtraining specific muscles and their secondary or supportive structures can certainly occur.

An example of a safe isometric training program to avoid over-training and injury would involve working the legs and abdominals on Mondays and Fridays; the chest, shoulders and triceps on Tuesdays and Saturdays; and the back and biceps on Thursday and Sunday. This allows for Wednesday, mid-week, to become a rest day, essential for muscular growth and strength.

As always, keep in mind the client's current and past health history. **If isometric movements are performed against considerable resistance, such exercises have the potential to increase blood pressure.** If a client has reported a prior or current history of cardiovascular disease or stroke, ask him to speak with his healthcare professional prior to beginning an exercise program involving isometric exercises.

Creating A New Challenge for Clients

Varying a client's workout program every 4-6 weeks is a given, if growth and increased strength are the goals. Upon reaching a plateau, trainers must be prepared to find new and innovative ways to challenge each muscle group. Isometric exercises lend diversity as well as benefits to a traditional bodybuilding workout. This helps alleviate boredom and prevents common overuse injuries sustained from consistently increasing weight loads. The benefits over time will speak for themselves!

Visit our site soon for Part 2 of the Isometrics experience, where we will explore optimal approaches to incorporate this style of exercise into a client's training program, including sample exercise techniques, intervals, and much more!

Success in Cerebral Palsy Strength Training: CP Means "Continual Progress"

For many able-bodied clients, the goal of strength training is simply to improve appearance and increase strength. Such has not always been the case for children, adolescents, and adults living with cerebral palsy (CP). Today, we have the ability to change not only the belief associated with CP and exercise, but the reality of improvements as well.

Almost every exertional effort to improve strength in CP patients has been the subject of much debate. The current model, based upon scientific studies, confirms that **strength training *does confer* positive benefit, and is no longer perceived as having a negative effect on spasticity**. Such exercise in this demographic lends itself quite well to improvements in health, overall function and general well-being.

Leveling the Playing Field

According to Dr. Jack Engsberg, Director of the Human Performance Lab at Washington University in St. Louis, "Children with CP are weak almost everywhere, so why not try to get them as strong as their able-bodied peers? Then get them to apply that strength and flexibility to whatever they want to do in their lives. I think the same principles for strength training that apply to people without disabilities apply to those *with* disabilities. But you have to consider what the disabilities are, and design a program based upon that."

Engsberg, who is also a Professor of Occupational Therapy, Neurosurgery, and Orthopedics, suggested that those studies which did not reveal optimal results from strength training most likely failed to aim for enough of a strength increase. "These kids are already at 30% in terms of strength versus able-bodied kids, so a 10% increase isn't going to really benefit them," he said. "You want to show a dramatic change in the strength component—60% or more—so you have to tailor the training accordingly."

Christopher Joseph, MSPT, Director of Physical Therapy at the Kennedy Krieger Institute in Baltimore, addresses the difference between individuals with CP and healthy athletes: "The goal of strength training in children with CP is not to produce the same results that bodybuilders seek. We are looking to strengthen them *within their abilities*."

Catering to the Dysfunction or the Solution?

Orthopedic surgeon Lance Silverman, MD, of Silverman Foot & Ankle in Edina, MN, is a believer in postsurgical PT in general. However, he is quick to caution that "strength training by itself is a mistake, because it will only *strengthen the dysfunction* instead of *properly correcting the problem*."

A sound strength-training regimen will correct dysfunctional movement, followed up with subsequent work to improve functional movement. "It is the same process that would be used with a healthy population; it's just more challenging to do correctly with CP patients." Pediatric patients with a Gross Motor Function Classification System (GMCFS) score of IV or V—in which independent mobility is either very limited or nonexistent—may not be ideal candidates for strength training. "If I have a patient who I do not expect to walk after surgery, then I'm less likely to say that strength training is worthwhile," Silverman said. "If I have a patient who I expect to have a productive gait after surgery, but is having a difficult time with balance and coordination, then I think strength training has value."

Harnessing Optimal Results

The International Classification of Functioning, Health and Disability (ICF) has become a common tool for assessing disability and, ultimately, a child's capacity for cultivating strength. "The ICF considers the body structures and functional aspect of a health condition/disability, the impact on activity, and the impact on participation," explained Prue Golland, a consultant in physiotherapy at the Cerebral Palsy Alliance in Allambie Heights in New South Wales, Australia.

"In simple terms, muscle weakness is considered to occur at the body's *structural level*, while walking is assessed at the *activity level*. The literature suggests that interventions are generally effective at one level of the ICF only."

Engsberg explained that a strength training protocol starts with learning proper technique, which in itself can take a couple of months. "Then you start getting into the building of muscle mass," he said. "Strength training programs that only go for four or six weeks are not really getting into the two important components that make strength training worthwhile."

CP Success Story

The most common form of CP is *spastic diplegia*. Tyler Sexton received this diagnosis very early in his life, and endured 16 surgeries during his developmental years. At age 4, Tyler underwent selective dorsal rhizotomy surgery which enabled him to trade in his wheelchair for a walker. Sixteen subsequent surgeries included Achilles tendon lengthening, hamstring and adductor lengthening, and repairs to the lateral collateral ligament and meniscus in his left knee.

"I always kept up with my strength training and aggressive physical therapy before and after my various surgeries," Sexton explained. "I saw great improvement with strength training, specifically cycling. [It] was the best way to gain function and mobility. I rode a three-wheel bike and now I'm on a stationary bike. I still do this every day, and I'm 28."

Through his formative years, Sexton gained strength, mobility and functional use of his limbs. Such achievements propelled him to pursue many personal goals: abandoning ankle orthoses by age 13, learning to drive a car, working as a scuba diving instructor, and ultimately completing medical school and a residency in Pediatrics.

Currently President and CEO of Caribbean Hyperbaric Medicine in Zephyrhills, FL, and a clinical professor of Hyperbaric Medicine at the University of Southern Alabama in Mobile, Dr. Sexton dedicated his career to working alongside children with CP, and is an advocate for strength training within this population.

"I believe it does help with mobility and spasticity," he said. "I know the literature hasn't always found that to be true, but…I believe in the ability of strength training in CP. In myself and my patients, I've seen an increase in range of motion, a decrease in pain in the hips and knees, and an increase in endurance."

Exercising with Cerebral Palsy: Form and Function

Rather than adhering to a strict timeline for obtaining results, the therapists at Kennedy Krieger follow the child's progress in terms of *functional gains*, acquiescing that younger children require extended periods of training before observing progress ."If we have a CP child who walks at age two, we're going to work with them from twelve to sixteen months on strengthening in a functional context," Joseph said. "As they get older, then we may be able to focus on a more traditional strengthening protocol because they can follow directions better."

The American College of Sports Medicine recommends that healthy, able-bodied adults engage in at least 150 minutes/week of moderate-intensity cardiorespiratory exercise (an activity where the heart is challenged work-wise) AND at least 2 days/week of resistance training. Currently, there is no evidence to suggest that these requirements should be any different for those individuals living with cerebral palsy. Unfortunately, many such patients lead sedentary lives, rendering such recommended parameters challenging to achieve.

While severity of the affliction often dictates one's abilities and limitations, recent studies indicate that benefits can be achieved even with a diminished workload. By starting slowly, acquainting oneself with both aerobic and resistance exercise, and gradually extending exercise time, frequency and intensity, results will almost always materialize.

Effects of Progressive Strength Training

Researchers at the University of Nebraska Medical Center evaluated the effects of a conventional strength training intervention on walking ability in children with cerebral palsy. The primary focus was on strengthening muscles of the lower body. Scientists assessed the effects of strength training on walking speed as well as endurance.

Nine participants, all around age 13 with spastic cerebral palsy, completed a 6-week program during which increases in isometric joint strength were observed, albeit with little to no statistical changes in walking speed. A progressive strength-training program seemed to favor isometric and dynamic strength gains in the subjects.

Since strength training programs can vary greatly with regard to mobility outcomes, "analysis to identify the target and type of therapy that is most effective for each individual should be considered," one researcher commented. **"Despite often being overlooked, the hip abductors play an important role in stability during gait, and should be considered in future strength training protocols."**

For people living with cerebral palsy, muscle weakness of the shoulder, arm and hand has long been recognized as a contributor to difficulties faced in completing everyday activities such as dressing, using conventional cutlery, and propelling one's own wheelchair. Strength training for arms is often recommended by exercise physiologists, occupational therapists and physiotherapists as a way to increase muscle strength and improve one's ability to complete activities of daily life (ADL). This holds true for several forms of cerebral palsy: bilateral, diplegia, hemiplegia, quadriplegia, triplegia and unilateral CP.

Gait inefficiency and declines in gross motor function are commonly observed in children with cerebral palsy, particularly as they transition to adolescence. **Resistance training may improve gait efficiency through a number of biomechanical and neural mechanisms**. The aim of the *Strength Training for Adolescents* with cerebral palsy *(STAR)* trial is to evaluate the effect of resistance training on gait efficiency, activity and participation in adolescents. This program aims to determine both the biomechanical and neural adaptations that occur following resistance training, evaluating the feasibility and acceptability of such an intervention for adolescents with CP.

Isolating Muscle Groups

By eliminating training that leads to overcompensating for weak spots, trainers can help CP clients focus on activating the entire body. This decreases the risk of developing a variety of age-related health issues. Dedicating specific movements to activate atrophied muscle groups forces the body to respond to desired performance outcomes.

An example is performing a one-legged leg press, using the same amount of weight for both legs despite differences in strength ability. Dumbbells and resistance band have the same effect on upper body muscle groups: muscle tone evens out, improving aesthetic appearance as well as strength levels.

It has been found that strength gains achieved in a program of at least eight weeks will be lost approximately six weeks after training is discontinued. Thus, in order to maintain progress, clients need to continue strength training through a maintenance program. Uncertainty persists as to what type of training is most beneficial, and for whom such workouts can offer the most relief. As a safe point of reference, trainers may consider following this sample protocol:

*Aim to work with client 2–4 times a week on non-consecutive days.
*Exercises should be performed as: 1–3 sets of 6–15 repetitions at 50–85% of maximum capability.
*Training period should last at least 12–16 consecutive weeks.
*Over time, progression moves from primarily single-joint, machine-based resistance exercises to free-weight, multi-joint resistance exercises.

Coaching Fitness Clients Toward Behavior Change

The process of changing human behavior is challenging and complex given that it is an ongoing, nonlinear process influenced by a number of different factors that change over time. There's no single formula to help fitness professionals predict why, how, or *if* a client will adopt a healthy behavior, making coaching a client toward behavior change a unique challenge for us. However, truly understanding a client's *readiness* to change is an important factor in their success adopting of new behaviors. Personal trainers able to evaluate and respond optimally to that readiness will be the most masterful coaches.

A Framework for Understanding a Client's Readiness to Change

A widely referenced, researched, and utilized framework for describing the process of behavior change is Prochaska and DiClemente's (1984) Transtheoretical Model of Behavior Change (TTM) or the stages-of-change model. This model can easily be applied as a "ruler" for gauging a client's readiness to engage in a change process.

The tenets of the TTM include five stages of change, processes of change (what an individual relies on to transition from stage to stage), self-efficacy (the degree to which an individual believes he or she can make a change), and decisional balance (evaluation of pros and cons of change). The following outlines the five stages of change and their associated characteristics:

Stage 1: Precontemplation: Individuals are nonbelievers and are not considering a change. They do not generally perceive current behavioral habits to be a concern. They do not see physical activity as important. (Probably not a current client, although current clients may be resistant to a specific plan of action that you have deemed vital or quite important)

Stage 2: Contemplation: Individuals in this stage are inactive but are considering making a change soon (within the next 6 months). They are beginning to see physical activity as important.

Stage 3: Preparation: Individuals in this stage are making attempts to change and generally have a plan to make a full change in the next month.

Stage 4: Action: This stage is characterized by individuals actively engaged in physical activity but have been active for less than 6 months.

Stage 5: Maintenance: Clients in this stage have been active for longer than 6 months.

Strategies to Apply Based on Stage of Change

The TTM uses what are called *processes of change* to describe how a client might be motivated to transition from one stage to the next. These processes or strategies are defined as either cognitive process (results in new ways of thinking) or behavioral processes (new behaviors that support change). The cognitive processes are especially useful for clients in the earliest stages of behavior change (i.e. precontemplation, contemplation, preparation). In contrast, the behavioral processes are more often applied with clients during the later stages of change. Refer below for the processes, their characteristics, and an example of their application.

Cognitive Processes

Consciousness Raising: Raising awareness; finding and learning new facts.

- Example: Your client is provided information about the benefits of physical activity (i.e. increased energy, better sleep, boosted productivity, etc.).

Dramatic Relief: Experiencing a negative emotion due to the unhealthy behavior.

- Example: Your client has a "close to home" experience with a relative diagnosed with Type II diabetes due to a hypokinetic lifestyle.

Environmental Reevaluation: Recognizing how the current unhealthy behavior is impacting the individual's social environment.

- Example: Your client considers how a lack of consistent healthy nutrition at home affects her children.

Self-reevaluation: Realizing the importance of making a change.

- Example: Your client sees her sedentary lifestyle as a barrier to other activities she wishes to enjoy.

Self-liberation: Deciding to make a positive change and developing new beliefs in his/her ability to make a change.

- Example: Your client is moved to change and begin to increase activity and establish better eating habits to support a new lifestyle approach.

Behavioral Processes

Helping Relationships: Identifying and relying on social support resources.

- Example: Your client accepts help from friends so that she can attend exercise sessions without worrying about care for her kids

Reinforcement Management: Increasing rewards for healthy behavior change; decreasing rewards for engaging in unhealthy behaviors

- Example: Your client rewards herself for making it to her exercise sessions. She decides to reward herself with a massage twice a month.

Stimulus Control: Using reminders to engage in healthy behaviors and removing cues to engage in unhealthy practices.

- Example: A client sets out her workout clothes the night before and packs a healthy lunch for work to avoid the breakroom food options.

Counterconditioning: Substituting healthy behaviors for unhealthy behaviors.

- Example: Your client plans a new response to triggers that encourage her to return to old habits. Instead of watching TV on the couch, she does light calisthenics during her favorite program.

Social Liberation: Engaging with people who help to model newly adopted and healthy behaviors

- Example: Your client engages socially with other members of her gym and office coworkers who are avid exercisers and gym goers. She is enjoying feeling happier and more energized.

Personal Trainers as Coaches

Personal trainers are uniquely positioned to actively coach their clients toward lifestyle change – not just toward a specific fitness goal. Many clients seek the services of a personal trainer to "lose weight", "tone up", "or get healthier" – each of which are outcomes of adopting and maintaining behavior changes that support the attainment of those goals. As a personal trainer, you have the opportunity to identify a client's readiness to change and apply specific strategies accordingly to help your clients move from stage to stage. **It's important to understand that although you may have a client in the action or maintenance stages of change, you should not assume permanency**. Relapses and lapses can and do occur, which is why it's crucial to help clients identify potential barriers to success, plan for high-risk situations, and incorporate strategies to address both. If you continue to take a coach approach in encouraging the continued sustainment of an existing positive change, clients will have a greater likelihood of long-term success.

Where to Begin Coaching Behavior Change

Begin as you always would, engage in a thoughtful conversation (*pro tip: use motivational interviewing where necessary if the client is ambivalent*) with your client about his or her beliefs about healthy change and work to identify ways to combat problems that threaten to interfere with sustained motivation and commitment to that change. Eventually, those changes will become important facets of your client's everyday lifestyle. In what ways do you gauge a client's readiness to change and commitment to activity?

Re-Injury Prevention: A Fresh Perspective on a Prevalent Problem

Incomplete rehabilitation in athletes, as well as the general fitness population, has led to an unfortunate **re-injury epidemic**. *Should our goal as trainers be to get clients back to training/exercising as quickly as possible, or to help them prevent re-injury?* **"Injury Prevention" can be viewed as the dual role of the rehab practitioner and personal trainer/coach.** Physical therapy tends to focus on restoring function through a variety of methods, and eventually enabling the patient to feel confident enough in the injured area to use it fully. Our role as personal trainers is to facilitate *the completion of the rehab process*.

However, we often notice a gap between clients possessing the *functional capacity* to exercise symptom-free and having the *strength* to perform in the same skillful manner as before the injury.

Slow and Steady Return Can Be Complex

Returning from a serious injury must not be viewed as a quick process. Professionals no longer focus on rehabilitation as the *isolation* of injured areas, preferring instead to reformat *complex movement patterns, or integration*. This process may involve substituting and/or slowing the pace of movements until the athlete finds his new comfort zone and goes a long way towards breaking the cycle of what is often referred to as "rehab purgatory".

Far more strides can be made and successes claimed by smarter training modes that encourage the ultimate return to increased workloads as opposed to the metaphoric placing of a Band-Aid over the injury. By building upon what was developed in PT, striving to continually improve functionality, and ultimately adding strength in the process, athletes can look forward to long term success even after incurring a serious injury.

Blending Rehab with Personal Training

Programming a client's workouts after injury can be tricky and time-consuming. **The best window of opportunity to optimally complete the process of re-injury prevention lies between rehabilitation and performance training.** As trainers, we strive to continue the client's healing process; but at some point, we also need to re-integrate his or her previous exercises to prepare him for performance re-entry.

A popular strategy is incorporating rehabilitation-type movements with traditional strength movements as supersets, to be performed either as part of a dynamic warm-up or during the training session itself. Pairing rehab exercises with more traditional ones helps ease the transition, provided those can be executed effectively without restriction.

Static Stability

***Static Stability* and *Dynamic Stability* are strong cohorts in helping an athlete regain proprioception and awareness.** By purposefully placing stress near the rehabilitation site on the body, and by challenging other joints to move, the injured area remains static while a dynamic exercise is performed elsewhere.

A great example involves attempting to maintain a neutral ankle. A trainer might instruct his client to begin by executing a single-leg stance on the floor, then moving to the same stance on a padded or slightly unstable surface. The last progression might be maintaining the stance while catching a ball. The client must, therefore, call upon his core and hips while trying to stabilize his ankle.

Re-Grooving Mobility

Part of rehabbing injuries is learning how to move again, and challenging old patterns that may have been executed consistently *incorrectly*. Rehab workouts typically require a modification of an original movement, and these can be safely incorporated by a professional, well-informed personal trainer.

Re-establishing — and more importantly, maintaining — functional range of motion is the first step when strategizing a path from rehab to strength. We can call this "re-grooving". Seek to incorporate patterns that restore the client's ability to move within the ranges required for his specific sport and exercise goals.

The function of a particular move, and how it ultimately serves to improve a client's sports performance while remaining injury-free, is the trainer's primary focus. In the case of low back pain, for example, reworking the positioning of a squat can have a tremendous impact on eliminating pain. In cases of upper-body injuries, regaining the rhythm and mobility of the shoulder and scapula becomes important.

Regaining Strength To Prevent Re-Injury

As lengthy of a process as this appears, proper rehab and training skills ultimately prepare the client for beginning to regain strength. Easing into this phase, known as *load management*, trainers can progressively add weight to those movement patterns that were "re-grooved" in the previous phase of training. **To avoid accidental overloading, often a result of an impatient athlete wanting to forge ahead, focus on strength paradigms incorporating high volume hypertrophy work before moving into max strength moves.**

In 2016, a panel of experts for the International Olympic Committee covered many of the subtle details involved in load management in a scientific paper entitled ***"How much is too much?"***

Some of the main points covered were as follows:

- Although research in this field is limited, experts remain confident that "load management" serves an important role in preventing re-injury.
- Injury recovery and rehabilitation share many of the same components as recovering and transitioning back to full activity following a serious illness.
- Load management requires a delicate balance, as both *too much, as well as insufficient,* load have the propensity to increase the risk of both re-injury and setbacks in illness recovery. **Dynamic load changes — increasing intensity up or down too rapidly — pose much bigger risks than absolute load.**
- In general, elite athletes are relatively immune to the risks of overload. However, our everyday clients definitely need us to practice prudent load management in their workouts.

Getting Client's Head Back in the Game

"Load" can also refer to non-physical yet still vitally important aspects of training. Mental fortitude does matter, whether it interferes with effective training in the form of an athlete's self-doubt, lack of confidence, or overall fear of a serious re-injury.

Even after completion of the PT program, many recreational athletes find that they do not yet have the strength and/or mental fortitude to pick up where they left off prior to the injury. If this seems to be a problem area, you may suggest visualization techniques, where the client sees him or herself as 100% successful. Tapping into the mental aspects of excelling in a sport will allow athletes to master those last few steps of a total rehabilitation process in the gym. ***Fear*** of reinjury after a sports injury, as a client transitions from rehab movements to actual sports-specific actions, can negatively impact an athlete's recovery, thereby preventing a successful and complete return to competitive sports.

As trainers, we may wish to educate ourselves in the application of *psychologically informed practice*. This methodology provides interventions to reduce fear of reinjury, thereby optimizing rehabilitation outcomes.

Healing Mind *And* Body

Currently, attention tends to focus on the inclusion of psychological interventions during sport injury rehabilitation. Many rehabilitation paradigms have begun integrating these steps, thereby expediting both physical and psychological recovery from injury. Among the myriad of techniques available, a client/patient may learn relaxation, mindfulness, imagery, goal setting and stress management.

Studies consistently reveal how such psychological interventions help diminish negative consequences, improve coping skills, and reduce re-injury anxiety. Consequently, recovery periods shorten, and injured athletes frequently return to their sport sooner than anticipated. Although few controlled outcome studies have been published, anecdotal evidence continues to support psychological interventions as powerful tools in decreasing negative healing consequences while increasing confidence in former movement patterns.

Maintaining Momentum

As mindful as trainers are in terms of formatting a recovery program, encouraging clients to maintain their PT exercises on training off-days is always a good practice. This helps the client know that a "safety net" supports him as he moves toward a return to full movement. Many athletes favor an injury longer than necessary, most likely out of fear of re-injury or even of "testing" the affected area. **If a trainer does not feel comfortable addressing the psychological component of recovery and prevention, seeking out other, more specific professional resources on a client's behalf will always be appreciated.**

Recognizing the Role of Rest

Fatigue contributes significantly in any injury recovery program. Sleep deprivation, a seriously underestimated problem, often leads to development of chronic pain. Training regularly in a fatigued state not only impairs athletic performance, but negatively impacts the rate of injury recovery.

The risk of *collateral* injury is a significant factor in many cases of chronic pain. This term refers to the idea that when an athlete incurs an injury, he places himself at higher risk for all manners of other injuries. A seemingly minor setback in terms of re-injury can thwart the healing process and ultimately lead to a lifetime of chronic discomfort.

For decades, athletes have been encouraged to "get back in the game" following an injury, often by professional trainers and coaches who place a higher value on a team's success than in addressing a potentially serious risk. Physical therapy previously supported the practice of "mobilizing injuries" as rapidly as an athlete's pain level would allow. As a result, serious sprains were rarely casted, despite the fact that a sprain can in some cases be worse than a fracture.

A 2009 study published in the Lancet presented clear evidence that a full cast for a severe ankle sprain facilitates healing far better than using either braces or tubular compression bandages. Sadly, we learn that re-injury avoidance has not always been a top priority.

The Total Package

Keeping an ethical perspective on our scope of practice, personal trainers can safely utilize their knowledge to help recreational or high-level clients make a full return to their chosen sport following injury. Feel encouraged to contact the referring physical therapist, and discuss a client's past exercises when necessary. A combined professional effort is what clients deserve, and we now have the ability to create successful outcomes.

Liver Health Awareness: The Risks of Supplement Toxicity

For many years, research has suggested that many commonly used bodybuilding supplements pose a significant threat to the liver, **including non-steroid products sold online or over the counter in sports-related and health food stores**. What should we advise our clients to reduce or avoid altogether with regards to supplementation and liver health?

Limits of the Liver

American Association for the Study of Liver Disease and the *National Institutes of Health* have announced that the use of herbal and dietary supplements now accounts for 20% of cases of hepatotoxicity in the United States, up from 7% a decade ago. Bodybuilding and weight-loss supplements continue to confer the greatest risk, according to a report published in the journal *Hepatology* by Victor Navarro, M.D. and colleagues, liver experts at Einstein Medical Center in Philadelphia.

The major culprits include anabolic steroids, green tea extract, and multi-ingredient nutritional supplements. Such products, possibly in your fitness and weight loss clients' cabinet right, now represented 50% of all reported liver damage cases linked to supplement usage. A major contributor to this problem stems from the inclusion of multiple ingredients, making it difficult to identify the offending compounds. Often these supplements have even been found to contain prescription drugs **not listed on the label**, says Marvin M. Lipman, M.D., *Consumer Reports'* Chief Medical Adviser. "As surprising as it may seem, manufacturers are not required to prove to the Food and Drug Administration that their products are safe, or that they're effective for their advertised use, before they are sold," says Chuck Bell, programs director for *Consumers Union*, the branch of Consumer Reports whose job revolves around petitioning the FDA to exert authority/pressure on removal of harmful dietary supplements from store shelves. "The rising number of liver injury cases is yet more evidence that the loose regulation of supplements is putting consumers at risk," Bell says.

Weight Loss at the Expense of Liver Damage?

While anabolic steroids marketed as bodybuilding supplements typically induce a **self-limiting** liver injury, green tea extract and many other thermogenic-centric weight loss products can easily cause acute hepatic injury as well. According to statistics from the *Drug Induced Liver Injury Network*, a program funded by the NIH, approximately 700 cases of liver damage were reported during the period of a single study; among those reported cases, 130 were linked to the use of dietary supplements.

Since 2008, the FDA has lashed out at companies whose supplements are found to contain prescription drugs and controlled substances, said Daniel Fabricant, Director of Dietary Supplement programs in the agency's *Center for Food Safety and Applied Nutrition*. Recently this agency facilitated the removal of a so-called "fat burning" product from shelves, *OxyElite Pro*; its use had been linked to one death as well as many cases of hepatitis and liver injury across the United States.

OTC Pain Relievers Carry Risk

Supplements may not be the only cause for strain on the liver. When muscle pain is severe, many recreational athletes reach for their OTC pain reliever of choice and commonly disregard dosage warnings printed on the drug's label, often taking as much as twice the recommended dosage. **If a product does not require a prescription, many individuals assume an absence of potentially severe side effects. Nothing could be further from the truth.**

According to Brian Strom, Director of the Center for Clinical Epidemiology and Biostatistics at the Perelman School of Medicine, University of Pennsylvania, any product on drugstore shelves containing an "active ingredient" can "interfere with normal bodily functions". In the case of acetaminophen, such side effects can prove deadly.

Acetaminophen is the most widely used pharmaceutical analgesic in the world. While safe and effective when consumed in appropriate dosages, the *American Association of Poison Control Centers* counts this over-the-counter panacea as

among the most common pharmaceuticals associated with unintentional poisoning. **Acetaminophen poisoning continues to top the list of hepatic failure requiring liver transplantation in Great Britain.**

In the United States, such poisoning has leapt ahead of viral hepatitis as the most common cause of acute hepatic failure, and is the second leading cause of liver failure requiring transplantation. Robert J. Fontana, M.D., Associate Professor of Internal Medicine at the University of Michigan Medical School and Medical Director of liver transplantation, endorses Tylenol (a common brand-name of acetaminophen) as a safe drug. However, his caveat remains: "…Like most other things in life, too much of a good thing can be bad for you."

In July of 2011, *Johnson & Johnson* announced a reduction of its previously stated maximum daily dose of Extra Strength Tylenol, in an effort to lower the risk of accidental overdose from the product's active ingredient, acetaminophen. The company's *McNeil Consumer Healthcare Division* plans to introduce new labels on Extra Strength Tylenol, indicating a maximum dosage of 3,000 milligrams, downshifting from its previous daily allocation of 4,000 milligrams (the equivalent of 8 pills). Medical providers, too, might follow suit and consider promoting awareness and providing greater education to their patients prior to suggesting any common painkiller.

While proactive measures serve to ensure the safety and well-being of the consumer, effectiveness only occurs when the public learns to adhere to dosage recommendations. If we encourage clients to think of the information printed on over-the-counter labels as equal in importance to what doctors write on a prescription pad, we might steer them away from engaging in **the risk of self-medicating.**

Natural, Low-Risk Pain Management

Though a personal trainer's scope of practice limits the doling out of medical advice, we can certainly enlighten clients, recommending a more natural path when they speak of suffering sore muscles a day or so after a tough workout. "Inflammation goes hand in hand with pain, so if you can block the inflammation, you can decrease the pain response," says John DeLuca, MD, DC, of a health and wellness center in Palm Beach Gardens, Florida.

The spice turmeric possesses certain well-documented anti-inflammatory properties and can be taken in capsule form or used in a variety of recipes. Turmeric is featured prominently in Indian cuisine, especially curry. It also makes a delicious addition to soups, rice dishes, smoothies, and on vegetables.

Curcumin, the active ingredient in turmeric, fends off pain by blocking a number of different pathways that lead to inflammation. Studies indicate the pain from osteoarthritis can be mitigated just as well with turmeric as ibuprofen.

Although considered safe, those with GERD, gallbladder or blood-cloting issues or estrogen-sensitive conditions should consult a physician before taking turmeric as a supplement.

Ginger is another powerful anti-inflammatory agent. A 2013 research study revealed that while the mechanism of Tylenol or Advil blocks the formation of inflammatory compounds, ginger actually "blocks the formation of the inflammatory compounds–prostaglandins and leukotrienes–and also has antioxidant effects that break down existing inflammation and acidity in the fluid within the joints," reported *care2.com.*

From ginger chews and hard candies to brewed ginger tea, this unique spice can add a pungent aroma to many recipes while also healing sore muscles.

Our bodies, complex machines at their very core, strive to maintain homeostasis at all costs. Thus, proceed with caution: researching supplements and their ingredients thoroughly while also maintaining a healthy respect for over-the-counter medications can mitigate the risk of putting the body's filtering organs like the liver in danger.

Creatine Supplementation: Everything You Need to Know

Most fitness enthusiasts who have had their sights set high on muscle growth have certainly heard of creatine if they aren't already taking it. If you've taken it and tolerated it well, it's probably still a part of your pre-workout ritual. And with good reason: Creatine is the most well-documented sports supplement touted for boosting athletic performance and greater gains.

But that's just the tip of the iceberg. **As it turns out, creatine has all sorts of other benefits besides helping bodybuilders squeeze out a few more reps.** It has been shown to improve post-exercise recovery, prevent injury, and assist in thermoregulation and rehabilitation. It also can help heal concussion and provide spinal cord neuroprotection.

That's not all!

The *International Society of Sports Nutrition*'s stance on creatine is that its use is safe in addition to its many benefits. Their 2017 review of creatine supplementation indicates successes with regard to "neurodegenerative diseases, diabetes, osteoarthritis, fibromyalgia, aging, brain and heart ischemia, adolescent depression, and pregnancy".

If you're still not impressed, read on. If for any reason you had a preconceived notion that taking this supplemental superstar might have a more negative impact than positive, the large body of evidence available suggests otherwise.

What is Creatine?

Creatine is defined as a non-protein amino acid compound found exclusively in vertebrate animals and functions in the formation and recycling of adenosine triphosphate (ATP) in muscle cells and also to a lesser extent, testes, heart, and brain tissue. It is produced in the body by the liver, but once released, 95% is stored in the skeletal muscle tissue. A large percentage (about 65%) of total creatine is in the form of phosphocreatine (PCr)–the form able to be highly mobilized for energy production. The rest is in the form of free creatine (Cr), waiting to be converted into PCr by the enzyme creatine kinase.

Once converted to PCr, the production of ATP via ATP synthase is then possible. ATP is the driver of most cell processes, including muscle contraction, nerve impulses and chemical synthesis. We can produce up to 250g of ATP daily, and surprisingly, the body recycles its own weight in ATP daily via creatine processes. While ATP can be synthesized through several pathways, creatine is required for the production of ATP in order to fuel short bursts of energy .

Our NFPT Manual reminds us: "There are about 4 seconds worth of ATP already stored in the working muscle cells. After this period of sustained muscle contractions, ATP in the working muscle is exhausted and the cells resort to the use of Creatine Phosphate and ADP to create more ATP, providing energy for about another 25-30 seconds."

When it comes to exercise, the more ATP we have available for use, the more energy we have to perform our workouts. **So it follows, the more Cr we have available in our cells, the more ATP can be produced for short, high-intensity exercises such as weight lifting or sprinting.**

For an average 70kg human (approximately 155lbs) the total creatine amount (PCr + Cr) found in the muscle averages about 120 mmol/kg of dry muscle mass (*mmol = millimole. A mole is an amount of a substance that contains a large number (6.02214078×10^{23}) of molecules or atoms. A millimole is one-thousandth of a mole.*) The upper limit that *can* be maintained in the human body at any given moment is closer to 160 mmol/kg of muscle mass, indicating that there is room for supplementation.

Vegetarians/vegans have been reported to have naturally lower stores (90–110 mmol/kg of dry muscle) and may benefit from creatine supplementation most for normal functioning. Additionally, athletes with high muscle mass and engaging

in regular intense activity are more likely to deplete their stores and would benefit from supplementing between 5 and 10 grams a day simply to maintain normal levels.

Don't get too hung up on these chemical measurements. **Suffice it to say, there is an average at which the body measures for creatine levels without supplementation, but it does not reach the body's threshold of how much it is able to harbor.**

Furthermore, about 1-2% of intramuscular creatine is metabolically broken down into creatinine and excreted through the urine. This equates to 1-3 grams of Cr that would need replenishment on a daily basis. Most of that can be gained through high-protein foods such as beef and chicken; the remainder is manufactured in the liver and kidneys. But even with diets garnering the appropriate amount of creatine from food, it still leaves the body's creatine stores only 60-80% saturated.

To affect athletic performance via increased ATP production and storage making slightly more energy available for intense exercise, additional supplementation of creatine appears to be a reasonable strategy. What does the research say?

Does Creatine Supplementation Really Work?

In order for creatine stores to reach threshold, the muscle stores must be saturated. A loading phase has been studied to observe fast and measurable changes in these stores.

The supplementation of 20-30 grams of creatine a day for up to a week is known as a loading phase to saturate the muscle stores. After that, most folks can take 3-5 grams/daily to maintain those stores, though some athletes may need 5-10 if they work more intensely, more frequently and have above-average muscle mass. Further, creatine is reported to have greater muscle retention rates when consumed with carbohydrate or a carbohydrate + protein.

Loading isn't necessarily to saturate muscle stores, however. Ingesting a modest 3 grams a day for a month will also saturate stores, albeit more slowly and with less evident performance improvements.

A 1992 study published by *Clinical Science* tested how levels of supplementation affected subjects who already measured below normal on total creatine levels. They found that a protocol of administering five grams 4-6 times a day for at least two days resulted in a significant rise in total creatine levels, but especially so in the muscles that engaged in heavy exercise. Interestingly, however, no rise in ATP levels was detected.

Other studies have demonstrated that ATP production after the loading phase does indeed significantly increase. For instance, Kurosawa et al (2003) tested subjects' handgrip strength using a dynamic exercise before and after creatine loading and found that ATP synthesis was highly correlated with Cr supplementation, as was mean power output for the 10-second exercise.

The review of the *Journal of International Society of Sports Nutrition* mentioned at the beginning of this article cites nearly 30 research articles that support the efficacy of creatine supplementation in improving sports performance across all sorts of populations, from adolescents to seniors, and both men and women—though some evidence suggests women do not gain as much benefit as men.

Still, there has been little evidence to refute its utility in gaining an added muscle-energy boost during workouts and plenty to say that it does. Since creatine is naturally occurring in the body and in our food, there are no legal restrictions on its use for professional sports, and therefore, is a favorite supplement amongst athletes. An estimated 15-50% of athletes and military personnel report using it.

Other Benefits

Recovery and Rehab

The health benefits from creatine supplementation don't stop at athletic performance. Aside from a boost seen in speed, strength and muscle size from increased energy stores, creatine also appears to speed recovery and reduce injury. **The first interesting finding is that taking creatine is better than carbohydrate loading alone in maintaining glycogen stores–a condition known to improve recovery.**

Another study measured recovery by testing isokinetic and isometric contractions post-workout in individuals supplementing with creatine, and found that both were higher with supplementation. One study found lower levels of blood markers associated with inflammation and muscle soreness in marathon runners supplementing with creatine compared with controls.

Additional evidence suggests that taking the supplement seems to prevent overtraining symptoms when overdoing it would otherwise result in decreased athletic performance. For those with injuries or engaging in post-rehab exercise recovery, taking creatine appears to reduce atrophy and boost muscle performance, as you would expect.

Injury Prevention

A study comparing football players both taking creatine or not indicated no ill-effects were experienced by those supplementing, and in fact, they reported "less incidence of cramping, heat illness/dehydration, muscle tightness, muscle strains/pulls, non-contact injuries, and total injuries/missed practices than those not taking creatine".

Similar findings were replicated among other football, soccer and basketball players refuting the longheld belief that creatine causes dehydration and muscle cramping, among other things.

Dehydration or Hydration?

One area where the accusation holds water is that creatine promotes fluid retention, primarily in the skeletal muscle itself, and can cause weight gain because of this retention. But plenty of research examining if that retention somehow translates into dehydration determined that it unequivocally does not. Even better, it seems to even boost an athlete's ability to perform in the heat without thermoregulation failure.

Are There Risks of Creatine Supplementation?

Is there any truth to the purported ill-effects of taking creatine on a regular basis? Rumor has it that it can cause a plethora of side effects including (but not limited to):

- Kidney damage and stones
- Liver damage
- Weight gain
- Dehydration
- Muscle cramps
- Digestive problems
- Compartment syndrome
- Rhabdomyolysis
- Bloating

Kreider et al. (2003) determined that long-term use of up to 21 months at recommended dosages did not significantly alter any health markers amongst athletes. And this was compared to a control group as well. They looked at metabolic markers, muscle and liver enzymes, electrolytes, lipid profiles, hematological markers, and lymphocytes, as well as renal function.

Basically, almost every study that has tried to find a side effect of creatine usage found none, aside from weight gain, which has been attributed to water retention, if not muscle gain. When creatine supplementation ceases, weight and water retention decreases.

Aside from that, there was little evidence to indicate any ill effects result from taking supplemental Cr. And while looking for bad things, they found good things. I suggest reading the full review on creatine by the ISSN for all the details I didn't include here, including its many medical applications.

But so, there you have it: creatine is backed by research to be both safe and effective as a supplement.

How to Take It and Who Should

Should you recommend creatine to all of your clients?

I'd say it's a personal choice and you can start with educating your clients about supplements in general. There are a ton of options out there and anyone can get roped into a too-good-to-be-true promise. For the average weight loss or fitness client, knowing anything about creatine supplementation to start is not only unlikely, but they'll probably be more inclined to want a supplement geared towards weight loss or energy—products that are actually quite likely to cause damage or contain undisclosed, potentially dangerous ingredients and still don't promote long term results.

If you have clients serious about putting in the effort to build muscle, improve performance and change their body composition, creatine is a perfectly safe addition to their program. It's worth mentioning that there are MANY forms of creatine marketed today, each proclaiming to be either fast-absorbing, more bioavailable, less-bloating, etc, etc. The large body of evidence indicates that plain old *creatine monohydrate* does the job and the others don't do any better. So, don't fall victim to advertising ploys.

I just purchased this very basic, inexpensive creatine product (affiliate link!) that comes in powder form for about $11, containing 80 five-gram servings, projected to last 45 days if I do a week loading phase. **Those who consider themselves compliant and able to follow a multi-occasion daily protocol should consider implementing the loading phase: Take 5 grams of creatine 4 to 6 times a day for 5 to 7 days. After that, a maintenance dose of 3-5 grams is appropriate for most people.** Those with more muscle mass or who perform intense exercise can take up to 10 grams a day.

Women and lighter individuals can probably take it fewer times a day for fewer days for the loading phase, and take 3 grams for the maintenance period. Even athletes under 18 are cleared to take supplemental creatine.

Coupling your creatine supplement with a carb and protein will help the muscles retain more of the compound. Consider mixing it in with a protein shake and eating a banana. Or, take it in water and have a spoonful of peanut butter on a piece of toast. Taking creatine while active should result in noticeable performance gains, but it is worth noting that stopping your supplementation does not result in a drop below baseline levels. I.e., your body is not going to become reliant on the supplementation and stop its own creatine synthesis. Stop taking it and you will probably just return to your baseline level pre-supplementation.

Have you seen differences in your own performance while taking creatine monohydrate?

Core Training Versus Core Strengthening: Is There A Difference?

The true foundation of a client's fitness success is that their journey aligns concordantly with their level of fitness and progresses appropriately as they achieve set goals. Knowing the difference between core training and core strengthening is key to programming clients responsibly.

When it comes to core strength—arguably *the* foundation of the body's overall strength—we as personal trainers can ensure such progress takes place by first evaluating their core *functioning*, and being certain that the exercises we program will be effective for the client's current abilities.

For instance, if a 65-year-old woman, a career accountant with four grown children interested in working with you explains that she has done some yoga over the years, but hasn't followed a formal exercise program before, you wouldn't want to start her on TRX plank-ups week one. Most of us know at least that much!

However, even putting her in a modified plank and dynamic bird dog may also be too advanced without first determining if your new client is truly "connected" to her deep core musculature at all. Jumping right to our core exercise go-to's, even when they seem to be the simplest and most regressed versions of standard movements may cause us to overlook an inherent failure to activate the deep core muscles: the pelvic floor, the transverse abdominous (TVA), and the surrounding muscles that support the spine like the deep intrinsic back muscles, that are potentially underperforming—especially if someone is new to exercise later in life.

Further, some folks who report unexplained low back or abdominal pain tend to have inhibited core engagement, most likely due to a disruption in the way the brain communicates directly to the muscles. If this is the case, jumping right into a core *strength* routine will not only be ineffective, but may result in more pain or injury to your client.

Core "Training" Terms

So we've got core activation, core training, core stability, core strengthening….did I miss anything?

These terms might often be used interchangeably when discussing fitness programming but we would all do well to adhere to some agreement in the definitions since their meanings do indeed differ.

Core Activation: Attempting to isolate specific muscles of the core, (such as the TVA, diaphragm, pelvic floor muscles and multifidus) to ensure that they are functioning and integrated with movements initiated by global musculature (like compound exercises). This cannot be achieved by visible movements or "doing", only by visualizing, cueing and feeling your way through it. A mentally difficult attempt must be made to isolate and engage the target muscles and then sustain a contraction. You can attempt to assist your client manually in this endeavor or have them use their own hands to palpate activation, when possible.

For example: lying supine, placing fingers just medial to ASIS and attempting to engage the TVA by gently pulling the lower abdomen in towards the spine is a TVA activation technique.

Core Training: Once activation is successful and the target muscle can be contracted more readily on cue, the muscle must be taught the proper timing and sequence to fire. The purpose of these deep core muscles is to provide a stable base from which movement can take place with essential spinal and trunk support. If the muscles fire *after* a large movement is initiated (or not at all), pain and injury may follow. This step involves training the muscles to fire synergistically with the global musculature, but the movements are small, subtle and allow for the determination that the core muscles are truly participating.

For example: Drawing up the pelvic floor muscles, pulling in TVA and connecting with the multifudus muscles of the sacral spine all at once engages the deep core muscles as a unit. Maintaining the contraction while breathing normally is the first step in core training. Performing this task in different positions like sitting, quadruped or standing is necessary before adding movement. Simple extremity movements are then added, such as abducting an arm while standing or flexing one arm only while in quadruped. These can become increasingly complex when mastery is demonstrated.

Core Strengthening: If the client can consistently show that these intrinsic core muscles are able to co-contract with global core muscles (like rectus abdominus and the obliques) and control the trunk and limbs, it is appropriate to add load and complexity to the program making way for strengthening to take place.

Signs That Your Client Needs Core "Training"

Of course, not everyone has to be regressed this way, but there are some indications that point to a poorly functioning core. Clients with previous abdominal surgery, past trauma or injury or recurrent abdominal pain may have a dysfunctional core system.

As mentioned above any woman who has been pregnant and certainly multiple pregnancies may have extensive pelvic damage and if the client is experiencing pain, she may benefit from seeing a pelvic health specialist. Always assess for a Diastasis Recti, since this will surely point to weak deep core muscles. **Consistent bouts of mild, lower back pain or the kind that only surfaces while exercising may be due to poor core performance for pretty much anyone.**

Doing the proper assessments may give you great clues, but may not always be enough. A client whose trunk collapses forward into spinal flexion during a *modified* Overhead Squat Assessment (hands on hips rather than overhead) is positive for an intrinsic core failure.

The following visuals signs are indicative of a deep core system that is malfunctioning:

1. Posterior pelvic tilt
2. Bulging abdomen
3. Depression of the rib cage
4. Breath-holding
5. Internal oblique dominance as indicated by fingers that placed medially to ASIS rise when TVA contraction is attempted
6. OHSA sign of trunk flexion

If your client is positive for any of these signs, walk them through some core activation techniques and gauge their performance (and degree of frustration). Someone may be great at activating the pelvic floor, but with an overactive synergist like the internal obliques to dominate trunk stability, simply cannot effectively connect with the TVA.

You can help them do this!

A Sample Core Progression Program

Deep Core Activation

Applying on 30% effort is recommended for these activation tasks.

- Activate the Pelvic Floor Muscles– Kegel exercises essentially–Instruct the client to lie supine with knees bent and attempt to engage the muscles that cut off a stream of urine. Also, cue him or her to visualize the muscles at the bottom of the pelvic "bowl" are lifting up and away from the bones.
- Activate the TVA by first pulling up the pelvic floor muscles and then gently drawing the lower abdomen away from the waistband.
- Connecting to the multifudus is a bit trickier. He or she should lie on their side for this one, with knees bent and head supported. It's helpful if you as the trainer palpate the multifidus which are arranged just along the spine in the lumbosacral region. If you can feel the muscles engage after a few attempts (and this is quite subtle!), then have the client place a thumb and forefinger just lateral to the bony spinal processes of the lower lumbar spine and feel for him or herself. After cueing both pelvic floor and TVA activation instruct the client to visualize an invisible string from the pubic bone to the lumbar spine and then another from one side of the pelvis to the other and imagine they both are shortening. It would feel as though the pelvis is becoming smaller and the lower back is firming up.
- These initial activation contractions should be held for 3 – 5 seconds while breathing out slowly. Then, cue the client to relax and breathe in to prepare for the next rep. Then the next contraction can be initiated, held and released with the outbreath.
- Synchronize this process with breathing for 3 sets of 10 repetitions 3 – 4 times per day for 2 weeks.
- Being able to perform these contractions while standing and in quadruped position and sustain them while breathing normally (both in *and* out) through the diaphragm is an indication that the client is ready to move on.

Core Training

The breath should be incorporated naturally into the newly integrated core contractions. The muscles should maintain performance whether breathing in or breathing out.

- The above activation should be easily performed and felt by the client without much effort.
- While lying supine with knees bent and back neutral, instruct the client to engage all of the muscles of the deep core and allow the left leg to abduct slight while keeping the foot on the ground, like a hinge, and then return to start.
- The focus should be on maintaining the strong core contraction before, during and after the movement and also keeping the pelvis and other extremities perfectly still.
- Perform this movement 10 times per side up to 3 times daily for two weeks.
- Similar exercises include marching, leg slides, and shoulder scaption.
- Certainly incorporating the deep contractions while walking, sitting, standing and performing ADLs is part of the core training program.

Core Stability and Strengthening

The client should now have control over the core muscles and not have to think about engaging them during regular movements successfully and also should not be experiencing the same level discomfort or pain in the low back or abdomen as before they started. Strength training all the core abdominal muscles by incorporating bird-dogs, prone bridges (plank), side planks, side bridges, supine bridges and dead bugs into your client's programming is now appropriate. Once these exercises are mastered, adding loads, complexity, instability and novel environments are great ways to progress.

SELF – TEST: December 2019

1. A motivational intervention that utilizes mental visualization to achieve personal goals is called:
    a. FIT: Functional Imagery Training
    b. FIT: Fitness Imagination Technique
    c. MIV: Mental Imagery Visualization
    d. MIV: Making Imaginary Views

2. The deltoid muscle consists of three distinct 'heads' with very different joint actions that, when engaged simultaneously, work together to produce:
    a. Shoulder adduction
    b. Shoulder abduction
    c. Humeral flexion
    d. Humeral retraction

3. The Anterior Deltoid is also known as the:
    a. Front deltoid
    b. Middle deltoid
    c. Back deltoid
    d. Obscure deltoid

4. This exercise, essentially transverse abduction, emphasizes posterior deltoid contraction, but will also recruit other back musculature such as the rhomboids and trapezius.
    a. Cable front raise
    b. High pulley row
    c. Reverse flye
    d. Dumbbell lateral raise

5. Which of the following ways can blood pressure be affected by the hot summer weather:
    a. Less blood flow to the skin
    b. Increase in blood volume
    c. Increase demands on the heart
    d. Decrease risk of hydration

6. Individuals already managing high blood pressure can significantly lower their systolic blood pressure reading by:
    a. Increasing potassium through healthy whole-food choices
    b. Decreasing potassium through high quality supplements
    c. Increasing sodium intake through high quality supplements
    d. Decreasing sodium intake through healthy whole-food choices

7. Potassium has benefits on the following functions:
    a. Maintaining the body's pH balance
    b. Carrying nutrients to the cells
    c. Neither of these
    d. Both of these

8. Mechanical loading coupled with metabolic stress are the primary drivers spurring hypertrophy when using this kind of training technique:
    a. Body Flow Reclusion
    b. Blood Flow Restriction
    c. Blood Force Recovery
    d. Bodyweight Force Recovery

9. The BFR strategy should not be employed in one area for longer than _____ at a time:
    a. 4 minutes
    b. 6 minutes
    c. 8 minutes
    d. 10 minutes

10. Studies show that more female athletes:
    a. Would rather have a female coach
    b. Would rather not have a coach at all
    c. Would rather have a male coach
    d. Didn't care if they had a male or female coach

11. If the trainer:client relationship is going to continue over time, the following should be considered:
    a. Comfort level
    b. Communications
    c. Working rapport
    d. All of the above should be considered

12. The human body cannot make these elements on their own, so the proper amounts of each must be obtained through one's diet:
    a. Potassium and Sodium
    b. Sodium and Chloride
    c. Chloride and Potassium
    d. Potassium and Iron

13. In a study of protein powders, conducted by the Clean Label Project, it was determined that which of the following contained higher amounts of certain heavy metals?
    a. Egg protein
    b. Whey protein
    c. Plant-based protein
    d. All were determined to have about equal parts

14. What does it mean that a product be within the heavy metals "safe harbor"?
    a. The level of daily exposure to the product is accepted and scientifically approved as safe for consumption
    b. The product contains too much of one heavy metal but the degree by which other metals are found is within the level of safety
    c. A level of 0 when the product is tested upon shipment to its point of sale and no heavy metals are found present in the product
    d. That no amount of exposure to the product, no matter how frequently used, would be considered unsafe

15. Which of the following are heavy metals tested for unsafe impact on human consumption?
    a. Lead, calcium and arsenic
    b. Mercury, magnesium and lead
    c. Cadmium, arsenic and mercury
    d. Magnesium, boron and potassium

16. In the United States, with dietary supplements, the FDA:
    a. Leaves it up to the manufacturer to evaluate the safety and labeling of its products
    b. Requires more strict controls and testing processes than all other consumer products
    c. Is not the governmental agency which has any authority over consumer food products
    d. Only tests protein powders but not dietary supplements in pill form

17. Traditionally, the best source to replenish the building blocks of lean muscle tissue that gets broken down during the workout, is:
    a. Complex Carbohydrates
    b. Whey Protein
    c. Simple Sugars
    d. Plant-based Powders

18. Which of the following is the human body's preferred energy source:
    a. Protein
    b. Hormones
    c. Glucose
    d. Insulin

19. Most athletes aim for this ratio range of simple carb to protein (in grams) in order to slightly spike insulin thereby facilitating the body's ability to shuttle post-workout protein into the bloodstream:
    a. 2:1 - 3:1
    b. 1:2 - 1:3
    c. 3:4 - 4:5
    d. 4:5 - 4:3

20. When an insulin spike occurs, the muscle "cell doors":
    a. Close, enabling the body to retain a much higher percentage of glucose for energy
    b. Open, allowing the body to store and utilize a much lower percentage of protein
    c. Close, Allowing the body to utilize a much lower percentage of glucose for endurance
    d. Open, enabling the body to retain and utilize a much higher percentage of protein

21. Training on an empty stomach makes the body more efficient at:
    a. Protein production
    b. Glycogen storage
    c. ATP regeneration
    d. None of these

22. Which of the following is an activity that promotes the release of Growth Hormone (GH)?
    a. Sleep
    b. Fasting
    c. Both of these
    d. Neither of these

23. Fasting can be ineffective and/or dangerous for:
    a. People who have struggled with eating disorders
    b. Bodybuilders who want to make gains
    c. People who feel weak or dizzy during their workout
    d. All of the above

24. Energy expenditure associated with spontaneous movement is referred to as:
    a. No Energy Aptitude Techniques
    b. Never Exercise Attitude Training
    c. Non-Exercise Activity Thermogenesis
    d. Non-Elemental Activation Temperature

25. The energy expenditure of NEAT can be as much as:
    a. 2000 calories per day
    b. 2000 calories per week
    c. 4000 calories per day
    d. 4000 calories per week

26. Finding the body's daily total energy expenditure includes assessing these three parameters:
    a. Resting heart rate, thermic effect of food, energy spent on physical activity
    b. Blood pressure, body fat percentage, total calories ingested
    c. Basal metabolic rate, thermic effect of food, energy spent on physical activity
    d. Total calories ingested, basal metabolic rate, thermal body temperature

27. NEAT corresponds to energy expenditure associated with:
    a. Regular exercise
    b. Daily living activities
    c. A clean and healthy diet
    d. Overtraining

28. EPOC is a concept that refers to which of the following?
    a. The amount of oxygen our body consumes following a bout of exercise
    b. The number of calories our body uses during a bout of exercise
    c. The excess amount of oxygen our body exhales during recovery
    d. The continuous returning to an exercise heart rate in order to burn the most calories possible

29. Which of the following occurs during EPOC?
    a. Increase in body temperature
    b. Depletion of circulatory hormones
    c. Neither of these occur
    d. Both of these occur

30. Which of the following types of exercise elicit the greatest EPOC response?
    a. Low intensity and/or longer duration cardio and resistance exercise
    b. High intensity and/or shorter duration cardio and resistance exercise
    c. High intensity and/or longer duration cardio and resistance exercise
    d. Only high intensity resistance exercise, no cardio

31. Under optimal training conditions, the muscle cell experiences intermittent periods of:
    a. Momentary relaxation
    b. Forceful contraction
    c. Cell wall hardening
    d. Spontaneous recovery

32. The leg raise exercise is NOT:
    a. using hip flexion
    b. an ab movement
    c. a movement that flexes the spine
    d. useful at all for any purpose

33. Whenever we continuously perform a movement that extends or flexes the spine in a contraindicated way, our _____ slowly acquire a new deformed shape:
    a. superficial muscles
    b. rib cage and diaphragm
    c. pelvic girdle and hip flexors
    d. Intravertabral discs

34. An example of an acute injury is:
    a. muscle strain
    b. ligament sprain
    c. partial dislocation
    d. All of these are acute injuries

35. The general 'rule' for the application of heat or ice is to apply _____ for inflammation and soft tissue damage; apply _____ for muscle tension/tightness and trigger point pains.
    a. Heat; Ice
    b. Ice; Heat

36. Isometrics refer to exercise wherein the muscles are:
    a. Contracting against the force of a movement
    b. Producing force in the absence of movement
    c. Contracting with force to move an object
    d. Producing fatigue in a muscle pushing against a forceful movement

37. Functional isometrics:
    a. Will spare the neurological system and transfer eccentric strength to the muscle
    b. Transfers a greater amount of energy to concentric strength
    c. Enables the neuromuscular system to adapt to handling heavier weights
    d. All of these

38. Isometrics facilitates the isolation of:
    a. Ab muscles
    b. Small muscles
    c. Large muscles
    d. Bicep muscles

39. The following may improve gait efficiency through a number of biomechanical and neural mechanisms for this with cerebral palsy:
    a. Long distance running
    b. Resistance training
    c. Cross fit training
    d. None of these will make improvements

40. Which of the following is the five stages of change, in order, of the trans-theoretical model of behavior change (TTM):
    a. Precontemplation, contemplation, preparation, action, and maintenance
    b. Action, maintenance, precontemplation, contemplation and preparation
    c. Contemplation, preparation, action, maintenance and precontemplation
    d. Maintenance, precontemplation, contemplation, action and preparation

41. A behavioral process that uses reminders to engage in healthy behaviors and removing cues to engage unhealthy behaviors, is called:
    a. Reinforcement management
    b. Counter conditioning
    c. Social liberation
    d. Stimulus control

42. To avoid accidental overload with a motivated athlete who wants to prevent re-injury but is ready to get back to it, focus on:
    a. Cardio shifts that incorporate low intensity and long volume endurance work before moving on to resistance
    b. Resistance loading that incorporates their 1RM in the onset of the workout
    c. Strength paradigms incorporating high-volume hypertrophy work before moving into max strength moves
    d. None of these are good for re-injury prevention

43. Which of the following, according to a report published by liver experts in the journal *Hepatology*, is/are the major culprits in increased cases of hepatoxicity?
    a. Green tea extract
    b. Multi-ingredient supplements
    c. Neither of these
    d. Both of these

44. This commonly used pharmaceutical is most often associated with unintentional liver poisoning due to overuse:
    a. Ibuprofen
    b. Amoxicillin
    c. Acetaminophen
    d. Antihistamine

45. What is creatine?
    a. A non-protein amino acid Compound found exclusively invertebrate animals and functions in the formation and recycling of ATP in muscle cells
    b. A protein based mineral found only in vertebrate humans and uses the ATP it dispenses from the gall bladder
    c. A liver enzyme that found exclusively in plant based sources that can be infused into the bodies muscle cells through ATP processing
    d. A liver compound found exclusively in invertebrates and functions only in the formation of proteins in the muscle cells

46. Coupling your intake of creatine with a ____ and _____ will help the muscles retain more of the compound.
    a. fat and protein
    b. carb and protein
    c. fat and carb
    d. protein and water

47. Core strength is arguably the:
    a. foundation of the body's overall strength
    b. less important factor in overall strength
    c. only kind of training that anyone should be doing
    d. only type of training the works the entire body

48. The following visual sign(s) are indicative of a deep core system that is malfunctioning:
    a. Depression of the rib cage
    b. Breath holding
    c. Bulging abdomen
    d. All of the above are signs

SIDE 1

○ RESCORE | ○ MARK ✓ ○ TOTAL ONLY/BOTH SIDES

Trans-Optic® forms by NCS Pearson MM19641-2 654321

	T	F
1	A	B C D E
2	A	B C D E
3	A	B C D E
4	A	B C D E
5	A	B C D E
6	A	B C D E
7	A	B C D E
8	A	B C D E
9	A	B C D E
10	A	B C D E
11	A	B C D E
12	A	B C D E
13	A	B C D E
14	A	B C D E
15	A	B C D E
16	A	B C D E
17	A	B C D E
18	A	B C D E
19	A	B C D E
20	A	B C D E
21	A	B C D E
22	A	B C D E
23	A	B C D E
24	A	B C D E
25	A	B C D E
26	A	B C D E
27	A	B C D E
28	A	B C D E
29	A	B C D E
30	A	B C D E
31	A	B C D E
32	A	B C D E
33	A	B C D E
34	A	B C D E
35	A	B C D E
36	A	B C D E
37	A	B C D E
38	A	B C D E
39	A	B C D E
40	A	B C D E
41	A	B C D E
42	A	B C D E
43	A	B C D E
44	A	B C D E
45	A	B C D E
46	A	B C D E
47	A	B C D E
48	A	B C D E
49	A	B C D E
50	A	B C D E

KEY ITEM COUNT

0	0	0
1	1	1
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9

1 FEED THIS DIRECTION

NFPT ID

0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

MARKING INSTRUCTIONS

Use a No. 2 Pencil

Ⓐ ● Ⓒ Ⓓ Ⓔ
Fill circle completely

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
Erase cleanly

SCORE		# CORRECT
		% CORRECT
RESCORE		# CORRECT
		% CORRECT
ROSTER NUMBER		SCORE
		RESCORE

NAME _____

SUBJECT **DEC 2019 CEC Self Test**

PERIOD _____ DATE _____

TEST ANSWER SHEET B
Form No. 19641

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